BIOMASS CROP ASSISTANCE PROGRAM

Programmatic

Environmental Impact Statement

United States Department of Agriculture
Farm Service Agency

DRAFT

July 2009

Draft Programmatic Environmental Impact Statement

Biomass Crop Assistance Program
Farm Service Agency
U.S. Department of Agriculture
Abstract

The Biomass Crop Assistance Program (BCAP) is a new program established under Title IX (Energy) of the 2008 Farm Bill. The program is composed of two components, the Project Area Program component which supports the establishment and production of biomass crops for conversion to bio-energy in approved project areas, and the Collection, Harvest, Storage, And Transportation (CHST) component which provides monetary assistance with CHST of eligible materials for use in a biomass conversion facility (BCF). BCAP is administered by the Farm Programs Division of the FSA on behalf of the Commodity Credit Corporation (CCC). To implement the proposed action, FSA would develop a Proposed Rule. This Draft Programmatic Environmental Impact Statement (PEIS) analyzes the impacts of the two action alternatives of the Project Areas Program component on the nation's environmental resources and economy. The alternatives examine (1) a targeted implementation of the Program, examining limited development of new commercial BCFs and newly established crops and (2) an extensive expansion of current biomass programs and new programs to greatly expand participation. The no action alternative (continuation of current program) is also analyzed in this draft PEIS to provide an environmental baseline.

To comment on this draft PEIS, please use one of the following methods:

Regular Mail:
BCAP Draft PEIS
c/o Geo-Marine, Inc.
2713 Magruder Blvd., Suite D
Hampton, VA 23666

Internet:
http://public.geo-marine.com/

Comments must be received within 45 days of publication.

For additional information, please contact:
USDA/FSA/CEPD
Matthew T. Ponish
National Environmental Compliance Manager
1400 Independence Ave. SW
Mail Stop 0513
Washington, D.C. 20250
(202) 720-6853
Matthew.ponish@wdc.usda.gov

EXECUTIVE SUMMARY

1.0 BACKGROUND

The United States Department of Agriculture (USDA) Commodity Credit Corporation (CCC) proposes to implement the Biomass Crop Assistance Program (BCAP) enacted by Title IX, Section 9011 of the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Bill). This legislation, which was passed into law on June 18, 2008, creates the BCAP and authorizes the program through September 30, 2012. The BCAP is administered by the Farm Programs Division of the Farm Service Agency (FSA) on behalf of the CCC with the support of other Federal and local agencies. The BCAP is composed of two components: (1) the Collection, Harvest, Storage, and Transportation (CHST) Matching Payment Program, and (2) the Project Areas Program. This Programmatic Environmental Impact Statement (PEIS) is being prepared by FSA to assess the potential environmental impacts of alternatives for administration and implementation of the Project Areas Program component of the BCAP.

The program supports the establishment and production, in approved project areas, of biomass crops for conversion to bio-energy in a biomass conversion facility (BCF).

2.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to establish and administer the Project Areas Program component of BCAP, specifically the establishment and production of eligible biomass crops, as provided for by Title IX of the 2008 Farm Bill. The need for the Proposed Action is to fulfill the CCC Charter Act (15 United States Code [U.S.C.] 714, et seq.) and FSA's responsibility as assigned by the Secretary of Agriculture (hereinafter referred to as Secretary) to administer the provisions of the 2008 Farm Bill.

3.0 PROPOSED ACTION

The Proposed Action is to establish and administer the Project Areas Program component of BCAP as mandated in Title IX of the 2008 Farm Bill.

3.1 NO ACTION ALTERNATIVE

The No Action Alternative is carried forward in this PEIS in accordance with 40 CFR 1502.14(d) to represent the environmental baseline against which to compare the other alternatives. The No Action Alternative assumes that no Federal program like BCAP is implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need as described above, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

3.2 AFFECTED ENVIRONMENT

The geographic scope of the environment potentially affected by BCAP encompasses agricultural and forest lands of the U.S. This PEIS focuses descriptions of the affected environment on the proposed eligible lands under BCAP implementation. Resource areas potentially affected by this proposed action and analyzed in detail in this PEIS include:

- Socioeconomic and Land Use Resources
- Biological Resources
- Water Quality
- Soil Resources
- Air Quality
- Recreation

Biological resources encompass vegetation and wildlife

4.0 ENVIRONMENTAL CONSEQUENCES

The environmental consequences from the proposed action alternatives and no action alternatives are addressed in this PEIS and summarized in the table below.

Table ES-1. Summary f environmental Consequences

Resource	No Action	Alternative 1	Alternative 2
Socioeconomic and Land Use Resources	Under the No Action Alternative, the BCAP Project Areas Program would not be implemented for the establishment and production, with annual payments, for dedicated energy crops. There would be no significant changes to current land use, farm prices, or farm revenue measures. Dedicated energy crops would be established only in limited demonstration-scale quantities with other public and private funding sources. In the short term, it would be unlikely that domestic production for bioenergy would meet the demand for Energy Independence and Security Act (EISA) advanced biofuels components.	Under Alternative 1, the BCAP Project Areas Program would be implemented on a more restrictive or targeted basis. Project areas would be authorized for those that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands would be allowed to enroll for BCAP crop production. Modeling indicates that at the national level, direct impacts to realized Net Farm Income are expected to remain unchanged from that of the No Action Alternative due to limited funding. However, net returns are likely to improve for those producers selected as part of a BCAP project area. Total net returns for most potential project locations are positive, ranging between $2.7 and 7.3 million in Year 1 of the program. Modeling shows that positive Net Returns would still be expected over the long term (Year 3), indicating that the BCAP project areas remain capable of supplying a BCF with required feedstock. Alternative 1 would land use changes only at the local level (i.e., county or multi-county region). Land use changes range between 22,000 to 44,000 acres of crop (e.g., corn, wheat, soy, etc.) and hay land being converted to dedicated energy crops (switchgrass) from that of the No Action Alternative.	Alternative 2 expands the BCAP Project Areas Program, allowing anyone who meets basic eligibility requirements of the BCAP provisions in the 2008 Farm Bill to participate. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands would be allowed to enroll and the number of cropland acres would not be capped. Significant changes are expected in net revenues as total revenue values increase more than the feedstock production costs and as feedstock production reduces the supply of other crops and subsequently increases their prices. Price increases are most significant for wheat, corn, and soybeans, with price changes expected to increase by 15 to 20 percent. The addition of forestry resources as feedstock would reduce pressures somewhat, as would any future increase in crop yields. It is expected that government commodity payments would increase due to the price impacts triggered by the increased demand for cropland. Land use shifts, especially among the major crops, are expected under this alternative. Modeling indicates that by 2023, planting of energy dedicated crops will increase to over 30 million

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Socioeconomic and Land Use Resources (cont'd)		Economic indirect impacts under this alternative vary by plant location. Growing dedicated energy crops and subsequent land use changes for those crops, in a region would impact the agricultural sector by the creation of a new market. It is estimated that producing a dedicated energy crop would require $60/dry ton (approximately $10 million) to establish the crop. In order to receive payments to establish a dedicated energy crop, producers must first convert their land from traditional crops. This would result in negative impacts within the community as inputs from the traditional crops are not purchased. Costs vary based on the community and the required amount of land use changes required and range between $1.5 million to $ 5 million. Total economic impact ranges between $19 million and $28 million. Net positive impacts for the top five plants are between $21 million and $25 million for their region. However, land use changes would create negative impacts within a region ranging from $2.5 million to $10 million depending on location.	acres, while the amount of land planted in wheat and soybeans will decrease approximately 15 million acres. Of the estimated 350 million acres in use as pastureland, approximately nine million acres would shift to the production of dedicated energy crops. There would be both positive and negative indirect impacts from the establishment of dedicated energy crops which would flow through the rest of the economy. While payments for the establishment of dedicated crops is estimated to be $11 billion and the CHST component of BCAP is expected to create an estimated 280,000 jobs, the costs associated with land use changes required to meet the demand for dedicated energy crops and crop residues may bring a decline of $3.2 billion and a loss of 41,000 jobs. However, the total economic impact from implementation of Alternative 2 is estimated to be $88.5 billion and the creation of nearly 700,000 jobs.

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Biological Resources *Vegetation, Wildlife*	Under the No Action Alternative the BCAP Project Areas Program would not be implemented and financial assistance would ne be provided for the conversion of cropland and potentially other non-agricultural lands to the establishment and production of dedicated energy crops. No additional negative impacts to vegetation or wildlife would occur. The potential benefits to wildlife from the conversion of traditional crops to some types of biofuel crops such as switchgrass or short-rotation woody crops (SRWC) would not be realized. However, there would also be no loss of native habitat as would potentially occur under Alternative 2 due to the allowance for the conversion of non-agricultural lands to dedicated energy crops.	Under Alternative 1, the BCAP Project Areas Program would be implemented on a narrow scope, supporting only two to five BCFs. The amount of land within the 50-mile radius of qualified BCFs that has the potential to be converted to dedicated energy crops ranges from 0.7 to 77 million acres depending on the regions selected as Project Areas. However, the exact amount of land that may be converted is limited to 25 % of the acreage within each county being eligible for BCAP payments. This equates to a relatively small amount of vegetation being converted from traditional crops or pastureland to approved biofuel crop species. It is not likely there would be significant negative impacts to wildlife species from the conversion to dedicated energy crops. The large mammal with the greatest potential for impacts is the white-tailed deer. Deer are browsers; therefore the benefits of maintaining an early successional habitat like grasslands to not extend to them. They are more strongly associated with forest edges and are highly tolerant of disturbance. Direct impacts are expected to be negligible; they are highly mobile and able to escape during agricultural activities. There may be some mortality from conflicts during crop establishment and harvest, but since the scope under Alternative 1	Under Alternative 2, the BCAP Project Areas Program would be implemented on a broad scope, with potential regional impacts and across several ecosystems. Direct impacts to vegetation include the potential conversion of both traditional cropland and non-cropland to dedicated energy crops. Energy crops include perennial grasses, SRWC, and sugar crops. The amount and type of land converted to feedstock crop production would depend on which areas are designated as Project Areas in order to meet BCF requirements. Conversion may have both negative and positive impacts. The loss of forestland or native grasslands would decrease the habitat quality for several wildlife species. Yet, as described in Alternative 1, many of the feedstock options have a higher habitat quality than traditional crops. The types of impacts to wildlife during the establishment of feedstock crops would be similar to those described in Alternative 1; yet, with the potential to occur at a much broader scale. Again, the scale of this impact is dependent on the types and amount of land converted to dedicated energy. Negative impacts to large mammals, small mammals, reptiles and amphibians, and invertebrates are not expected to be significant. Similarly, impacts to birds are not

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Biological Resources *Vegetation, Wildlife* (cont'd)		is limited, no impact at a population level is expected. As with large mammals, the indirect impacts to small mammals are related to habitat change. The establishment of feedstock crops may remove small mammals from an area temporarily, but these areas should be quickly repopulated from adjoining land. Direct impacts to small mammals are expected to be minimal. While some mortality is likely, it is not expected to be significant. Direct impacts can be reduced by taking such actions as initiating activities at the center of field to allow for escape to either side, and following the outer most tracks of the previous pass. Conversion of cropland to switchgrass has the most potential to directly affect the reproductive success of grassland birds. The bunch grass nature of switchgrass can be very beneficial to species such as northern bobwhite and wild turkey due to the cover it provides for nesting and brooding. Similarly, higher densities and richness have been documented in SRWC than row crops or small grain crops. However, some mortality from collisions or nest destruction from farm equipment is still expected to occur. Provided establishment and harvest of feedstock does not occur during the Primary Nesting Season (PNS), these impacts should be minimized.	expected to impact population densities. However, the largest potential negative impact to grassland birds would occur during conversion or harvesting activities. Provided these activities do not occur during the PNS, and the small portion of grasslands in potential BCAP Project Area locations, impacts to grassland birds are minimal. As with Alternative 1, provided established provisions, standards, and guidelines are followed and the Conservation Plan is adapted to resource conditions, Alternative 2 would have no significant negative impacts on vegetation or wildlife.

Table ES-1. Summary of Environmental Consequences (cont'd)			
Resource	**No Action**	**Alternative 1**	**Alternative 2**
Biological Resources *Vegetation, Wildlife* (cont'd)		Reptiles and amphibians would potentially have negative and positive responses to the conversion to feedstock crops. The increase of native vegetation may increase the abundance of invertebrates, a source of food for many reptiles and amphibians. There may be short-term reductions in population sizes the year that conversion occurs from agricultural activity from collisions or crushing by farm equipment. The techniques described above for wildlife avoidance will reduce these impacts. Likewise, because of the limited implementation under this alternative, these impacts will not be local and not at the population level. Impacts to invertebrates are related to habitat, and will vary based on specific lifestyle and habitat preference. Properly managed switchgrass result in dense, uniform plant stands with minimal structural diversity. When compared to traditional crops, switchgrass results in a net improvement of habitat for invertebrates, but is equal or lower than native grasslands or haylands. Direct impacts to invertebrates are dependent on the degree of exposure and the mobility of a given species. Impacts from the establishment include destruction of nest sites, crushing, and the removal of food sources. These impacts can be	

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Biological Resources *Vegetation, Wildlife* (cont'd)		reduced if activities are not conducted during periods of highest florescence or when flowers are in bloom. Impacts to aquatic wildlife are associated with the dangers of sedimentation, and nutrient and agricultural chemical deposition into water bodies. However, provided established procedures for erosion and runoff control are followed, these potential impacts are not expected to be significant. Due to the small scope of this alternative, and provided established provisions, standards, and guidelines are followed and the Conservation Plan is adapted to resource conditions, Alternative 1 would have no significant negative impacts on vegetation or wildlife.	
Air Quality	Under the No Action Alternative, changes to green house gas (GHG) emissions or emissions of criteria pollutants from agricultural activities are not likely to change. There may be increased mobile source emissions and dust emissions from the transportation of current bioenergy materials from fields to qualified BCFs. However, since the number of qualified BCFs and the economically feasible distance to transport materials to these BCFs is limited, emissions would likely be restricted to a local scale.	Positive changes to air quality are expected under Alternative 1. However, since the scope of this alternative is limited, these changes would not be significant. Direct impacts relate to the energy and/or emissions from agricultural production activities. Under this alternative, energy consumption within the top five regions would be reduced by 3,664 Giga Joules (GJ) through the conversion to switchgrass when compared to the No Action Alternative. This energy change is minor, in most cases less than 0.1 percent. Carbon emissions were less than those of the No Action	Implementing Alternative 2 on a broader scale would reduce overall direct carbon equivalent emissions during switchgrass growth. However, it appears that overall emissions would increase as the amount of SOC decreases due to the loss of crop residue. Total energy use was approximately one to two percent higher in most years due to the indirect energy requirement for increased equipment manufacturing. Direct energy usage was either neutral or decreased over time. The effects of fugitive dust emissions during the establishment phase would be similar

Table ES-1. Summary of Environmental Consequences (cont'd)			
Resource	**No Action**	**Alternative 1**	**Alternative 2**
Air Quality (cont'd)		Alternative, yet small, usually less than 0.1 percent. Due to the limited scale of conversion under this alternative, the amount of fugitive dust emissions would be minor, temporary, local, and nearly equal to that of the No Action Alternative. Yet, over the long term, given the conversion to perennial dedicated energy crops and reduction tillage, there would be a reduction in fugitive dust emissions. These effects would be positive, but minor. Limited indirect impacts would occur from emissions from equipment exhaust or other mobile sources necessary for the establishment of dedicated energy crops. However, since machinery is already utilized on these fields, these impacts are similar to those of the No Action Alternative. Site-specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the Conservation Plan or through local or state regulations concerning air emissions of criteria pollutants. BMPs to reduce mobile sources include proper maintenance of equipment and dust suppression activities.	to those of Alternative 1. After establishment, fugitive dust emissions would decrease due to the alteration of cropping systems to perennial species. In the long term, these effects would be on a regional scale and would be positive. Indirect impacts are similar to those of Alternative 1. Site-specific mitigation measures and BMPs as described in Alternative 1 would reduce potential impacts to Air Quality under Alternative 2.
Soil Resources	Implementation of the No Action Alternative is not expected to change current cropping practices or species mix. Under this alternative, crops currently in use for bioenergy are Title I crops, Title I crop residues, and	Under Alternative 1, a reduction in erosion from all sources is expected. Conversion of croplands from traditional crops to switchgrass is estimated to reduce topsoil loss from these acres by 0.4 inches per year;	Alternative 2 would result in reductions at both the local and regional level of soil erosion due to the transition from traditional crops to perennial vegetation used for dedicated energy crops. Perennial crops, and the use of

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Soil Resources (cont'd)	woody biomass. The removal of residues may negatively impact soil quality; however, this impact can be reduced through the use of fertilizers. The use of best management practices (BMPs) would be necessary to ensure adequate amounts of crop residues remain after harvest to minimize loss of soil organic matter (SOM).	which equates to four inches over a ten year period. This results in the reduction of soil, nutrient, and chemical deposition into surface water bodies. Soil carbon increased between 0.2 and 10.1 percent over that of the No Action Alternative. Indirect impacts under Alternative 1 would be increased biodiversity of soil biota as a result of increased soil organic matter and the presence of perennial vegetation. The use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are implemented, Alternative 1 would have no significant negative impact on soil resources.	corn stover and wheat straw, shift away from conventional tillage to no tillage practices. This shifting of tillage practices on an estimated 11 million acres, conserving approximately 40 million tons of soil each year over that of the No Action Alternative. As with Alternative 1, the biological diversity of the soil would also increase. As with Alternative 1, the use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are implemented, Alternative 2 would have no significant negative impact on soil resources.
Water Quality and Quantity	Under the No Action Alternative, the use of Title I crops and crop residues does not produce a significant change in either water quantity or quality. Overall, projected land use changes under the No Action Alternative does not indicate an increased amount of acreage requiring additional water resources or the use of additional nutrients or agricultural chemicals.	Under Alternative 1, direct impacts to water quality are expected from the changes to the use of nutrients and agricultural chemicals for the establishment and production of switchgrass in the potential BCAP project locations. Decreases in the use of potassium (3.1%), lime (4.0%), herbicides (5.5%), insecticides (11.2%), and other agricultural chemicals (3.6%) are expected; while the use of nitrogen (2.1%) and phosphorus (2.9%) within the top five project areas are expected to increase over that of the No Action Alternative. The overall reduction in nutrients and agricultural chemical, erosion, total suspended solids (TSS), and	The direct and indirect impacts to water quality under Alternative 2 would be similar to those described in Alternative 1. However, as the amount of acreage converted from traditional crops to perennial crops increases, the benefits to both water quality and quantity increase. The same mitigation methods described in Alternative 1 would reduce potential impacts to water quality. Adherence to established conservation standards, provisions, and guidelines ensures Alternative 2 would have no significant negative impact on water quality.

Table ES-1. Summary of Environmental Consequences (cont'd)			
Resource	**No Action**	**Alternative 1**	**Alternative 2**
Water Quality and Quantity (cont'd)		sedimentation would be positive impacts on water quality from implementation of this alternative. However, due to the limited amount of acreage under this alternative, these benefits would be local. The change in the quantity of water required under this alternative would be minimal. The amount of water used for irrigation in the top five regions would only decrease approximately 0.25 over that of the No Action Alternative, saving an estimated 1.2 million gallons of water per day. When compared across all project area States, 23.6 million gallons of water per day would be conserved. Switchgrass does have a higher water use efficiency (WUE) than other traditional crops, and is highly tolerant of various water regimes and is more drought tolerant than traditional crops. Indirect impacts under Alternative 1 result from the reduction in sedimentation, and nutrient and agricultural chemical deposition into surface water bodies that move down stream, benefiting larger water stream courses and regional water quality. In order to further reduce impacts to water quality, buffer strips comprised of mixed native species between biofuel crop fields and surface water bodies should be established for sediment and nutrient retention. Adherence to established conservation	

Table ES-1. Summary of Environmental Consequences (cont'd)

Resource	No Action	Alternative 1	Alternative 2
Water Quality and Quantity (cont'd)		standards, provisions, and guidelines ensures Alternative 1 would have no significant negative impact on water quality.	
Recreation	Under the No Action Alternative there are no expected changes in Wildlife habitat. There will be no changes in recreation activities related to wildlife.	Under Alternative 1 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.	Under Alternative 1 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION 1-1

1.1 Program History and legislative authority 1-1
1.2 Purpose and Need including the Proposed Action 1-1
1.3 The National Environmental Policy Act Process and BCAP PEIS 1-1
1.3.1 USDA NEPA Approach 1-1
1.3.2 The Collection, Harvest, Storage, and Transportation Component of the BCAP 1-2
1.3.2.1 Definitions Applicable to the CHST Provisions of the BCAP. 1-3
1.3.2.2 CHST Matching Payment Program Provisions 1-4
1.3.3 Resource Specific Guidance 1-6
1.3.4 Other Related Actions, Federal Permits, and Licenses 1-6
1.3.4.1 Other Related Actions 1-6
1.3.4.2 Federal Permits, Licenses and other Entitlements 1-6
1.3.5 Cooperating Agencies 1-7
1.3.5.1 Rural Development 1-8
1.3.5.2 Animal and Plant Health Inspection Service 1-8
1.3.5.3 Forest Service 1-10
1.3.5.4 Fish and Wildlife Service 1-10
1.4 Biomass Program Overview Industry 1-10
1.4.1 Biomass Resource Base 1-11
1.4.2 BCAP Eligible Crops 1-12
1.4.3 Forest Resources 1-12
1.4.4 Agricultural Resources 1-14
1.4.5 Biomass Conversion Facilities 1-15
1.4.5.1 Current Ethanol Production Facilities 1-15
1.4.5.2 Current Electricity Generation 1-17
1.5 Organization of the PEIS 1-17

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION 2-1

2.1 Proposed Action 2-1
2.1.1 Establishment and Purpose 2-1
2.1.2 Project Area Application Requirements 2-1
2.1.3 Project Area Selection Criteria 2-1
2.1.4 BCAP Contract Terms 2-2
2.1.5 BCAP Payments 2-2
2.1.6 BCAP Reporting Requirements 2-2
2.2 Alternatives Development 2-2
2.2.1 Agency and Public Scoping 2-3
2.2.2 Scoping Issues 2-3
2.3 BCAP Project Areas Program Alternatives Analyzed 2-3
2.3.1 No Action Alternative 2-4
2.3.2 Action Alternatives 2-4
2.3.2.1 Alternative 1 – Targeted BCAP Implementation 2-4

2.3.2.2 Alternative 2 – Broad BCAP Implementation 2-5
2.4 Resources Considered but Eliminated from Analysis....................................... 2-6
2.4.1 Wetlands 2-6
2.4.2 Floodplains 2-6
2.4.3 Protected Species... 2-6
2.4.4 Coastal Zones.. 2-7
2.4.5 Prime and Unique Farmland 2-7
2.4.6 Environmental Justice.. 2-7
2.4.7 Cultural Resources 2-8
2.4.8 Noise 2-8
2.4.9 Other Protected Resources 2-8

3.0 AFFECTED ENVIRONMENT (BY RESOURCE AREA) 3-1

3.1 Socioeconomics and Land Use 3-1
3.1.1 Definition of the Resource 3-1
3.1.1.1 Net Farm Income 3-1
3.1.1.2 Farm Prices... 3-1
3.1.1.3 Agricultural Government Payments 3-1
3.1.1.4 Land Use Shifts.. 3-2
3.1.2 General Agricultural Characteristics 3-2
3.1.2.1 Number of Farms & Land in Farms...................................... 3-2
3.1.2.2 Rural Population Trends 3-2
3.1.2.3 Primary Field Crops 3-2
3.2 Biological Resources 3-6
3.2.1 Definition of a Resource 3-6
3.2.2 Existing Condition 3-9
3.2.2.1 Vegetation and Wildlife 3-9
3.3 Air Quality 3-25
3.3.1 Definition of the Resource 3-25
3.3.2 Existing Conditions 3-25
3.4 Soil Quality 3-27
3.4.1 Definition of the Resource 3-27
3.4.1.1 Primary Proposed Energy Crop Regions 3-27
3.4.1.2 Secondary Energy Crop Regions 3-30
3.4.2 Existing Conditions 3-30
3.4.2.1 Primary Proposed Energy Crop Regions 3-30
3.4.2.2 Secondary Energy Crop Regions 3-32
3.4.2.3 Soil Carbon Sequestration 3-33
3.5 Water Quality and Quantity 3-34
3.5.1 Definition of the Resource 3-34
3.5.2 Existing Conditions 3-34
3.5.2.1 Surface Water Quality 3-34
3.5.2.2 Groundwater Quality 3-35
3.5.2.3 Water Use/Quantity 3-36
3.6 Recreation 3-40
3.6.1 Definition of the Resource 3-40
3.6.2 Existing Conditions 3-41

4.0 ENVIRONMENTAL CONSEQUENCES 4-1

4.1 Socioeconomics and Land Use 4-1
4.1.1 Significance Thresholds....4-1
4.1.2 Methodology 4-1
4.1.2.1 Model Details 4-1
4.1.2.2 Definition of Types of Impacts....4-2
4.1.2.3 Model Variables 4-3
4.1.2.4 Assumptions and Data Limitations....4-4
4.1.3 Action Alternative 1....4-6
4.1.3.1 Direct Impacts 4-6
4.1.3.2 Indirect Impacts....4-16
4.1.4 Action Alternative 2....4-21
4.1.4.1 Direct Impacts 4-21
4.1.4.2 Indirect Impacts....4-31
4.1.5 No Action Alternative 4-32
4.2 Biological Resources....4-33
4.2.1 Significance Thresholds....4-33
4.2.2 Methodology 4-33
4.2.3 Action Alternative 1....4-35
4.2.3.1 Vegetation....4-35
4.2.3.2 Wildlife 4-47
4.2.4 Mitigation Measures....4-58
4.2.5 Action Alternative 2....4-63
4.2.5.1 Vegetation....4-63
4.2.5.2 Wildlife 4-67
4.2.6 No Action Alternative 4-69
4.2.6.1 Vegetation....4-69
4.2.6.2 Wildlife 4-76
4.3 Air Quality....4-77
4.3.1 Significance Thresholds....4-77
4.3.2 Methodology 4-77
4.3.3 Action Alternative 1....4-78
4.3.3.1 Direct Impacts 4-78
4.3.3.2 Indirect Impacts....4-81
4.3.3.3 Mitigation Measures....4-81
4.3.4 Action Alternative 2....4-81
4.3.4.1 Direct Impacts 4-81
4.3.4.2 Indirect Impacts....4-83
4.3.4.3 Mitigation Measures....4-83
4.3.5 No Action Alternative 4-83
4.4 Soil Quality 4-83
4.4.1 Significance Thresholds....4-83
4.4.2 Methodology 4-83
4.4.3 Action Alternative 1....4-84
4.4.3.1 Direct Impacts 4-85
4.4.3.2 Indirect Impacts....4-88
4.4.3.3 Mitigation Measures....4-88
4.4.4 Action Alternative 2....4-88
4.4.4.1 Direct Impacts 4-88
4.4.4.2 Indirect Impacts....4-89
4.4.4.3 Mitigation Measures....4-90
4.4.5 No Action Alternative 4-90

4.5 Water Quality and Quantity 4-90
4.5.1 Significance Thresholds....................................4-90
4.5.2 Methodology 4-90
4.5.3 Action Alternative 1....................................4-90
4.5.3.1 Direct Impacts 4-91
4.5.3.2 Indirect Impacts....................................4-96
4.5.3.3 Mitigation Measures....................................4-96
4.5.4 Action Alternative 2....................................4-96
4.5.4.1 Direct Impacts 4-96
4.5.4.2 Indirect Impacts....................................4-96
4.5.4.3 Mitigation Measures....................................4-96
4.5.5 No Action Alternative 4-96
4.6 Recreation 4-97
4.6.1 Significance Thresholds....................................4-97
4.6.2 Methodology 4-97
4.6.3 Action Alternative 1....................................4-97
4.6.3.1 Direct Impacts 4-97
4.6.3.2 Indirect Impacts....................................4-98
4.6.3.3 Mitigation Measures....................................4-98
4.6.4 Action Alternative 2....................................4-98
4.6.4.1 Direct Impacts 4-98
4.6.4.2 Indirect Impacts....................................4-98
4.6.4.3 Mitigation Measures....................................4-98
4.6.5 No Action Alternative 4-98
4.6.5.1 Direct Impacts 4-98

5.0 CUMULATIVE IMPACTS ASSESSMENT....................................5-1

5.1 Definition 5-1
5.2 Recent Legislation and Legislative Programs 5-1
5.2.1 Energy Independence and Security Act of 2007 and Renewable Fuel Standards 5-1
5.2.2 American Recovery and Reinvestment Act of 2009 Funding 5-2
5.2.3 Food, Conservation, and Energy Act of 2008 Titles 5-2
5.2.4 Oregon Biomass Producer or Collector Tax Credits....................................5-3
5.3 Cumulative Impacts Analysis 5-4
5.3.1 Socioeconomics and Land Use 5-5
5.3.2 Biological Resources 5-6
5.3.3 Air Quality 5-7
5.3.4 Soil Quality....................................5-7
5.3.5 Water Quality and Quantity....................................5-8
5.3.6 Recreation 5-8
5.3.7 Transportation....................................5-8
5.3.8 Energy Balance 5-9
5.4 Irreversible and Irretrievable Commitment of Resources 5-10

6.0 MITIGATION 6-1

6.1 Introduction....................................6-1
6.2 Roles and Responsibilities 6-1
6.3 Mitigation Recommendations 6-1

7.0 REFERENCES 7-1

8.0 PREPARERS 8-1

9.0 PERSONS AND AGENCIES CONTACTED 9-1

10.0 INDEX 10-1

11.0 GLOSSARY 11-1

APPENDICIES

Appendix A—Federal Register Notices
Appendix B—BCAP-CHST Eligible Materials List
Appendix C—BCAP PEIS Scoping Comments

FIGURES

Page

Figure 1.4-1. Distribution of Biomass Resources across the United States (DOE 2009b) 1-12
Figure 1.4-2. Availability of Logging Residue from Timberlands, 2007 1-13
Figure 1.4-3. Availability of Fuel Treatment Thinnings from Timberlands, 2007 1-14
Figure 1.4-4. Availability of Corn Stover Residue, 2007 1-16
Figure 1.4-5. Locations of U.S. Biomass Conversion Facilities 1-17
Figure 3.2-1. NRCS Land Resource Regions (NRCS 2006) 3-7
Figure 3.4-1. Primary Crop Residue Areas within the United States 3-29
Figure 3.5-1. Water Withdrawals for Irrigation 3-37
Figure 3.5-2. Figure Irrigation Withdrawals for Each State by Source 3-39
Figure 4.1-1. Location of the Top 5 BCAP project sites in the Nation 4-7
Figure 4.1-2. The Top 5 BCAP projects and the detailed area of influence 4-8
Figure 4.1-3. Top BCAP project site in States with enough Feedstock Production Potential 4-9
Figure 4.1-4. Direct, Indirect, and Induced Economic Impacts for Both the State and Top Five BCF Potential Project Locations 4-20
Figure 4.1-5. Economic Impacts for Each Type Estimated by Potential BCAP Project Location 4-21
Figure 4.1-6. Feedstock Participation in Achieving EISA Target (Scenario 3) 4-22
Figure 4.2-1. Locations of Existing BCFs in United States with 50-mile Buffer 4-34
Figure 4.2-2. Map Showing Existing and Potential Location New BCFs with 50-mile Radius under Alternative 1 4-39
Figure 4.2-3. Crop residue regions (Gallagher *et al.* 2003) 4-69
Figure 4.2-4. Historical Trends of Planted Acres of Corn (NASS 2009b) 4-70
Figure 4.5-1. Estimated Water Use for Irrigation in Top Five BCAP Project Locations 4-93
Figure 4.5-2. Estimated Water Use for Irrigation in Top BCAP Project Locations in States with Sufficient Feedstock Potential 4-95

TABLES

Page

Table 1.3-1. Other Federal Actions Directly Related to BCAP 1-9
Table 2.3-1. BCAP PEIS Public Meeting Locations and Dates 2-4
Table 2.3-2. Action Alternatives Summary 2-5
Table 3.1-1. Number of Farms, Land in Farms, and Average Size of Farms by Farm Typology (2007) 3-4
Table 3.1-2. Planted Acres, Harvested Acres, and Production of Select Field Crops 2003-2008 3-5
Table 3.1-3. Annual Percent Change 2003-2008 for Planted Acres, Harvested Acres, and Production of Select Storable Field Crops 3-6
Table 3.2-1. Selected States to Represent Land Resource Regions 3-8
Table 3.2-2. Amount (acres) of Level 1 Land Cover Types by Region 3-10
Table 3.4-1. Regional Production Potential 3-28
Table 3.4-2. Soil Order Descriptions 3-31
Table 3.5-1. Water Withdrawals from 1950 to 2000 3-38
Table 3.6-1. Number of Persons Participating in Wildlife Related Activities 3-42

Table 3.6-2. Fishing Related Expenditures 3-44
Table 3.6-3. Hunting Related Expenditures....3-47
Table 3.6-4. Wildlife Watching Related Expenditures....3-50
Table 3.6-5. Estimated CRP Benefits of Selected Wildlife Related Practices 3-52
Table 4.1-1. Impact on Net Returns (constant U.S. dollars) by BCAP location area and source....4-11
Table 4.1-2. Cropland Use (in acres) in the Selected Sites for BCAP projects under the No Action Alternative 4-13
Table 4.1-3. Cropland Use (acres) in the Selected Sites for BCAP projects under Alternative 1 4-14
Table 4.1-4. Change under Alternative 1 from the No Action Alternative in Cropland Use in the Selected Sites for BCAP projects 4-15
Table 4.1-5. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO and Jobs)....4-17
Table 4.1-6. Direct, Indirect, and Induced Economic Impacts by Five Top Potential Project Locations Year 3 (TIO and Jobs) 4-18
Table 4.1-7. Aggregate Realized Net Farm Income for Alternative 2 as Compared to the No Action Alternative 4-23
Table 4.1-8. Crop and Feedstock Prices for Alternative 2 as Compared to the No Action Alternative 4-25
Table 4.1-9. Changes in Commodity Government Payments ($000s) Under Alternative 2 4-27
Table 4.1-10. Land Use Impacts of Alternative 2 as compared to the No Action Alternative (million acres) 4-28
Table 4.1-11. National Economic Impacts Resulting from Achieving EISA (TIO and Jobs) ..4-32
Table 4.2-1. Amount (acres) of Level 1 Land Cover Types Located within Existing BCFs by Region 4-37
Table 4.2-2. Projected Amount (acres) for Existing and Potential BCFs: Level 1 Land Cover Types by Region 4-41
Table 4.2-3. Proportional Increase (%) in BCF Acreage under Alternative 1 from the Original Acreage under No Action Alternative 4-44
Table 4.2-4. Primary Nesting Season Dates by State 4-53
Table 4.2-5. Representative Grassland Birds by State....4-55
Table 4.2-6. Distribution of lands that can grow energy crops by NRCS LRR 4-66
Table 4.3-1. Table Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative) 4-79
Table 4.3-2. Table Percent Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative) 4-80
Table 4.3-3. Percent Change in Net Carbon Flux, Carbon Equivalent Emissions, and Energy Consumed from No Action Alternative to Alternative 2 4-82
Table 4.4-1. Estimated Reduced Levels of Erosion as a Result of Land Conversion to Dedicated Energy Crops (tons/year) 4-86
Table 4.4-2. Percent Changes in Use of Fertilizers and Chemicals after Implementation of Alternative 1 4-87
Table 4.4-3. Change in Acreage Planted under Alternative 2 from the Baseline, 2022 4-89
Table 4.4-4. Changes in Erosion Compared to the Baseline (Scenario 1), 2022 4-89
Table 4.5-1. Agricultural Water Irrigation Withdrawals Top Five Potential BCAP Potential Project Locations 4-92
Table 4.5-2. Agricultural Water Irrigation Withdrawals Potential BCAP Potential Project Locations within Each State 4-94
Table 5.3-1. Potential Benefits and Challenges of Biofuels....5-4

Table 5.3-2. Estimated Cumulative Effects by Alternative for BCAP 5-5
Table 5.3-3. NEB Ratio (Output/Input) by Product Type 5-10
Table 5.3-4. Energy Efficiency Cradle to Farm–Gate by Plant Species 5-10

Acronyms and Abbreviations

2008 Farm Bill	Food, Conservation, and Energy Act of 2008
ACRE	Average Crop Revenue Election
APHIS	USDA Animal and Plant Health Inspection Service
ARRA	American Recovery and Reinvestment Act of 2009
BCAP	Biomass Crop Assistance Program
BCF	Biomass Conversion Facility
Bgal/d	Billion gallons per day
BLM	Bureau of Land Management
BMP	Best Management Practice
BRDB	Biomass Research Development Board
BRS	Biotechnology Regulatory Services
Btu	British thermal units
CAA	Clean Air Act
CCC	Commodity Credit Corporation
CEAP	Conservation Effects Assessment Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHST	collection, harvest, storage, and transportation
CO	Carbon monoxide
CO2	Carbon dioxide
CRIA	Civil Rights Impact Analysis
CRP	Conservation Reserve Program
CRS	Congressional Research Service
CSiTE	Carbon Sequestration in Terrestrial Ecosystems
CSU	Colorado State University
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Pla
DOE	Department of Energy
DOT	Department of Transportation
DPEIS	Draft Programmatic Environmental Impact Statement
EBI	Environmental Benefits Index
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act

Acronyms and Abbreviations (cont'd)

EO	Executive Order
EPA	Environmental Protection Agency
ERS	Economic Research Service
ESA	Endangered Species Act
FCA	Full Carbon Accounting
FCIC	Federal Crop Insurance Corporation
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FPEIS	Final Programmatic Environmental Impact Statement
FR	Federal Register
FSA	Farm Service Agency
FSFL	Farm Storage Facility Loan
FSP	Forest Stewardship Plan
GDP	Gross Domestic Product
GE	Genetically Engineered
GHG	Greenhouse Gases
GIS	Geographical Information System
GJ	Giga Joules
HEC	Herbaceous Energy Crops
HEL	Highly Erodible Land
IAP	Interagency Agricultural Projections
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Analysis
mgy	million gallons per year
MLRA	Major Land Resource Areas
MOSS	Micro Oriented Sediment Simulator
MOU	Memorandum of Understanding
N2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASS	National Agricultural Statistics Service
NECB	Net Ecosystem Carbon Budgets
NEB	Net Energy Balance
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NO2	Nitrogen dioxide

Acronyms and Abbreviations (cont'd)

NOFA	Notice of Funds Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	USDA Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRI	National Resource Inventory
O3	Ozone
ORNL	Oak Ridge National Laboratory
PARC	Partners in Amphibian and Reptile Conservation
Pb	Lead
PEIS	Programmatic Environmental Impact Statement
PHMSA	Pipeline and Hazardous Material Safety Administration
PIP	Plant-Incorporated Protectant
PL	Public Law
PM	Particulate Matter
PM2.5	Particles Less Than 2.5 Micrometers in Diameter
PM10	Particles Greater Than 2.5 Micrometers and Less Than Ten Micrometers in Diameter
POLYSYS	Policy Analysis System
PPA	Plant Protection Act
ppm	parts per million
REAP	Rural Energy for America Program
RD	USDA Rural Development
RFA	Renewable Fuels Association
RFS2	National Renewable Fuel Standards
ROI	Region of Influence
RPC	Regional Purchase Coefficient
SAM	Social Accounting Matrix
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO2	Sulfur dioxide
SRWC	Short Rotation Woody Crops
SSSA	Soil Science Society of America
SWAP	State Wildlife Action Plan
THPO	Tribal Historic Preservation Officer
TIO	Total Industry Output

Acronyms and Abbreviations (cont'd)

TSS	Total Suspended Solids
USACE	U.S. Army Corp of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDC	U.S. Department of Commerce
USDOI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
WTW	Well-to-wheels
WUE	Water Use Efficiency
Xerces	Xerces Society for Invertebrate Conservation

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 PROGRAM HISTORY AND LEGISLATIVE AUTHORITY

The United States Department of Agriculture (USDA) Commodity Credit Corporation (CCC) proposes to implement the Biomass Crop Assistance Program (BCAP) enacted by Title IX, Section 9011 of the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Bill). This legislation, which was passed into law on June 18, 2008, creates the BCAP and authorizes the program through September 30, 2012. The BCAP is administered by the Farm Programs Division of the Farm Service Agency (FSA) on behalf of the CCC with the support of other Federal and local agencies. The BCAP is composed of two components: (1) the Collection, Harvest, Storage, and Transportation (CHST) Matching Payment Program, and (2) the Project Areas Program. This Programmatic Environmental Impact Statement (PEIS) is being prepared by FSA to assess the potential environmental impacts of alternatives for administration and implementation of the Project Areas Program component of the BCAP.

The program supports the establishment and production, in approved project areas, of biomass crops for conversion to bio-energy in a biomass conversion facility (BCF).

1.2 PURPOSE AND NEED INCLUDING THE PROPOSED ACTION

The purpose of the Proposed Action is to establish and administer the Project Areas Program component of BCAP, specifically the establishment and production of eligible biomass crops, as provided for by Title IX of the 2008 Farm Bill. The need for the Proposed Action is to fulfill the CCC Charter Act (15 United States Code [U.S.C.] 714, et seq.) and FSA's responsibility as assigned by the Secretary of Agriculture (hereinafter referred to as Secretary) to administer the provisions of the 2008 Farm Bill.

1.3 THE NATIONAL ENVIRONMENTAL POLICY ACT PROCESS AND BCAP PEIS

This PEIS is prepared to satisfy the requirements of the National Environmental Policy Act (NEPA; Public Law [PL] 91-190, 42 U.S.C. 4321 et seq.); implementing regulations adopted by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1500-1508); and FSA implementing regulations, Environmental Quality and Related Environmental Concerns – Compliance with NEPA (7 CFR 799). According to CEQ guidance, the primary purpose of an environmental impact statement (EIS) is to "provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.4). A Federal agency must prepare an EIS when a proposed action or program constitutes a major Federal action that may have significant impacts to the natural or human environment (40 CFR 1508.18).

1.3.1 USDA NEPA Approach

This PEIS is an evaluation of the potential environmental consequences of implementing a new Federal program, BCAP, on a national scale. Because the specific locations of BCAP project areas and numbers of participants are not known, and the choice of specific program components cannot be determined at this time, this PEIS is prepared at a programmatic level. The BCAP PEIS will assist FSA and the CCC in determining (1) the conditions under which particular component actions of the program do not have the potential for significant environmental impacts and may be categorically excluded from further evaluation under NEPA; (2) those proposed actions that would require site-specific environmental reviews and compliance with applicable environmental laws in accordance with 7 CFR 799 and procedures established in the FSA Handbook on Environmental Quality Programs for State and County Offices (1-EQ Revision 2) (FSA 2009); and (3) those actions that may require an individual Environmental Assessment or EIS. The evaluation of future BCAP project specific potential environmental impacts would therefore tier from the BCAP PEIS.

Development of the BCAP PEIS in accordance with CEQ guidance and implementing regulations is a multi-phase process beginning with notifying the public and government agencies of CCC's intent to complete the PEIS, gather public and agency comment relevant for the identification of preliminary alternatives and environmental concerns, and conducting public scoping meetings. The first Notice of Intent (NOI) for BCAP was published in the Federal Register (FR) on October 1, 2008 (73 FR 57047-57048) with the amended NOI published on May 13, 2009 (74 FR 22510-22511). These NOI can be located in Appendix A. Six public scoping meetings were held in six states in late May and early June, 2009 (see Section 2.2.1). The next phase of the BCAP PEIS process involves development of a draft PEIS (DPEIS) with preliminary alternatives for administration and implementation of BCAP and potential impacts on specific resources, taking into account public and agency comments gathered previously. The DPEIS is then circulated for public and agency comment, and a final PEIS (FPEIS) published for additional public review and comment. Upon review of the comments received, the CCC issues a decision on the action based in part on the FPEIS, prior to implementing the program.

1.3.2 The Collection, Harvest, Storage, and Transportation Component of the BCAP

The CCC and FSA provided a Notice of Funds Availability (NOFA) for the CHST of eligible material on June 11, 2009 (74 FR 27767-27772) and on July 12, 2009 provided an additional notice concerning the implementing regulations for the CHST Matching Payment Program. The NOFA announces the availability of funds beginning in 2009 for certain provisions of BCAP allowing for matching payments to certain persons or entities for CHST of eligible material delivered to qualified BCFs in advance of full implementation of BCAP. FSA invited comments on the NOFA from all interested individuals and organizations over a 60-day comment period until August 10, 2009.

The NOFA and additional notice were published in response to the Presidential Directive issued to the Secretary of Agriculture directing an aggressive acceleration of investment in and production of biofuels. The Presidential directive requests that the Secretary of Agriculture take steps to the extent permitted by law to expedite and increase production of and investment in biofuel development by making the renewable energy financing available in the 2008 Farm Bill available within 30 days. This included guidance and support for CHST assistance of eligible materials for use in qualified BCF. The NOFA and additional notice were the first in a multi-step process to provide guidance to interested parties on funding for CHST pursuant to the Presidential Directive consistent with the 2008 Farm Bill.

The NOFA and additional notice provided a general summary of the provisions that would be used to administer payments for CHST in advance of the rule on BCAP (Appendix A). Specifically, they provide policies and processes for (1) providing payments for the CHST of eligible material, to qualified BCF, and (2) describe the process for qualifying CHST BCFs. The CHST matching payment program will be implemented under the guidance of the Executive Vice President, CCC, and the Deputy Administrator for Farm Programs, FSA (Deputy Administrator). Exceptions to the requirements of the NOFA may be granted by the Deputy Administrator provided they are not inconsistent with the 2008 Farm Bill or other applicable law and will not adversely affect the CHST matching payments program. Matching payments are paid at a rate of $1 for each $1 per dry ton received from the qualified BCF by the eligible material owner, equal to not more than $45 per ton, and are only available for a period of two years from the date of application approval. The funds are being made available per P.L. 110-246 (2008 Farm Bill) Section 9011 (d), Assistance with CHST.

The USDA has determined that making these funds available as soon as possible is in the public interest, and that withholding funds for CHST to provide for public notice and comment would unduly delay the provisions of the benefits associated with the program. The full PEIS and all comments and lessons learned from the BCAP notices, including the NOFA, will be utilized during the rulemaking process for the entire BCAP program.

1.3.2.1 Definitions Applicable to the CHST Provisions of the BCAP

The following provides definitions of important concepts related to the provisions of the CHST matching payments portion of the BCAP.

Renewable biomass is (1) materials, pre-commercial thinning, or invasive species from National Forest System land and public lands that are the byproducts of preventative treatments to reduce hazardous fuels, reduce or contain disease or destructive pests, or restore ecosystem health, which would not be otherwise used for a higher-value product, and was harvested/collected in accordance with all applicable laws and regulations; (2) any organic matter that is available on a renewable or recurring basis from non-Federal or land belonging to an Indian or Indian Tribe that is held in trust by the United States or subject to a restriction against alienation imposed by the United States. Renewable plant material includes feed grains, other agricultural commodities, other plants and trees, and algae. Waste materials include crop residue, other vegetative waste (wood waste and wood residues), animal waste and byproducts (fats, oils, greases, and manure), food waste, and yard waste.

Eligible material is renewable biomass with the exclusion of (1) harvested grains, fiber, and other commodities eligible to receive payments under Title I of the 2008 Farm Bill; (2) animal waste and byproducts; (3) food and yard wastes; and (4) algae.

Biomass Conversion Facility (BCF) is a facility that converts or proposes to convert eligible materials into (1) heat; (2) power; (3) biobased products; or (4) advanced biofuels.

Qualified BCF is a facility that meets all the requirements for qualification under the NOFA and has entered into a Memorandum of Understanding (MOU) for such qualifications with the Deputy Administrator.

Eligible material owners are defined as persons having the right to collect or harvest eligible material and that has delivered the material to a qualified BCF, which includes (1) for eligible material collected from private lands, including cropland, the land owner, the operator or producer conducting farming operations, or any other person designated by the land owner, and (2) for eligible material collected from public lands, those persons authorized through contract or permit with the USDA U.S. Forest Service (USFS) or other appropriate Federal agency to collect eligible material. These contracts and permits include timber sales contracts, stewardship contracts or agreements, service contracts or permits, and other applicable Federal land contracts or permits.

Biobased CHST product is a product, determined by the Deputy Administrator to be a commercial of industrial product (excluding food or feed) that is (1) composed in whole, or in significant part, of biological products, including renewable domestic agricultural and forestry materials; or (2) an intermediate ingredient or feedstock.

Intermediate ingredient or feedstock is a biobased CHST product that are subsequently used to make a more complex compound or product.

One ton equals 2,000 pounds; the **dry ton** equivalent is the weight of the actual biomass with zero percent moisture.

1.3.2.2 CHST Matching Payment Program Provisions

The NOFA and additional notice detailed the components of the CHST Matching Payment Program. The components include: land types and categories from where eligible materials may and may not be harvested/collected; which components CHST matching payments are not authorized; the application process for eligible material owners; the application process for receiving CHST matching payments; CHST matching payment provisions; and the qualified BCF requirement.

1. The eligible material must be listed as eligible on the official BCAP CHST Eligible and Ineligible Materials List that will be maintained of the FSA BCAP website. Eligible materials must be harvested or collected from sites within the U.S. or U.S. territories. Eligible materials may be harvested/collected from:

- National Forest System (NFS) or Bureau of Land Management (BLM) public lands accomplished according to all laws and regulations that apply to the Forest Service or BLM;
  - Certain NFS lands designated as components of the Wilderness Preservation System, the Wild and Scenic River System, as a National Monument, or composed of inventoried roadless areas are excluded; except for biomass CHST conducted by an eligible material owner who has an existing contract or grant issued by the USFS for the sale or removal of the material; and are subject to all laws and regulations that apply to the USFS including the Endangered Species Act and environmental analysis and approval as required by NEPA.
- Tribal, State, and other government locally owned land when performed in accordance with all applicable laws, regulations, ordinances, and permits;

- Privately owned land, including cropland, pastureland, rangeland, and forestland when performed to all applicable laws, regulations, ordinances, and permits.
- If collected or harvested from cropland, it must be consistent with the Conservation Plans required for highly erodible lands (HEL) provisions of Title VII of the Food Security Act of 1985, as amended;
- Non-industrial private forest lands in accordance with applicable Forest Stewardship Plans (FSP);
- If removed from Conservation Reserve Program (CRP) contract acreage, the material must be harvested or collected under the managed haying and grazing provisions of 2-CRP, Part 13;
- If removed from other lands enrolled in Federal, State, or local private land programs, the eligible material must be harvested or collected in accordance with the program's rules and requirements; and
- All eligible material must be collected and harvested in compliance with Executive Order 13112 (Invasive Species), February 3, 1999 (64 FR 25).

2. CHST matching payments are not authorized for (1) eligible material delivered to a qualified BCF prior to the publication of the NOFA; (2) eligible material delivered before the initial application for CHST matching payments has been received and approved by FSA; and (3) eligible material delivered to a facility that is not a CHST-qualified BCF; (5) material not originating from the U.S. or U.S. territories, including the source material used by intermediate factories/facilities; (5) materials removed from Federal lands other than U.S. National Forest or BLM public lands; and (6) for any material for which a payment has already been applied, approved, earned or is subject to a scheme or device used to circumvent the NOFA and related program requirements.

3. An eligible material owner must complete an application with the FSA to determine eligibility and the amount of eligible materials that an applicant can receive matching payments toward. An eligible material owner may make deliveries to multiple qualified BCF; however, a separate application must be completed for delivery to each qualified BCF. The details of the application process are included in the NOFA and additional notice (Appendix A).

4. After the application has been approved, the eligible material owner will need to provide evidence of delivery and payment by a qualified BCF to request payment of the CHST matching funds. The details of the payment request process are included in the NOFA and additional notice (Appendix A).

5. CHST matching payments will be made to approved eligible materials owners at a rate of $1 for each $1 received from the BCF at a maximum of no more than $45 per ton. Payments will be made for a period not to exceed 24 months from the date of approval of the eligible material owner's application. Only one owner will receive CHST matching payments for any eligible materials. The program will be administered according to all applicable laws, regulations, and USDA guidance. Additionally, not more than 20 percent of

the funding available under this NOFA will be used for CHST matching payments for crop residues from commodities eligible to receive payments under Title I of the 2008 Farm Bill (Appendix A).

6. A BCF must enter into an MOU with the CCC and meet all the requirements set forth in the NOFA and additional notice to be considered a qualified BCF (Appendix A).

1.3.3 Resource Specific Guidance

A variety of laws, regulations, and Executive Orders (EO) apply to actions undertaken by Federal agencies and form the basis of the analysis prepared in this PEIS. These include but are not limited to:

- National Historic Preservation Act
- Endangered Species Act
- Clean Water Act
- Clean Air Act
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations
- EO 11988, Floodplain Management
- EO 11990, Protection of Wetlands
- Coastal Zone Management Act

1.3.4 Other Related Actions, Federal Permits, and Licenses

1.3.4.1 Other Related Actions

Other Federal agency actions directly related to BCAP implementation are administered by USDA agencies such as the Biorefinery Expansion Program; the Farm Storage Facility Loan Program, the Forest Biomass for Energy Program, the Bioenergy Program for Advanced Biofuels, a Pilot Energy Crop Insurance Study, and tax credits for production of cellulosic biofuel. Table 1.3-1 summarizes the other Federal agency actions directly related to BCAP implementation and existing or planned NEPA documents evaluating the environmental impacts of these programs.

1.3.4.2 Federal Permits, Licenses and other Entitlements

Other Federal permits, licenses and other entitlements which must be obtained in implementing the Proposed Action are required under the following:

<u>Section 404 of the Clean Water Act</u>

The U.S. Army Corps of Engineers (USACE) regulates the placement of dredged or fill material in waters of the United States, which includes some wetlands, pursuant to 33 CFR parts 320-3320. Work and structures that are located in, or that affect, navigable waters of the U.S, including work below the ordinary high water in non-tidal waters are also regulated by the USACE.

Section 402 National Pollutant Discharge Elimination System

The U.S. Environmental Protection Agency (EPA) currently regulates storm water discharges from construction sites that are 1 acre or larger. Documenting project compliance with the National Pollutant Discharge Elimination System (NPDES) general permit involves the preparation of a Storm Water Pollution Prevention Plan and submittal of a Notice of Intent to Discharge to EPA.

Section 401 Water Quality Certification

Pursuant to Section 401 of the Clean Water Act, Federal permits for projects in wetlands or waterways must be certified by the state licensing or permitting agency to ensure that state water quality standards are met. Projects requiring a Section 404 or Section 402 also need a Section 401 permit.

USDA APHIS Permit -Introduction of Genetically Engineered Organisms

USDA Animal Plant Health Inspection Service (APHIS) issues permits for importation, interstate movement, or environmental release of certain genetically engineered (GE) organisms. A developer wishing to introduce a GE organism must obtain the necessary authorization before proceeding. Depending on the nature of the GE crop, an applicant files either a notification or a permit application for APHIS review.

USDA USFS Special Use Permit

The Agency's special-uses program authorizes uses on NFS land that provide a benefit to the general public and protect public and natural resources values. The USFS carefully reviews each application to determine how the request affects the public's use of NFS land. Normally, NFS land is not made available if the overall needs of the individual or business can be met on nonfederal lands.

Transportation

The Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA), PHMSA is responsible for regulating and ensuring the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines. Special permits (formerly called waivers) may be issued to individual operators in response to petitions. They waive parts of PHMSA regulations if the petitioner demonstrates and PHMSA agrees that doing so is consistent with pipeline safety. They are usually contingent on specific requirements set forth in the permit.

1.3.5 Cooperating Agencies

Cooperating agencies as defined by the CEQ include any Federal agency other than the lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in proposed legislation, a proposed action, or reasonable alternative (40 CFR

1508.5). Cooperating agencies may include a State or local agency with similar qualifications, at the invitation of the lead Federal agency. The following agencies are cooperating with FSA and the CCC in the BCAP Project Areas Program PEWS:

- USDA Rural Development (RD)
- USDA APHIS
- USDA Forest Service (USFS)
- U.S. Fish and Wildlife Service (USFWS)

1.3.5.1 Rural Development

The USDA RD mission statement is to, "increase economic opportunity and improve quality of life for all rural Americans." Under the 2008 Farm Bill RD was delegated authority for five of the programs relating specifically with rural energy and the advancement of rural energy opportunities. More specifically, RD has authority over Section 9003, Biorefinery Assistance, which is directly related to the BCAP implementation, as well as the following, Section 9004, Repowering Assistance; Section 9005, Bioenergy Program for Advanced Biofuels; Section 9007, Rural Energy for America Program (REAP); and Section 9009, Rural Energy Self-Sufficiency Initiative.

1.3.5.2 Animal and Plant Health Inspection Service

The USDA APHIS is responsible for protecting United States' agriculture from pests and diseases under the authority of the Plant Protection Act (PPA), Title IV of the Agricultural Risk Protection Act of 2000 (APHIS 2002). The PPA gives the Secretary of Agriculture, through delegated authority to APHIS, the ability to prohibit or restrict the importation, exportation, and the interstate movement of plants, plant products, certain biological control organisms, noxious weeds, and plant pests. APHIS issues permits for the importation, interstate movement, or environmental release of specific GE plants. Permit applications provide details about the nature of the GE organism to be introduced and measures that will be taken to prevent the spread and establishment of the organism in the environment; all applications are reviewed by APHIS experts. APHIS issues the permit for the introduction of GE organisms (including plants, insects or microbes) that may pose a plant pest risk; hence, APHIS has regulatory authority over potential implementation of GE-modified BCAP biomass crops.

Table 1.3-1. Other Federal Actions Directly Related to BCAP

Program	Establishment/Administration	Program Summary
Biorefinery Assistance (Biorefinery Expansion)	2008 Farm Bill Title IX, Section 9003 / USDA Rural Development, in consultation with Department of Energy	Provides competitive grants, not to exceed 30% of project cost, for the development and construction of demonstration-scale biorefineries that convert renewable biomass to advanced biofuels. Provides loan guarantees of up to 90% of principle and interest for the development, construction and retrofitting of commercial-scale biorefineries. Mandates $75 million in FY2009 and $245 million in FY 2010, through the CCC, for loan guarantees. Biorefineries are full fuel production phase facilities that include biomass conversion operations eligible under BCAP.
Forest Biomass for Energy	2008 Farm Bill Title IX, Section 9012 / USDA Forest Service	Authorizes new competitive research and development programs that encourage use of forest biomass for energy; priority project areas include: (1) developing technology and techniques to use low-value forest biomass for energy production, (2) developing processes to integrate energy production from forest biomass into biorefineries, (3) developing new transportation fuels from forest biomass, and (4) improving growth and yield of trees intended for renewable energy. Authorizes the appropriation of $15 million annually for FY 2009 through 2012.
Bioenergy Program for Advanced Biofuels	2008 Farm Bill Title IX, Section 9005 / USDA Rural Development	Authorizes payments to eligible agricultural producers for the expanded production of advanced biofuels (biofuels derived from renewable biomass other than corn-kernel starch). Eligible producers entering into a contract are paid based on the quantity and duration of advanced biofuel production and on the net nonrenewable energy content of the advanced biofuel. Provides $55 million in FY 2009 and 2010, $85 million in FY 2011, and $105 million in FY 2012. The bill also authorizes an additional $25 million per year from FY 2009 through 2012.

Table 1.3-1. Other Federal Actions Directly Related to BCAP (cont'd)

Program	Establishment/Administration	Program Summary
Farm Storage Facility Loan (FSFL)	2008 Farm Bill Title I, Subtitle F, Section 1614 / USDA through FSA	Provides low-interest loans for producers to build or upgrade farm storage and handling facilities. The costs for building or upgrading farm storage and handling facilities include such expenses as price and sales tax, shipping and delivery charges, site preparation costs, installation, and new material and labor for concrete pads. This program is eligible for producers that produce corn, grain sorghum, rice, soybeans, oats, peanuts, wheat, or minor oilseeds harvested as whole grain. Also eligible are corn, grain sorghum, wheat, oats or barley harvested as other-than-whole grain. The FSA is currently completing an Environmental Assessment of the FSFL Program expected to be completed by July of 2009.
Pilot Energy Crop Insurance Study	2008 Farm Bill Title XII, Section 12023/USDA Risk Management Agency	Requires the Federal Crop Insurance Corporation (FCIC) to contract for studies of insurance policies for energy crops, aquaculture, poultry, apiary (bees), and skip-row cropping practices (for corn and sorghum in Central Great Plains).
Tax Credit for Production of Cellulosic Biofuel	2008 Farm Bill Title XV, Section 15321	Provides temporary cellulosic biofuels production tax credit of up to $1.01/gallon through Dec 31, 2012 to any producer of qualified cellulosic biofuel.

1.3.5.3 Forest Service

The USDA USFS manages a portfolio of more than 193 million acres of national forest and grasslands throughout the United States. The Forest Service is directly involved in the BCAP implementation due to the potential for woody biomass to be used as a crop type. The Forest Service provides assistance to private woodland owners and maintains a large staff of scientists related to all aspects of forest health, forest economics, and other issues.

1.3.5.4 Fish and Wildlife Service

The USFWS' mission statement is conserving the nature of America. This agency is specifically interested in the potential effects to fish and wildlife resources, including habitat, from the BCAP implementation.

1.4 Biomass Program Overview Industry

In 2007, biomass production contributed 3.6 quadrillion British thermal units (Btu) of energy to the 71.7 quadrillion Btu of energy produced in the United States or about 5 percent of total energy production. Because a substantial portion of U.S. energy was imported in 2007, biomass supplied approximately 3.5 percent of the total energy consumption in the U.S., which include both domestic production and imported energy sources (101.6 quadrillion Btu) (DOE 2009a). Biomass is unique among renewable energy resources in that it can be converted to carbon-based fuels and chemicals, in addition to electric power (Perlack *et al*. 2005).

1.4.1 Biomass Resource Base

The biomass resource base is composed of a wide variety of forestry and agricultural resources, industrial processing residues, and municipal solid and urban wood residues (Figure 1.4-1). Forest resources include residues produced during the harvesting of forest products, fuel wood extracted from forestlands, residues generated at primary forest product processing mills, and forest resources that could become available through initiatives to reduce fire hazards and improve forest health. Agricultural resources include grains used for biofuels production, animal wastes and byproducts (e.g., fats, oils, greases, and manure), and crop residues derived primarily from corn and small grains (e.g., wheat straw). A variety of regionally significant crops, such as cotton, sugarcane, rice, and fruit, and can also be a source of crop residues. Municipal and urban wood residues are widely available and include a variety of materials — yard and tree trimmings, land-clearing wood residues, wooden pallets, packaging materials, and construction and demolition debris (Perlack *et al*. 2005).

Dedicated biomass energy crop production is still in its infancy, but given the changing dynamics in assistance programs to generate long-term interest and sustainability of production, dedicated biomass energy crop production is anticipated to increase. With the increase in production, there will be a commensurate increasing need for storage of materials until transportation to a biomass conversion facility is required. In 2007, the United States produced 3.6 quadrillion BTUs of energy from biomass, with the majority from wood wastes or byproducts (U.S. Department of Energy [DOE] 2009a). In the DOE report, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply* (Perlack *et al.* 2005), indicated a potential for new biomass energy crops to produce, at a moderate crop yield, 164.1 million dry tons per year, which would need new storage capacity. This does not include any Title I crops.

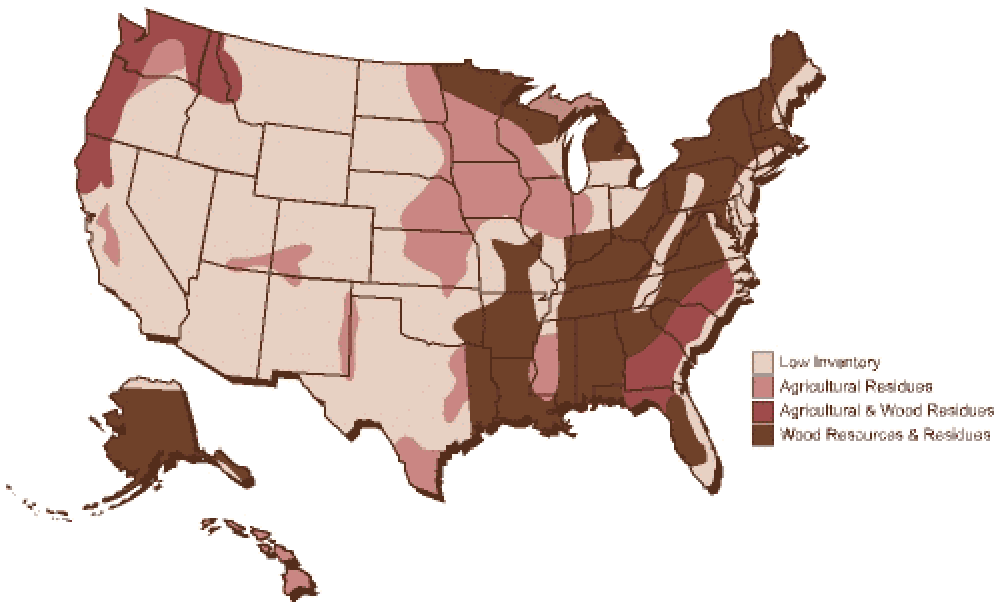


Figure 1.4-1. Distribution of Biomass Resources across the United States (DOE 2009b)

1.4.2 BCAP Eligible Crops

The 2008 Farm Bill defines Eligible Crops under BCAP as a crop of renewable biomass with the exclusion of any crop that is eligible to receive payments under Title I of the 2008 Farm Bill or any plant that is considered invasive or noxious or has the potential to become invasive or noxious. Under BCAP, first generation biomass sources (feedstocks), such as corn grain, would not be eligible for inclusion as an eligible crop; however, crop and forestry residues (second generation feedstocks) would be considered eligible materials for CHST (see Section 1.3.2). The BCAP focuses on the establishment of third generation feedstock more commonly referred to as dedicated energy crops, to sustain the development of an economically viable cellulosic bioenergy industry. Cellulosic biomass is composed of very complex sugar polymers, which cannot be easily converted into a food source. The major types of BCAP eligible crops that will be discussed and analyzed in this PEIS are the following: short rotation woody crops (SRWC) and other dedicated tree/shrub species, perennial grasses (e.g., switchgrass, energycane, energy or sweet sorghum, etc.), and non-Title I oilseeds (e.g., Camelina).

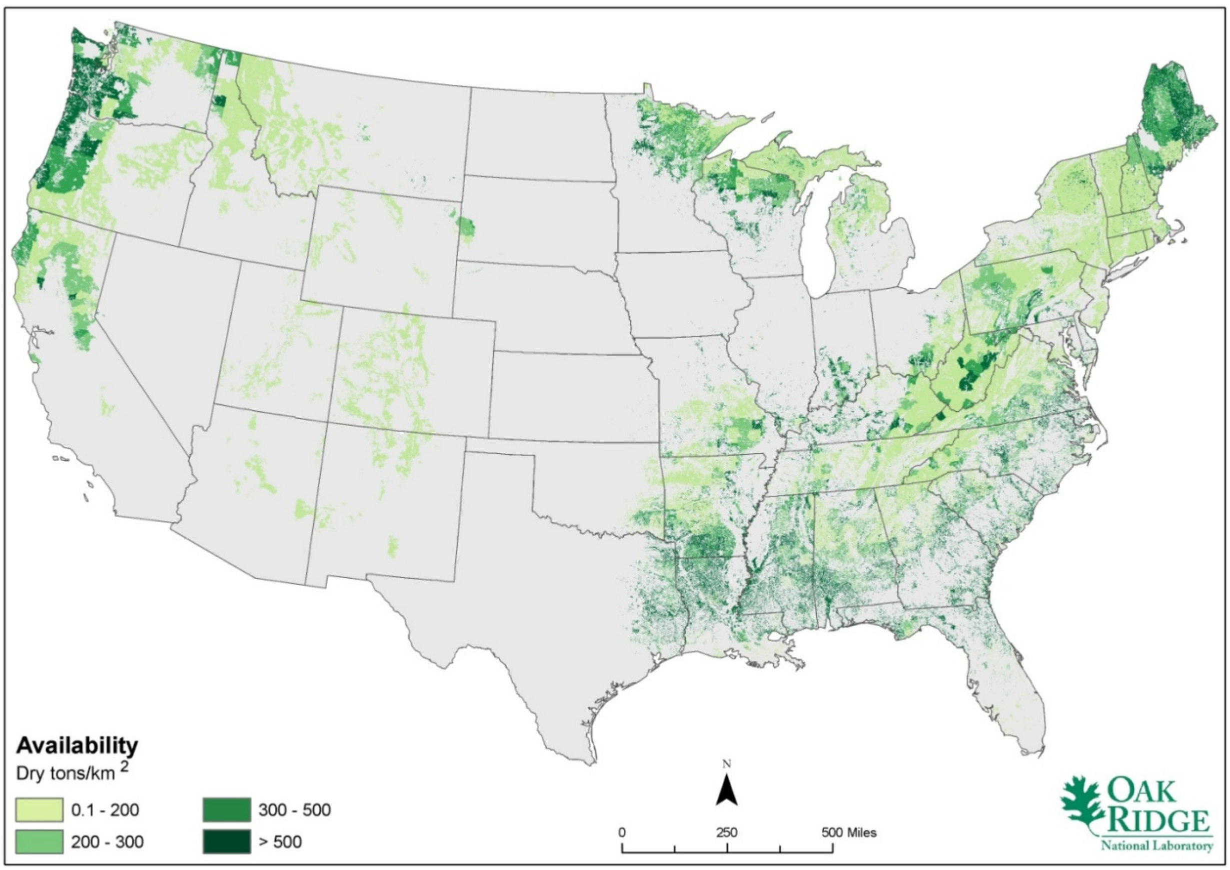
1.4.3 Forest Resources

Forest lands are defined as lands at least 10 percent of stocked by forest type trees of any size. (Lubowski *et al.* 2006) Forest type trees do not include ornamental trees, and trees used for fruit and nuts production. Forest lands include those lands that were cleared of trees but previously met this definition and are being allowed to regenerate naturally or artificially. The minimum size for classification as forest land is one acre. Linear forested areas (riparian areas, shelterbelts, etc.) must have a crown width of at least 120 feet to qualify as forest land (Lubowski *et al.* 2006).

There are approximately 23 billion acres of land in the U.S. including Hawaii and Alaska. According to 2002 figures, forest land made up approximately 749 million acres in the U.S. (of which Alaska contributes 185 million acres). This acreage is approximately 1/3 of the estimated forest land area at the time of the arrival of Europeans in the western hemisphere. In 2002, 57 percent of the forest lands were on private lands. Private forest land ownership dominates in the east US while public ownership dominates in the west.

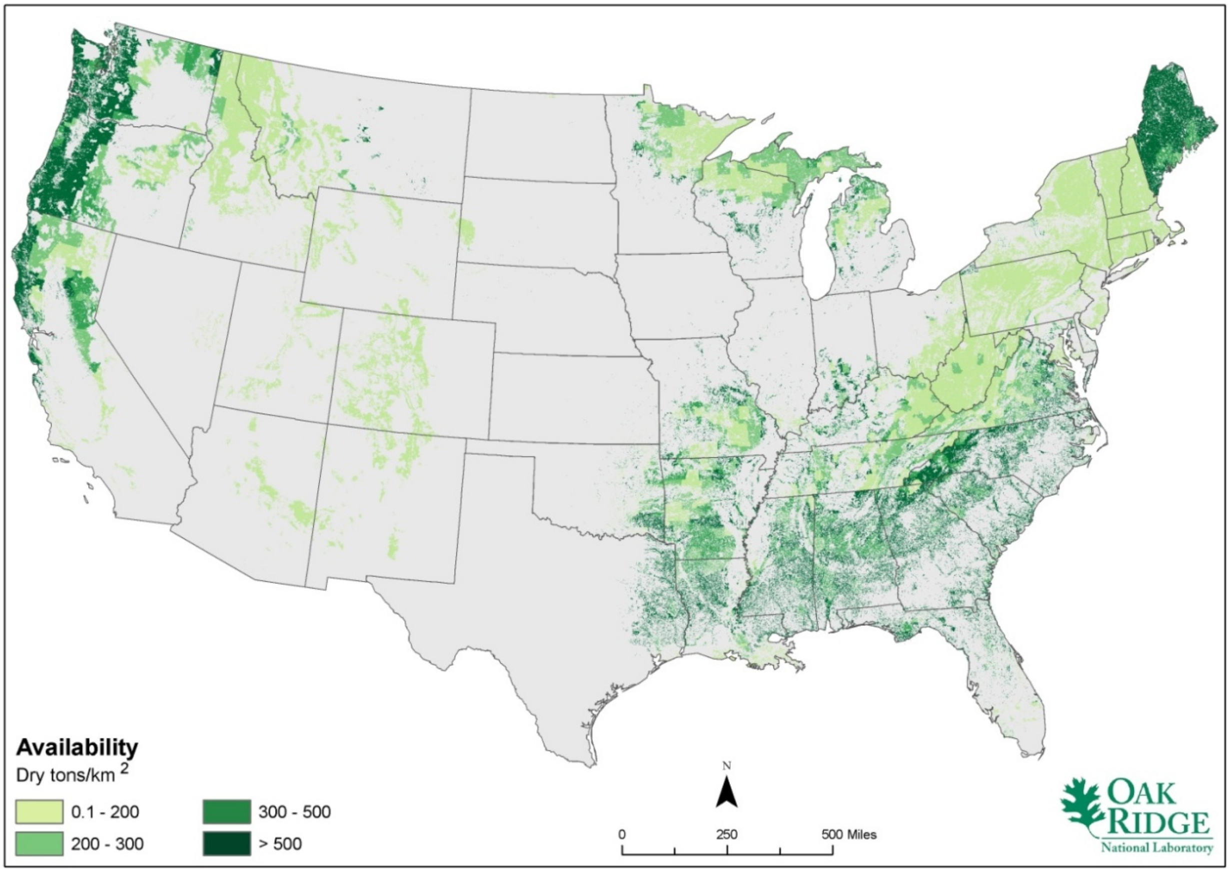
Approximately 504 million acres of forest lands (66 percent of the total U.S. forest lands) is classified as timberland. Timberland is defined forest land that is producing or is capable of producing crops of industrial wood and which has not been withdrawn from timber utilization by statute or administrative regulation (Lubowski *et al.* 2006).

Woody biomass are the trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management (Figures 1.4-2 and 1.4-3). Forestlands make up about one-third of the nation's total land area. Biomass derived from forestlands contributes about 142 million dry tons to the total annual consumption in the United Sates of 190 million dry tons. According to a study sponsored jointly by USDA and DOE (Perlack *et al.* 2005), the amount of



Source: ORNL (Oak Ridge National Laboratory) 2008a

Figure 1.4-2. Availability of Logging Residue from Timberlands, 2007



Source: ORNL (Oak Ridge National Laboratory) 2008b

Figure 1.4-3. Availability of Fuel Treatment Thinnings from Timberlands, 2007

forestland-derived biomass that can be sustainably produced is approximately 368 million dry tons annually in the U.S. from logging residues and fuel treatment thinnings. Currently, very little of this woody biomass is used for energy production due to the costs and difficulty associated with collecting and transporting this material (Wilkerson *et al.* 2008).

1.4.4 Agricultural Resources

Agriculture is the third largest single use of land in the United States. It has been estimated that these lands can provide nearly 1 billion dry tons of sustainably collectable biomass and continue to meet food, feed, and export demands (Perlack *et al.* 2005). This estimate includes 446 million dry tons of crop residues and 377 million dry tons of perennial crops.

Switchgrass (*Panicum virgatum L.*),is a thin-stemmed, warm season, perennial grass that has shown high potential as a high-yielding crop that can be grown in most areas of the nation that are also suitable for crop production (Wright *et al.* 2006). Generally, a ten year production rotation is assumed before replanting, but periods of different lengths are possible if circumstances warrant it. Perennials such as switchgrass have several benefits over many major agricultural crops (the majority of which are annual plants). First, energy crops based on perennial species are grown from roots or rhizomes that remain in the soil after harvest. This reduces annual field preparation and fertilization costs. Second, perennial crops in temperate zones may also have significantly higher total biomass yield per unit of land area compared to annual species because of higher rates of net photosynthetic carbon dioxide (CO_2) fixation into sugars. Third, lower fertilizer runoff, lower soil erosion, and increased habitat diversity are also attributes that make perennial crops more attractive than annual crops (DOE 2006). However, switchgrass and other energy crops are not currently harvested on the large scale which will be needed in order that this biomass resource can compete with existing uses for agricultural land. Switchgrass is expected to be most competitive with existing land uses in the southeastern and northeastern U.S. and in a ring surrounding the Corn Belt (Sun Grant BioWeb 2009). Switchgrass can spread aggressively and without proper management may become weedy or invasive in some regions or habitats.

Agricultural crop residues are the biomass that remains in the field after harvest. The eight leading U.S. crops can produce more than 450 million tons of residues each year (Perlack *et al.* 2005). A sizeable portion of this is corn stover (Figure 1.4-4). Corn stover refers to the stalks, leaves and cobs that remain in corn fields after the grain harvest. Farmers leave it on their fields to revitalize the soil and prevent erosion. Crop residues can be found throughout the U.S., but are primarily in the Midwest because of corn stovers preeminence.

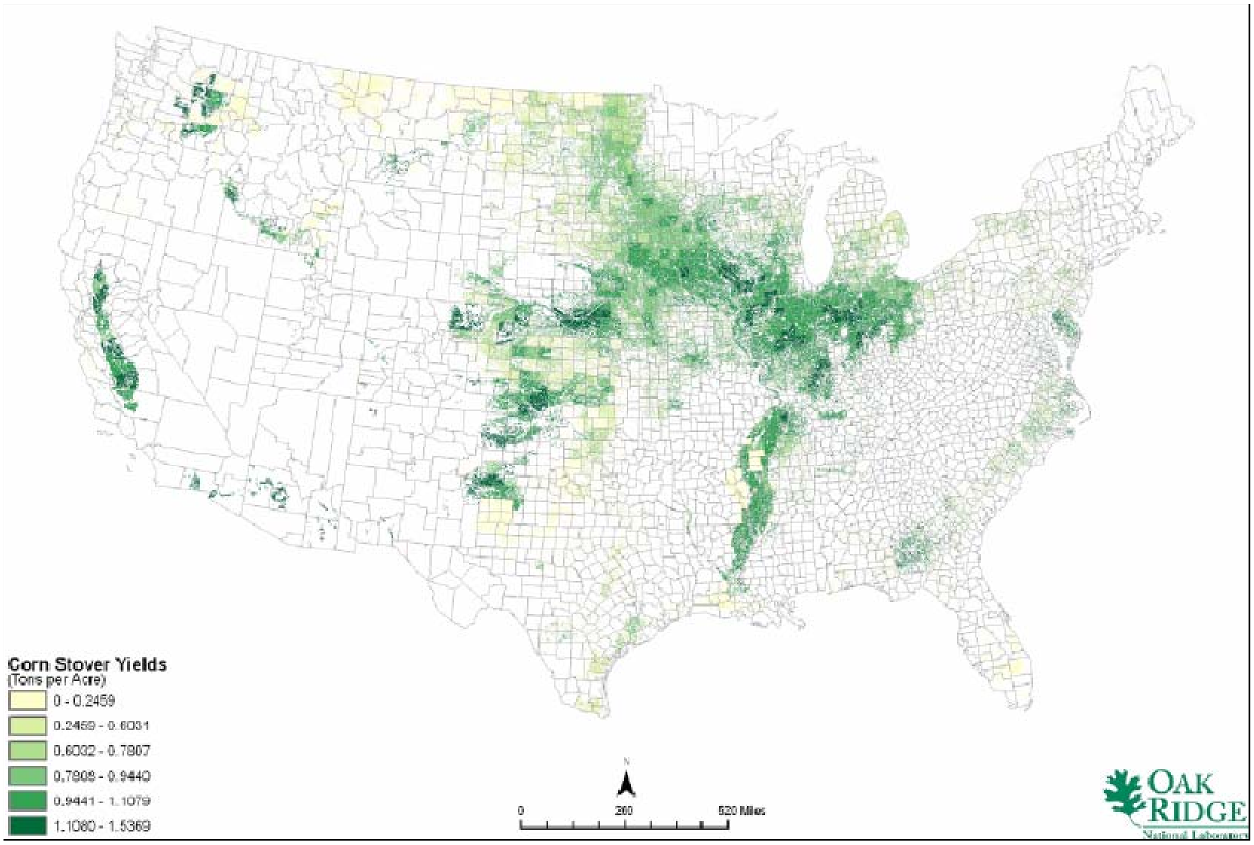
Crops high in sugar content, like sugarcane, are easier to process into ethanol than starch crops since the sugar required by fermentation is already present. In 2008, around 860,000 acres of U.S. sugarcane were harvested which is less than 1 percent of total acres devoted to corn. According to USDA data for 2008, a total of 30 counties in Florida, Louisiana, Hawaii, and Texas produced sugarcane (NASS 2008a). Constraints on the use of sugarcane as a biomass resource, in the U.S., include limited geographic production regions due to its sensitivity to frost, and the costs of producing the sugarcane and recovering the sugar.

1.4.5 Biomass Conversion Facilities

A BCF under Title IX of the 2008 Farm Bill (Section 9001) is a facility that converts renewable biomass into heat, power, biobased products, or advanced biofuels, while a biorefinery is a facility that converts renewable biomass into biofuels, biobased products, and may produce electricity. Currently, renewable biomass in the U.S. is being used at existing biorefineries to create transportation fuel products (i.e., ethanol), while also generating co-products that can be used as livestock feeds, fertilizer, and other industrial inputs. Additional uses for renewable biomass are as secondary fuel sources at co-fired electricity generating power plants and at local levels to heat schools, municipals building, and other select sources.

1.4.5.1 Current Ethanol Production Facilities

Ethanol producing biorefineries use corn and other high starch sources to produce transportation fuels. The Renewable Fuels Association reported 170 U.S. ethanol distilleries in operation and another 24 under construction, in 26 states as of January 2009 (Renewable Fuels Association [RFA] 2009). The ethanol industry has grown substantially within the last decade. Ethanol production has grown from 175 million gallons in 1980 to approximately 9,000 million gallons by 2008 (RFA 2009). Growth in ethanol production in the 1980s averaged 22.3 percent;



Source: ORNL (Oak Ridge National Laboratory) 2008c

Figure 1.4-4. Availability of Corn Stover Residue, 2007

however, growth was highly slanted toward the early 1980s, with growth of over 40.0 percent from one year to the next, while in the late 1980s, growth slowed tremendously, to approximately 1.0 percent per year (RFA 2009). Between 1999 and 2008, 89 new ethanol facilities have come on-line to reach an industry capacity of greater than 7,888 million gallons per year (mgy) (RFA 2009). In addition to domestic production, the United States has been importing ethanol at an average rate of 5.2 percent of domestic demand per year since 2002 (RFA 2009). During the period between 2002 to 2008, the average annual demand for ethanol in the United States has been growing at 29.4 percent (RFA 2009).

LECG, LLC (2009) indicated that the ethanol industry in 2008 spent more than $28.6 billion, which flowed through the economy to create an additional $65.7 billion in gross domestic product (GDP), $19.9 billion in earnings, and created more than 494,000 employment positions. Additionally, the production and use of ethanol as a transportation fuel displaced approximately $32 billion in crude oil use in the United States (LECG 2009).

Currently, a majority of ethanol is made from corn but to significantly increase ethanol production the use of cellulosic feedstock such as agricultural residues, grasses, and wood will be needed. Research over the past several years has developed several technologies that have the capability of converting many types of cellulosic resources into a wide range of products. The goal for biorefineries is to produce both high-volume liquid fuels and high-value chemicals or products to address national energy needs while enhancing economic operations. Figure 1.4-5 shows the locations of U.S. BCFs, a total of 315, including biorefineries and wood pellet mills.

Figure 1.4-5. Locations of U.S. Biomass Conversion Facilities

1.4.5.2 Current Electricity Generation

The Energy Information Administration (EIA) of the DOE in the Electric Power Annual – 2007 details energy source and megawatt capacity. In 2007, 346 generators used wood and wood derived fuels as an energy source with a nameplate capacity of 7,510 MW (net summer capacity of 6,704 MW, net winter capacity of 6,745 MW) (EIA 2009).

1.5 ORGANIZATION OF THE PEIS

This PEIS assesses the potential impacts of the action and the No Action alternatives on potentially affected environmental and socioeconomic resources.

- **Chapter 1** provides background information relevant to the Proposed Action, and discusses its purpose and need.
- **Chapter 2** describes the alternatives including the Proposed Action.

- **Chapter 3** describes the baseline conditions (i.e., the conditions against which potential impacts of the Proposed Action and alternatives are measured) for each of the potentially affected resources.
- **Chapter 4** describes potential environmental consequences on these resources.
- **Chapter 5** includes analysis of cumulative impacts and irreversible and irretrievable resource commitments.
- **Chapter 6** discusses mitigation measures.
- **Chapter 7** is a list of references cited in the PEIS.
- **Chapter 8** lists the preparers of this document.
- **Chapter 9** contains a list of persons and agencies receiving this document and contacted during the preparation of this document.
- **Chapter 10** is an index of subjects discussed in the PEIS.
- **Chapter 11** contains a glossary of technical terms utilized.
- Appendices.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 PROPOSED ACTION

The Proposed Action is to establish and administer the Project Areas Program component of BCAP as mandated in Title IX of the 2008 Farm Bill. A detailed description of the actions required for establishment and administration of the Project Areas Program is presented in the following sections.

2.1.1 Establishment and Purpose

In accordance with Section 9011 of the 2008 Farm Bill legislation, the Secretary shall establish and administer the BCAP to:

- Support the establishment and production of eligible crops on eligible land for conversion to bio-energy in selected BCAP project areas; and
- Provide financial assistance to producers of eligible crops in a BCAP project area.

Eligible crops means crops of renewable biomass, but do not include:

- Any crop that is eligible to receive payments under Title I of the 2008 Farm Bill or subsequent amendments; or
- Any plant that has the potential to be invasive or noxious, or as determined further by the Secretary in consultation with other appropriate Federal or State departments or agencies.

The specific eligible BCAP crop types as proposed by USDA are presented in Appendix B.

A BCAP project area must have specific boundaries; which include producers with contract acreage that will supply a portion of the renewable biomass needed by a BCF; and is physically located within an economically feasible distance from the BCF. A qualified BCF means a facility that converts or proposes to convert eligible renewable biomass into heat, power, bio-based products, or advanced biofuels.

2.1.2 Project Area Application Requirements

To be considered for selection as a BCAP project area, a project sponsor consisting of a group of producers or a BCF shall submit to the Secretary a proposal that minimally includes: (1) a description of the eligible land and eligible crops of each producer that will participate in the proposed BCAP project area; (2) a letter of commitment from a BCF that the BCF will use eligible crops intended to be produced in the BCAP project area; (3) evidence that the BCF has sufficient equity available if the BCF is not operational at the time the project area proposal is submitted; and (4) other information that gives the Secretary a reasonable assurance that the BCF will be in operation by the time that the eligible crops are ready for harvest.

2.1.3 Project Area Selection Criteria

BCAP project area selection criteria include the amount of eligible crops produced in the BCAP project area and the probability that such crops will be used for the purposes of BCAP; the amount of biomass likely to be available from sources other than the crops grown with support from the BCAP; the local economic impact of the project; the opportunity for local investors to participate in the ownership of the BCF; the participation rate of beginning or socially disadvantaged farmers and ranchers; the environmental impact of the proposal; the variety of agronomic practices and species – including mixes of different crops – proposed within a BCAP area; the range of eligible crops among project areas; and any other additional information as determined by the Secretary.

2.1.4 BCAP Contract Terms

Producers would be required to enter into individual contracts. To be considered for the BCAP, the proposed land must be in compliance with highly erodible and wetland conservation requirements of Title II of the 2008 Farm Bill. In addition, the applicant must have a Conservation or Forest Stewardship Plan, commit to provide information to promote the production of eligible crops and the development of biomass conversion technology, preserve cropland bases and yield history, commit to a contract duration term of five years for annual and perennial crops and 15 years for woody biomass crops, and any additional requirements as determined by the Secretary.

2.1.5 BCAP Payments

Payments to BCAP participants shall include establishment payments and annual payments. Establishment payments will provide for up to 75 percent of establishment cost for perennial crops and includes cost of seed and/or stock and planting for perennials. In areas of non-industrial forest land, establishment payments will cover the cost of site preparation and tree planting.

Annual payments shall be reduced if an eligible crop is used for purposes other than the production of energy at the BCF, an eligible crop is delivered to the BCF, or the producer violates a term of the contract.

2.1.6 BCAP Reporting Requirements

The 2008 Farm Bill includes a provision that requires the Secretary to submit a report to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate a report on the dissemination by the Secretary of the best practice data and information gathered from participants receiving assistance under the BCAP no later than four years after enactment of the law.

2.2 ALTERNATIVES DEVELOPMENT

Scoping is a process used to identify the scope and significance of issues related to a Proposed Action while involving the public and other key stakeholders in developing alternatives and weighing the importance of issues to be analyzed in the PEIS. Those involved in the scoping process include Federal, State and local agencies, interested non-governmental organizations, producers eligible for the program, and the public. Scoping can help to resolve any conflicts or concerns prior to making a decision to implement an action. FSA has conducted both internal and external scoping of the Proposed Action and preliminary alternatives for the implementation and administration of the BCAP.

2.2.1 Agency and Public Scoping

Under the NEPA, the EIS process provides a means for the public to provide input on program implementation alternatives and on environmental concerns. CCC first provided notice of its intent (NOI) to prepare the proposed BCAP PEIS in the Federal Register on October 1, 2008 (73 FR 57047-57048). CCC provided an amended NOI to prepare the proposed BCAP PEIS in the Federal Register on May 13, 2009 (74 FR 22510-22511) and solicited public comment on the proposed PEIS for BCAP. Six public scoping meetings were held in May and June 2009 to solicit comments for the development of alternatives and to identify environmental concerns. FSA performed a density analysis of likely BCAP participation to determine those areas that would utilize the program and meetings were planned for these six locations. Public meetings were held in Washington, Texas, Iowa, Louisiana, Georgia, and New York in the cities and dates as presented in Table 2.3-1. The PEIS has taken into consideration comments gathered in the scoping process initiated with the October 1, 2008 NOI to develop the alternatives proposed for the administration and implementation of BCAP.

Announcements of the scoping meetings were posted in the FR, State and county FSA offices, and the FSA website prior to the meetings. A public website was created that provided program information, scoping meeting locations and times, and an electronic form for submitting comments via the internet. A presentation was given at each meeting followed by a comment period for attendees. Printed program information and comment forms were made available at the meetings, along with cards providing the public comment website address. Meetings were attended by the FSA National Environmental Compliance Manager or FSA Federal Preservation Officer, and were recorded by a court reporter.

2.2.2 Scoping Issues

All comments received during the scoping process were recorded and categorized, as applicable, to the stated purpose and need for the Proposed Action, the Proposed Action itself, preliminary alternatives, and environmental resource areas. The comments were evaluated by FSA to determine the scope and significance of each issue and the depth at which it would be analyzed in the PEIS. The scoping comments received have been summarized in a matrix provided in Appendix C.

2.3 BCAP Project Areas Program Alternatives Analyzed

Analysis of the potential impacts of not implementing a given proposed action is required by NEPA under 40 CFR 1502.14(d) and serves as an environmental baseline against which the impacts of action alternatives for program implementation may be compared. The criteria utilized to select an action alternative for analysis include:

- Meets basic purpose and need
- Is achievable within the legislated time constraints for the program

Table 2.3-1. BCAP PEIS Public Meeting Locations and Dates

Date	Public Meeting City	Public Meeting Location
28 May 2009	Olympia WA	Red Lion Hotel 2300 Evergreen Park Drive, Olympia, WA 98502
2 June 2009	Amarillo, TX	Hilton Garden Inn 9000 I-40 West, Amarillo, TX 79124
4 June 2009	Alexandria, LA	Alexander Fulton Hotel 701 4th Street Alexandria, LA 71301
8 June 2009	Des Moines, IA	Renaissance Savery Hotel 401 Locust Street Des Moines, IA 50309
10 June 2009	Albany, GA	Hilton Garden Inn 101 S. Front Street Albany, GA 31701
11 June 2009	Syracuse, NY	Hilton Garden Inn 6004 Fair Lakes East Syracuse, NY 13057

- Is achievable within the budget appropriated for the program
- Does not violate any existing laws

2.3.1 No Action Alternative

The No Action Alternative is carried forward in this PEIS in accordance with 40 CFR 1502.14(d) to represent the environmental baseline against which to compare the other alternatives. The No Action Alternative assumes that no Federal program for the Project Areas Program component of BCAP would be implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need as described above, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

2.3.2 Action Alternatives

Two alternatives are proposed for the administration and implementation of BCAP. The components of each alternative are presented in Table 2.3-2.

2.3.2.1 Alternative 1 – Targeted BCAP Implementation

Under Alternative 1, BCAP would be implemented on a more restrictive or targeted basis. BCAP project areas would be authorized for those projects that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands shall be allowed to enroll in the program for BCAP crop production. An additional limitation is imposed by the relatively small funding for implementation of a BCAP program provided in the preliminary FY 2010 President's budget, which could limit the number of viable areas analyzed under this alternative. Similar to the CRP administered by FSA, the number of acres enrolled in BCAP project areas for crop production shall be limited to no more than 25 percent of the cropland in a given county. Payment rates would be limited to an amount sufficient to provide some risk mitigation. To participate in a BCAP project area, a BCF that produces advanced biofuels must ensure the fuel meets the greenhouse gas test included in the Energy Independence and Security Act (EISA) of 2007, that is, a defined percent of the full life cycle reduction in greenhouse gas gained over the production and use of conventional fuels.

2.3.2.2 Alternative 2 – Broad BCAP Implementation

Alternative 2 would enable anyone who meets the basic eligibility requirements as outlined in the 2008 Farm Bill provisions governing BCAP to participate in a BCAP project area. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands would be allowed to enroll in the program for BCAP crop production, and

Table 2.3-2. Action Alternatives Summary

Alternative 1: Targeted Implementation of BCAP	Alternative 2: Broad Implementation of BCAP
BCFs supported by BCAP project areas are limited to producing energy.	All bio-based products produced by a BCF in BCAP project areas can be supported.
No new non-agricultural lands allowed for BCAP project area crop production.	New non-agricultural lands allowed for BCAP project area crop production.
Cropland acres enrolled in the program would be capped at 25 percent of cropland acres within a given county.	Cropland acres enrolled in the program would not be capped.
Advanced biofuels produced by BCAP project area BCFs must meet the greenhouse gas test.	Advanced biofuels produced by BCAP project area BCFs do not need to meet the greenhouse gas test.
Only new BCFs are allowed to be part of BCAP project areas and only newly established crops on BCAP contract acres are eligible crops.	Existing BCFs that meet BCAP eligibility requirements are supported.
Only large commercial BCFs would be allowed in BCAP project areas.	Small and Pilot BCFs would qualify for BCAP project areas.
Payments would be limited to provide some risk mitigation.	Payments would completely replace lost potential income from non-BCAP crops.

the number of cropland acres allowed to enroll in the program would not be capped. To maximize program participation, payments would be sufficient to completely replace the potential income from non-BCAP crop production. Advanced biofuels produced by a BCF participating in a BCAP project area need only meet the less restrictive definition provided in Title IX of the 2008 Farm Bill which does not include the greenhouse gas test as specified in the EISA.

2.4 RESOURCES CONSIDERED BUT ELIMINATED FROM ANALYSIS

CEQ regulations (§1501.7(a) (3)) state that the lead agency shall identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review. In consideration of the site-specific environmental evaluation that must be completed prior to approval of a BCAP project area, and that form FSA-850 Environmental Evaluation and AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification must be completed prior to BCAP project area approval, FSA has determined the Proposed Action has no potential for significant impacts on certain resources as defined by §1508.27. The following resources have therefore been eliminated from detailed analysis in this PEIS.

2.4.1 Wetlands

Wetlands are protected by the Clean Water Act (CWA). Before any BCAP project area may be approved, the applicant must complete FSA Form AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification. The form states that the BCAP participants would not use proceeds from any FSA farm loan, insured or guaranteed, or any USDA cost-share program, in such a way that might result in negative impacts to wetlands. This resource has therefore been eliminated from further analysis.

2.4.2 Floodplains

Floodplains are defined by the Federal Emergency Management Agency (FEMA) as those low lying areas that are subject to inundation by a 100-year flood, a flood that has a one percent chance of being equaled or exceeded in any given year. Floodplains provide for flood and erosion control support that helps maintain water quality and contribute to sustaining groundwater levels. Floodplains also provide habitat for plant and animal species, recreational opportunities and aesthetic benefits. Activities within a floodplain have a potential to affect the flooding of lands downstream of the activity. Based on EO 11988 Floodplain Management, Federal agencies are required to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development. Development or improvement is subject to different regulations depending upon their location within the floodplain. Agricultural crop production has little potential to affect floodplain functions and values protected under EO 11988. Floodplains have therefore been eliminated from further consideration in the BCAP PEIS.

2.4.3 Protected Species

Protected species are those federally designated as threatened or endangered and protected by the Endangered Species Act (ESA). Critical habitat is designated by the USFWS as essential for the recovery of threatened and endangered species, and like those species, is protected under ESA. Site specific environmental evaluation in accordance with established FSA regulation and existing procedures would verify the presence or absence of protected species or critical habitat. If protected species are present or suspected of being present, informal consultation with the USFWS would occur during the site-specific environmental evaluation to ensure the protection of these species. Formal consultation with USFWS would be completed in the event a BCAP practice may affect a listed species. If negative impacts to listed species are identified, it is not likely the land would be approved for inclusion in a BCAP action.

2.4.4 Coastal Zones

Congress passed the Coastal Zone Management Act of 1972 (CZMA) to establish the only national program to plan comprehensively for and manage development of the Nation's coastal land and water resources. Public access to coastal zones is protected under the Act. Federal actions that are likely to affect any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a given State's Coastal Zone Management Plan (CZMP) as administered by that State. The requirement that BCAP project area approvals are contingent upon FSA Form AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification, conservation and forest management plans are required for BCAP biomass crop producers, and storage facilities must be constructed in accordance with local zoning, land use plans, and building codes, ensures compliance with the local Coastal Management Plan. This resource has therefore been eliminated from further analysis.

2.4.5 Prime and Unique Farmland

The Farmland Protection Policy Act of 1981 protects farmland defined as prime or unique from conversion to other uses and is administered by the Natural Resources Conservation Service (NRCS). In accordance with 1-EQ, FSA policy has exempted the following actions from requiring NRCS consultation under the Act: (1) the Proposed Action includes new facilities or improvements, but are for an agricultural purpose and effect only farmland; or (2) the Proposed Action involves renovating or repairing existing facilities, and the future use of these facilities remains unchanged from the original use of the facilities. Since BCAP supports the establishment of biomass agricultural crop production and any facilities constructed falls under these two exemptions, prime and unique farmland has been eliminated from further analysis.

2.4.6 Environmental Justice

EO 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was issued by President Clinton in 1994. The purpose of the Environmental Justice EO is to ensure that minority and low-income populations are not disproportionately adversely impacted by Federal actions. The potential impacts of BCAP to environmental justice populations shall be evaluated in a Civil Rights Impact Analysis (CRIA) completed by USDA as required for any new program development prior to rulemaking. Therefore, environmental justice has been eliminated from further analysis in this PEIS.

2.4.7 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (as amended) (NHPA) and its implementing regulations (36 CFR §800) requires federal agencies to take into account effects on historic properties in advance of approving any activity that has the potential to affect the historic qualities of the resource, and to provide the Advisory Council on Historic Preservation and the State Historic Preservation Officer (SHPO) or Tribal equivalent (THPO) an opportunity to comment prior to implementing the proposed program or project. Cultural resources can consist of prehistoric and historic districts, sites, buildings, structures or objects that may be archaeological, architectural or traditional cultural properties. Historic properties are generally at least 50 years of age or older, although some may achieve historic significance in more recent times. A site-specific environmental evaluation would verify the presence or absence of historic properties and consultation with the SHPO or THPO to ensure the proper consideration of these resources.

2.4.8 Noise

Implementing the Proposed Action would not permanently increase ambient noise levels at or adjacent to BCAP fields or constructed on farm BCAP storage facilities, as noise from heavy equipment is common on farms. The potential for increased noise levels associated with these types of BCAP activities would be minor, temporary, and localized. However, there is potential for a specific BCAP project to increase traffic through communities that may increase ambient noise levels along existing transportation routes to a BCF. The NEPA compliance process for construction of a BCF built under the Biorefinery Assistance Program administered by RD requires a transportation analysis for how vehicles would access the facility, including an evaluation of potential associated noise impacts.

2.4.9 Other Protected Resources

The lands eligible for BCAP are privately owned; therefore, there is no potential for impacts to National Natural Landmarks, Federal Wilderness or Wilderness Study Areas, National or State parks, or Federal or State wildlife refuges. These other protected resources have therefore been eliminated from further analysis.

3.0 AFFECTED ENVIRONMENT (BY RESOURCE AREA)

3.1 SOCIOECONOMICS AND LAND USE

3.1.1 Definition of the Resource

Socioeconomic analyses generally include detailed investigations of the prevailing population, income, employment, and housing conditions of a community or Region of Influence (ROI). The socioeconomic conditions of a ROI could be affected by changes in the rate of population growth, changes in the demographic characteristics of a ROI, or changes in employment within the ROI caused by the implementation of the proposed action.

Socioeconomic resources within this document include general agricultural characteristics associated with number of farms, primary field crops, and existing on-farm and off-farm storage, including refrigerated storage capacity.

3.1.1.1 Net Farm Income

Net Farm Income is a measure of the overall economic performance of the agricultural sector. It is defined as the difference between total revenue and total expenses, including the gains or losses from the value of farm inventories. Computationally, a preferred variable is Realized Net Farm Income, which excludes the change in the value of farm inventories. For the purposes of this analysis Realized Net Farm Income would be used to measure the economic performance of the agricultural sector at the national level.

At the regional and farm levels all the elements of the Realized Net Farm Income variable are not readily available which is why at levels of aggregation lower than the national level, the variable to use to measure the performance of the agricultural activity would be Net Returns. Net Returns measure the difference between total revenues from agricultural activity and the total cash cost of production.

3.1.1.2 Farm Prices

Farm price is defined as the season average price received by farmers as they sell their production into the market. The farm price is usually determined by an aggregate market, usually national or global, with local differences created as a result of specific marketing conditions, such as distance to collection or consumption centers, storage availability, transportation, etc. All these local differences can be captured through an index, which allows for the translation of the average seasonal farm price at the national level, to more local geographic levels, i.e., state or county, prices. Hay price typically reflects local conditions and the hay market is defined in this analysis as a local market.

3.1.1.3 Agricultural Government Payments

Government payments are defined as any direct revenues receive from the federal treasury as a result of performing agriculture related activities. There are two general types of payments – those linked to the change in prices and or production, and those that are fixed regardless of prices and/or production levels. The BCAP program could directly or indirectly impact payments linked to price and/or production levels. These payments include counter cyclical payments, loan deficiency payments, and Average Crop Revenue Election (ACRE) payments.

3.1.1.4 Land Use Shifts

In the context of this analysis, Land use shifts indicate the changes in what is planted in a particular area of cropland. If crop “b” replaces crop “a” in a particular acre or group of acres, then a land use shift from “a” to “b” has taken place. Land use shifts occur as farmers make production decisions based on the economic use of the land taking into account agricultural policy and environmental considerations.

Direct land use shifts occur in response to prices or regulations that impact directly a crop, while indirect changes occur in response to changes in prices or land shifts affecting other crops. In this analysis we will deal with both direct and indirect land use shifts occurring in cropland in the continental US.

3.1.2 General Agricultural Characteristics

3.1.2.1 Number of Farms & Land in Farms

Between 1997 and 2007, the number of farms in the United States declined 0.5 percent (USDA 2009a). Most farm categories declined from 1997 to 2007, with the number of acres in farms declining 3.4 percent, the average size of farms declining by 3.0 percent, the amount of cropland declining by 8.7 percent, and the amount of harvested cropland acreage declining by 2.9 percent (USDA 2009a). The average market value of land and buildings increased approximately 90.2 percent for the average value per farm and approximately 95.7 for the average value per acre (USDA 2009a). Farm production expenses also showed an increase, of approximately 52.8 percent over the decade. When compared by type of farm, the group of farms fall within the small family farm – residential or lifestyle farm (36 percent) (Table 3.1-1). Farms with an average size of over 1,000 acres account for approximately 18 percent of the number of farms in the United States.

3.1.2.2 Rural Population Trends

The USDA Economic Research Service (ERS) found that by 2006 non-metro counties in the United States accounted for a population of approximately 50.2 million persons (approximately 16.8 percent of the total United States population (ERS 2008; U.S. Census Bureau [USCB] 2008). The general trend in these counties was a decline in the population with over 51 percent of the non-metro counties experiencing population declines of approximately 0.5 percent per year from 2000 to 2006.

3.1.2.3 Primary Field Crops

The 2003 National Resources Inventory indicates that approximately 368 million acres within the United States is cultivated cropland and 58 million acres is uncultivated cropland. In 1992, those figures were 334 million acres of cultivated cropland and 47 million acres of uncultivated cropland. Table 3.1-2 illustrates the amount of acreage planted to select primary field crops between 2003 to 2008 with projections to 2017, along with harvested acres of those crops, and total production of the crops (NASS 2009a; USDA 2008). As shown in the table, the amount of acreage planted in the specific crops generally increased from 2003 to 2008. Table 3.1-3 identifies the approximate year-to-year percent change during the period, as well as an average annual percent change.

Table 3.1-1. Number of Farms, Land in Farms, and Average Size of Farms by Farm Typology (2007)

ITEM	Total	Small Family Farms					Large family farms	Very large family farms	Nonfamily farms
		Limited resource farms	Retirement farms	Residential/ lifestyle farms	Farming occupation/ lower sales	Farming occupation/ higher sales			
Farms (number)	2,204,792	308,837	456,093	801,844	258,899	100,126	86,551	101,265	91,177
Farms (percent)	100	14	21	36	12	5	4	5	4
Land in farms (acres)	922,095,840	42,419,764	89,580,775	121,143,585	87,190,445	104,081,344	123,024,138	211,224,012	143,431,777
Average size of farm (acres)	418	137	196	151	337	1,040	1,421	2,086	1,573

Source: USDA 2009a

Table 3.1-2. Planted Acres, Harvested Acres, and Production of Select Field Crops 2003-2008

Crop Type	2008	2007	2006	2005	2004	2003	Percent Change 2003-2008	USDA 2017 Projection	Percent Change 2008-2017
Planted Acres (1,000 acres)									
Corn (Grain)	87,327	93,600	78,327	81,779	80,929	78,603	11.1%	92,000	5.4%
Sorghum (Grain)	9,420	7,486	6,454	6,522	7,712	8,284	13.7%	5,700	-39.5%
Oats	4,597	4,085	4,246	4,166	3,763	3,217	42.9%	3,800	-17.3%
Barley, All	5,348	4,527	3,875	3,452	4,018	4,234	26.3%	3,500	-34.6%
Wheat, All	63,457	60,433	57,344	57,229	59,674	62,141	2.1%	55,500	-12.5%
Soybeans	74,533	63,631	75,522	72,032	75,208	73,404	1.5%	68,000	-8.8%
Harvested Acres (1,000 acres)									
Corn (Grain)	78,940	86,542	70,648	75,117	73,631	70,944	11.3%	84,600	7.2%
Sorghum (Grain)	7,798	6,517	5,736	4,937	6,792	7,271	7.2%	4,900	-37.2%
Oats	2,220	1,787	1,823	1,564	1,504	1,395	59.1%	1,600	-27.9%
Barley, All	4,727	4,021	3,269	2,951	3,502	3,767	25.5%	3,000	-36.5%
Wheat, All	56,586	51,011	46,810	50,119	49,999	53,063	6.6%	47,200	-16.6%
Soybeans	72,121	62,820	74,602	71,251	73,958	72,476	-0.5%	67,100	-7.0%
Production (1,000 bushels)									
Corn (Grain)	10,087,292	13,073,893	10,534,868	11,114,082	11,807,086	10,089,222	0.0%	14,660,000	45.3%
Sorghum (Grain)	411,219	453,606	392,739	276,824	497,445	472,342	-12.9%	345,000	-16.1%
Oats	144,383	115,695	114,859	93,522	90,430	88,635	62.9%	105,000	-27.3%
Barley, All	278,283	279,743	211,896	180,165	210,110	239,498	16.2%	210,000	-24.5%
Wheat, All	2,344,415	2,066,722	1,812,036	2,104,690	2,158,245	2,344,760	0.0%	2,135,000	-8.9%
Soybeans	2,453,845	2,585,207	3,188,247	3,063,237	3,123,686	2,453,665	0.0%	3,095,000	26.1%

Table 3.1-3. Annual Percent Change 2003-2008 for Planted Acres, Harvested Acres, and Production of Select Storable Field Crops

Crop Type	2008-2007	2007-2006	2006-2005	2005-2004	2004-2003	Average Percent Change
	Percent Change in Planted Acres					
Corn (Grain)	-6.7%	19.5%	-4.2%	1.1%	3.0%	2.5%
Sorghum (Grain)	25.8%	16.0%	-1.0%	-15.4%	-6.9%	3.7%
Oats	12.5%	-3.8%	1.9%	10.7%	17.0%	7.7%
Barley, All	18.1%	16.8%	12.3%	-14.1%	-5.1%	5.6%
Wheat, All	5.0%	5.4%	0.2%	-4.1%	-4.0%	0.5%
Soybeans	17.1%	-15.7%	4.8%	-4.2%	2.5%	0.9%
Crop Type	**Percent Change in Harvested Acres**					
Corn (Grain)	-8.8%	22.5%	-5.9%	2.0%	3.8%	2.7%
Sorghum (Grain)	19.7%	13.6%	16.2%	-27.3%	-6.6%	3.1%
Oats	24.2%	-2.0%	16.6%	4.0%	7.8%	10.1%
Barley, All	17.6%	23.0%	10.8%	-15.7%	-7.0%	5.7%
Wheat, All	10.9%	9.0%	-6.6%	0.2%	-5.8%	1.6%
Soybeans	14.8%	-15.8%	4.7%	-3.7%	2.0%	0.4%
Crop Type	**Percent Change in Production**					
Corn (Grain)	-22.8%	24.1%	-5.2%	-5.9%	17.0%	1.4%
Sorghum (Grain)	-9.3%	15.5%	41.9%	-44.4%	5.3%	1.8%
Oats	24.8%	0.7%	22.8%	3.4%	2.0%	10.8%
Barley, All	-0.5%	32.0%	17.6%	-14.3%	-12.3%	4.5%
Wheat, All	13.4%	14.1%	-13.9%	-2.5%	-8.0%	0.6%
Soybeans	-5.1%	-18.9%	4.1%	-1.9%	27.3%	1.1%

Source: NASS 2009a

3.2 BIOLOGICAL RESOURCES

3.2.1 Definition of a Resource

Biological resources include plant and animal species and the habitats in which they occur. For this analysis, biological resources are divided into the following categories: vegetation and wildlife. Vegetation and wildlife refer to the plant and animal species, both native and introduced, which characterize a region. The geographic scale of the lands potentially affected by the implementation of the BCAP encompasses the entire U.S. and its territories; hence, a great variety of terrestrial and aquatic plant and animal species may be affected by the

Proposed Action. Given the national scale of the BCAP and the programmatic level of this analysis, it is not feasible to list all of the species that may be present on lands eligible for enrollment, but broad generalizations based upon the organizing principle of land resource regions within the U.S., can be made. The USDA NRCS published a handbook titled “Land Resource Regions and Major Land Resource Areas (MLRA) of the United States, the Caribbean, and the Pacific Basin” (Agriculture Handbook 296) (NRCS 2006). The Agriculture Handbook 296 describes 28 land resource regions and the physiography, geology, climate, water resources, soils, biological resources, and kinds of land use in 278 major land resource areas in the United States, the Caribbean, and the Pacific Basin (Figure 3.2-1). The name of each region reflects the types of agricultural activities that affect the economy and ecology of that region. The Land Resource Regions and Major Land Resource Areas map, provided in the handbook, was used to identify land resource regions within the U.S. to organize and evaluate the biological resources in context with the BCAP. The Agriculture Handbook 296 also identified the common wildlife and vegetation in the major land resource areas.

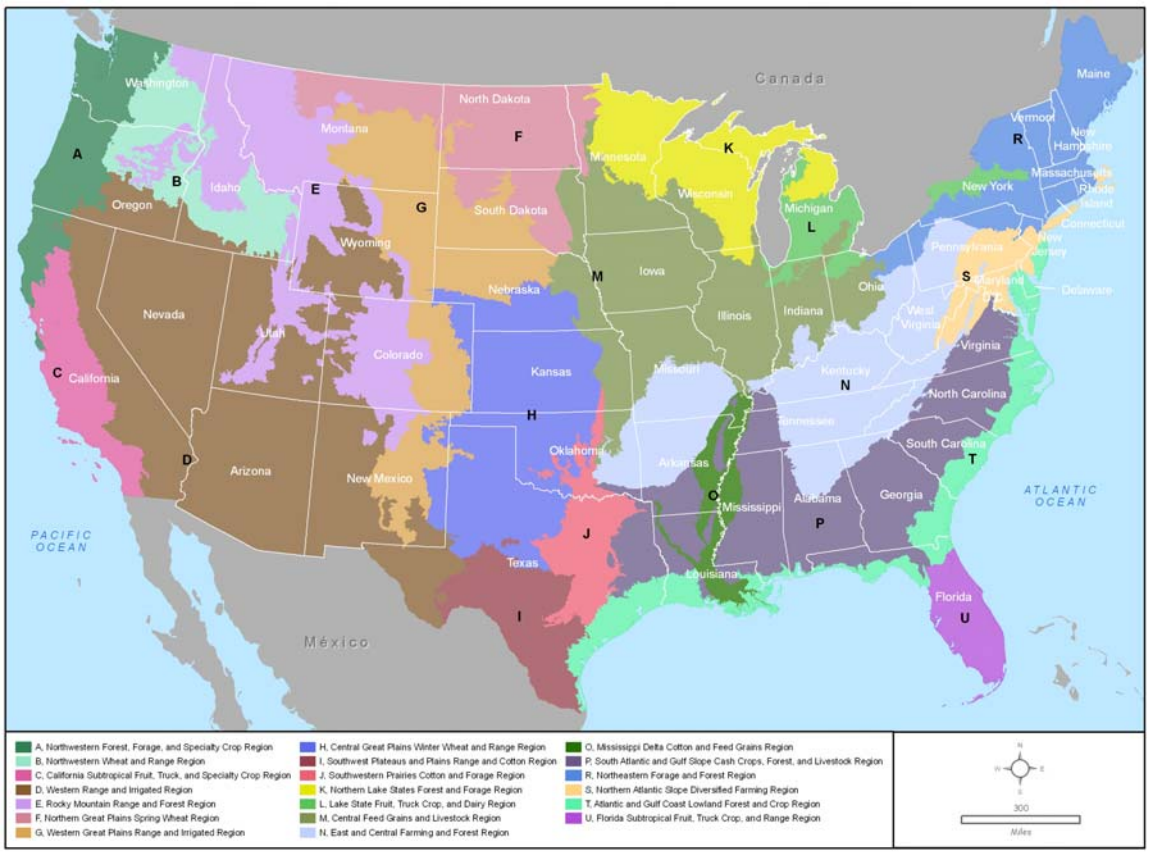


Figure 3.2-1. NRCS Land Resource Regions (NRCS 2006)

Individual State wildlife action plans (SWAP) were also used to assist in the analysis and evaluation of wildlife resources for each Land Resource Region. A representative State was chosen from each LRR. In each case, the State chosen comprises the largest proportion (i.e., acreage) of the particular region (Table 3.2.1). It is understood that habitat are independent and each will affect and be affected by others, especially those geographically adjacent to each other. Additionally, most species move freely across habitats and are dependent upon a diversity of resources for life. However, the SWAP have been developed and based on major land resource regions. Founded on the premise that managing the health and integrity of the habitats within a region, the broad array of wildlife that lives within each State will be conserved and maintained.

Table 3.2-1. Selected States to Represent Land Resource Regions

Region Code	Land Resource Region Descriptive	State
A	Northwestern forest, forage, and specialty crop region	Oregon
B	Northwestern wheat and range region	Idaho
C	California subtropical fruit, truck, and specialty crop region	California
D	Western range and irrigated region	Arizona
E	Rocky Mountain range and forest region	Montana
F	Northern Great Plains spring wheat region	North Dakota
G	Western Great Plains range and irrigated region	New Mexico
H	Central Great Plains winter wheat and range region	Kansas
I	Southwest plateaus and plains regions	Texas
J	Southwestern prairies cotton and forage region	Texas
K	Northern lakes states forest and forage region	Wisconsin
L	Lake states fruit, truck crop, and dairy region	Michigan
M	Central feed grains and livestock region	Iowa
N	East and Central farming and forest region	Kentucky
O	Mississippi Delta cotton and feed grains region	Arkansas
P	South Atlantic and Gulf slope cash crops, forest, and livestock region	Georgia
R	Northeastern forage and forest region	New York
S	Northern Atlantic slope diversified farming region	Pennsylvania
T	Atlantic and Gulf coast lowland forest and crop region	Louisiana
U	Florida subtropical fruit, truck crop, and range region	Florida

Developed under the 2001 Commerce, Justice, State and Related Agencies Appropriations Act (P.L. 106-553, U.S.C 16(2000) 669[c]), the SWAPs address eight key elements:

- Information on the distribution and abundance of wildlife, including low and declining populations, that describes the diversity and health of the state’s wildlife.
- Descriptions of locations and relative conditions of habitats essential to species in need of conservation.
- Descriptions of problems that may adversely affect species or their habitats, and priority research and survey efforts.
- Descriptions of conservation actions proposed to conserve the identified species and habitats.

- Plans for monitoring species and habitats, and plans for monitoring the effectiveness of the conservation actions and for adapting these conservation actions to respond to new information.
- Descriptions of procedures to review the plan at intervals not to exceed 10 years.
- Coordination with federal, state, and local agencies and Indian tribes in developing and implementing the wildlife action plan.
- Broad public participation in developing and implementing the wildlife action plan.

Hence, the SWAPs will provide a valuable foundation for analyses of the BCAP program on wildlife resources within a given region.

3.2.2 Existing Condition

A summary of each land resource region, in the continental U.S., and the associated vegetation and wildlife is provided below.

3.2.2.1 Vegetation and Wildlife

Northwestern Forest, Forage, and Specialty Crop Region (Region A)

This region lies in the northwestern U.S., encompassing portions of California, Oregon, and Washington along with two major mountain systems. Additional land features include foothills, valleys, marine coastline and inland waterways, including the Puget Sound (Figure 3.2-1). The agriculturally rich Willamette Valley separates the Cascade mountain system in the west from the Coast Range mountain system in the east; the Coast Range is anchored on the north by the Olympic Mountains and on the south by the Klamath Mountains. This land resource region is characterized by extremes in elevation (from sea level to over 14,000 feet) and rainfall patterns (nine to 25 inches per year east of the Cascade Mountains, 100 to 250 inches per year in the mountains) (NRCS 2006). Approximately 44 percent of the region is Federal land, with national forest designation.

Dairy farming is an important enterprise in the valleys that receive abundant rainfall. Grain crops, grass and legume seeds, fruits, and horticultural specialty crops are grown extensively in the drier valleys (NRCS 2006).

<u>Vegetation</u>

Vegetation is composed of various forest, prairie, grassland, and savanna species. Evergreen trees are the predominant vegetation (65 percent), and are heavily used in timber production (Table 3.2-2). Forested montane areas are primarily composed of Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and red alder (*Alnus rubra*); Sitka spruce (*Picea sitchensis*) and redwood (*Sequoia* spp.) belts run along the coastal states (NRCS 2006). Dominant grassland species include a variety of brome grasses (*Bromus* spp.), bluegrass (*Poa* spp.), and fescue (*Festuca* spp.) species.

Table 3.2-2. Amount (acres) of Level 1 Land Cover Types by Region

Level I Land Cover Type	Acres by Regions						
	A	B	C	D	E	F	G
Transitional	1,625,924	7,057	3,677	53,286	2,104,389	4,062	21,923
Deciduous forest	3,649,095	221,555	1,250,996	1,119,476	6,950,156	1,160,624	812,048
Evergreen forest	35,799,208	2,851,824	4,011,746	45,173,774	69,785,374	86,803	5,090,717
Mixed forest	4,854,050	65,967	1,645,257	1,203,443	1,415,805	2,184	52,574
Shrubland	2,553,182	26,267,127	7,205,119	229,339,250	25,174,891	2,571,389	13,743,261
Orchards and vineyards	215,595	198,604	2,580,196	112,453	8,085	0	10
Grasslands/herbaceous	3,331,080	6,871,092	11,443,570	38,522,853	32,952,900	27,459,450	95,192,693
Pasture/hay	2,499,847	3,530,425	2,819,552	5,472,594	2,968,309	7,523,272	3,323,953
Row crops	267,674	1,981,894	2,969,713	2,006,298	420,751	23,440,043	3,652,060
Small grains	251,010	5,608,047	1,732,921	1,132,524	2,664,024	16,700,945	6,211,755
Fallow	12,869	3,368,422	12,563	44,716	1,123,737	7,529,312	4,092,856
Total	55,059,534	50,972,014	35,675,310	324,180,667	145,568,421	86,478,084	132,193,850
	H	I	J	K	L	M	N
Transitional	11,051	326	51,615	386,740	13,304	42,196	710,270
Deciduous forest	1,910,955	1,424,563	6,920,582	21,753,836	5,959,362	20,598,450	77,260,846
Evergreen forest	824,344	4,967,639	1,633,910	4,888,733	718,276	475,974	9,821,817
Mixed forest	143,479	59,879	440,164	5,346,145	857,555	784,886	16,905,025
Shrubland	11,886,492	25,944,190	3,122,819	261,793	6,128	131,579	113,095
Orchards and vineyards	1,641	14,727	395	20	395	1,641	0
Grasslands/herbaceous	61,265,199	8,139,029	7,281,376	727,034	349,713	7,167,955	819,757
Pasture/hay	8,422,934	2,421,870	11,491,914	8,461,324	5,280,722	41,779,594	29,304,299
Row crops	27,820,748	2,538,385	2,864,199	10,471,576	11,472,294	95,256,041	8,579,668
Small grains	24,531,893	360,369	925,093	422,303	8,708	1,774,879	115,171
Fallow	1,464,920	12,088	830	0	0	1,453	0
Total	138,283,656	45,883,065	34,732,897	52,719,504	24,666,457	168,014,648	143,629,948
	O	P	R	S	T	U	
Transitional	35,969	4,693,649	605,250	101,916	1,426,055	366,467	
Deciduous forest	759,569	37,007,040	28,066,687	9,859,960	3,441,832	7,868	
Evergreen forest	477,050	35,232,497	10,077,403	1,035,727	11,697,100	3,182,629	
Mixed forest	432,492	27,316,475	16,762,761	2,309,961	3,654,867	1,058	
Shrubland	0	32,509	118,136	1,453	910,603	220,962	
Orchards and vineyards	0	16,655	9,983	10	9,519	1,043,062	
Grasslands/herbaceous	13,413	444,602	633	0	1,162,720	3,084,389	
Pasture/hay	1,746,198	21,623,641	7,264,869	7,104,577	4,519,370	1,141,973	
Row crops	13,042,625	21,739,899	4,134,311	1,516,002	6,536,205	2,012,713	
Small grains	1,303,159	406,034	227	0	1,640,177	0	
Fallow	0	0	0	0	0	0	
Total	17,810,475	148,513,001	67,040,260	21,929,606	34,998,448	11,061,121	

Wildlife

The largest portion of Region A is managed by various Federal entities, and therefore conservation practices throughout the rest of the region should focus on native wildlife and their associated habitats (Oberbillig n.d.). The diversity of this region supports game and non-game species. Large mammals such as the black-tailed (*Odocoileus hemionus*) mule deer provide plentiful hunting opportunities in forested habitats. Gamebird hunting is another economic opportunity in the areas comprised of prairies and savannas where species such as the California quail (*Callipepla californica*) and ringneck pheasant (*Phasianus colchicus*) reside.

Northwestern Wheat and Range Region (Region B)

This region lies in the northwestern U.S., encompassing portions of Idaho (the majority of acreage), Oregon, Washington, and a small section of Utah (Figure 3.2-1). Primary land features are dry plateaus, incised river valleys, and a few isolated mountain ranges. Elevation ranges from 300 to 12,000 feet, and average annual rainfall is six to 20 inches; rainfall in the mountains ranges from 45 to 85 inches per year (NRCS 2006). Approximately 29 percent of the region is Federal land, used for grazing.

Crops and grazing are the predominant uses of land (Table 3.2-2). Wheat grown by dry farming methods is the major crop in the region; however, oats, barley, lentils, and peas are also important crops. Fruits, mainly apples, are a major crop in the western part of the region. Potatoes, sugar beets, beans, and forage crops are grown under irrigation in the central Columbia basin in Washington and along the Snake River in Idaho (NRCS 2006). A variety of specialty crops are grown in local areas, including vegetables, vegetable seeds, mint, and hops. Grazing is the major land use in the drier parts of the region.

Vegetation

Shrubland composes the majority of the vegetation (52 percent), along with grasses and forbs (13 percent). Rangeland areas of mostly prairies and plateaus support shrub-grass plant communities dominated by snowberry (*Symphoricarpos* spp.) in the eastern part of the region, sagebrush species (*Artemisia* spp.) in the western part of the region and bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) throughout (NRCS 2006). Douglas-fir, aspen (*Populus tremuloides*), and ponderosa pine (*Pinus ponderosa*) are common on the few forested rocky slopes of the region (NRCS 2006). Western juniper (*Juniperus occidentalis*) is increasing its range in Oregon as wildfire suppression changes the landscape (Table 3.2-2).

Wildlife

The largest portion of Region B is cropland and areas suitable for grazing, but these areas also provide valuable habitat for pronghorn antelope (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and mule deer. These open areas are rich in small mammal and grassland bird diversity, where species such as the pygmy rabbit (*Brachylagus idahoensis*) and horned lark (*Eremophila alpestris*) are commonly observed (Oberbillig n.d.).

California Subtropical Fruit, Truck, and Specialty Crop Region (Region C)

This region lies entirely within the state of California, bordered by the Pacific Ocean and characterized by low mountains and broad valleys (Figure 3.2-1). The growing season is relatively long and rainfall low; average annual rainfall varies from six to 12 inches in the southern end of the region to 15 to 40 inches in the northern end. Approximately 16 percent of the region is Federal land, primarily in the Southern California Mountains.

Agricultural enterprises are plentiful, with a wide variety of crops grown (NRCS 2006). Citrus fruits, other subtropical and tropical fruits, and nuts are the major crops in the southern half of the region. Many kinds of vegetables, grown mainly under irrigation, are produced throughout the region. Rice, sugar beets, cotton, grain crops, and hay also are important crops. Dairying is a major enterprise near the large cities. Beef cattle production on feedlots and rangeland also is important. Many of the soils on floodplains and low terraces in the valley of the San Joaquin River are affected by salts and must be skillfully managed for good crop production (NRCS 2006).

Vegetation

Grasses and forbs compose the majority of the vegetation (32 percent), along with shrubland (20 percent). In lower elevations dominant vegetation is composed of brome grasses, wild oats (*Avena* spp.), fescue grasses, stork's bill herb (*Erodium* spp.), and burclover (*Medicago polymorpha*) dominate (NRCS 2006). A variety of oaks (*Quercus* spp.) and remnant redwoods are found in central California. Salt-tolerant brush and grass species are common in coastal, valley, and delta areas. A mixture of pines (*Pinus* spp.), Douglas-fir, incense cedar (*Calocedrus decurrens*), and various oaks grow at subalpine elevations in the Southern California Mountains (NRCS 2006). The rare Torrey pine (*Pinus torreyana*) can be found in a small area along the coastal plain. Small islands off of the southern coast of California are dominated by nonnative needlegrasses (*Achnatherum* spp.), oak, pine, and shrubs (Table 3.2-2).

Wildlife

California is home to a great deal of biodiversity, and is home to 222 species of mammal, 391 species of birds, and 160 reptiles and amphibians species. The majority of Region C is agricultural in nature making it a good source for burrowing small mammals like the western pocket gopher (*Thomomys bottae*) and for species that do well in hot, dry landscapes such as the black-tailed jackrabbit (*Lepus californicus*) (Oberbillig n.d.).

Western Range and Irrigated Region (Region D)

This region is characterized as a semi-desert or desert region of plateaus, plains, basins, and isolated mountain ranges found in the Rocky Mountain and Southwest states including Nevada and Arizona (Figure 3.2-1). Elevation ranges from 275 feet below sea level to over 11,500 feet (NRCS 2006). Approximately 60 percent of the region is Federal land, used primarily for grazing.

Irrigated crops are grown in areas where water is available and the soils are suitable. Feed crops for livestock are grown on much of the irrigated land. Peas, beans, and sugar beets are grown in many areas. Cotton and citrus fruits are important crops in southwestern Arizona

(NRCS 2006). The major resource management concerns on cropland include soil productivity and the content of salts and sodium in the soils.

Vegetation

Shrubland composes the majority of the vegetation (71 percent), along with evergreen trees (14 percent), and grasses and forbs (12 percent) (NRCS 2006). Grasslands are found throughout the region. Landscapes throughout most of the region typically exhibit saltbush-greasewood (*Atriplex* spp. – *Sarcobatus* spp.) community types in the lowest and driest areas, sagebrush communities in mid-elevation wetter climates, and pinyon pine-juniper (*Pinus* spp.– *Juniperus* spp.) woodland vegetation in the highest and wettest areas. In the Southern Cascade Mountains vegetation ranges from mixed conifer forests to oak grasslands to wet, woodland, and dry meadows (NRCS 2006). Much of the Great Salt Lake area is nearly barren. Many portions of Region D are characterized as deserts. A number of species are endemic and specific to the microclimates of the Lower Colorado Desert (NRCS 2006). Salt-desert zone vegetation is common in the desert basins, plateaus, and surrounding iodine flats. The central part of Region D transitions from desert scrub to high elevation (approx. 11,000 feet) mountain range dominated by ponderosa pine, spruce (*Picea* spp.), fir (*Abies* spp.), and other alpine vegetation. Southeastern Arizona and the Sonoran Desert area support forest, savanna, and desert shrub vegetation and contain numerous species common to Mexico (NRCS 2006) (Table 3.2-2).

Wildlife

The combination of arid habitat and grazing of rangeland in this region make the management for native wildlife particularly critical, and the greatest proportion of this region is owned by the public and managed under various federal land management agencies. Common species that inhabit the semidesert grasslands which comprise a large percentage of this region and house a large portion of the regions biodiversity include the Grasshopper sparrow (*Ammodramus savannarum*), desert bighorn sheep (*Ovis canadensis nelsoni*) and prairie falcon (*Falco mexicanus*). Management focused on acquiring conservation easements to protect native species and prevent the expansion of invasive species into areas of native habitat should be important (Oberbillig n.d.). Given the uniqueness of the region's biodiversity, the development of plans that protect native wildlife not covered under other plans and agencies should be a primary goal. The maintenance of sufficient forage for wildlife should be focused upon given the limited hydrological conditions relative to the rest of the country (Oberbillig n.d.). Other species commonly seen throughout the desert and montane areas in this region include the mule deer, long-eared owl (*Asio otus*) and sooty grouse (*Dendragapus fuliginosus*). Also of importance to native wildlife is the maintenance of travel corridors between areas of patchy resources.

Rocky Mountain Range and Forest Region (Region E)

This region follows the Rocky Mountains from the border with Canada south into New Mexico. The region is characterized by steep, rugged mountains, high elevation valleys and both natural and man-made lakes (Figure 3.2-1). Elevation ranges from 5,000 feet to over 14,000 feet, and average annual rainfall ranges from nine inches in the valleys to over 63 inches in the mountains (NRCS 2006). Approximately 60 percent of the region is Federal land.

Grazing is the leading land use in the valleys and mountains, but timber production is important on some of the forested mountain slopes. Recreation is an important use throughout the region (NRCS 2006). Some of the valleys are irrigated, and some are dry-farmed. Grain and forage for livestock are the main crops. Beans, sugar beets, peas, and seed crops are grown in areas where soils, climate, and markets are favorable (NRCS 2006).

Vegetation

Evergreen trees are the predominant vegetation (48 percent), with lodgepole pine (*Pinus contorta*), ponderosa pine, fir, spruce, and alpine meadow vegetation predominating at the highest elevations. In the region's valleys and foothills, shrub-grassland vegetation such as wheatgrass (*Agropyron* spp.), fescue grasses, and bearded wheatgrass (*Elymus canimus*) are common (NRCS 2006). High intermountain valleys support desert-shrub vegetation including salt-tolerant species and big sagebrush. Warm season herbaceous species become more typical in the southern portion of Region E (Table 3.2-2).

Wildlife

This region is high elevation rangeland primarily, the majority of which is under federal ownership. The grassland areas that lie on fertile land within the valleys and riparian areas are those prized both by agriculture and wildlife. The discord created by large scale disturbance to native habitat in this area should be a primary concern. The ecological complexity surrounding the grasslands of this region are highly interconnected from top to bottom, and it is important to protect the integrity of the entire trophic system from northern leopard frogs (*Rana pipiens*) and smooth green snakes (*Opheodrys vernalis*) to the ground squirrel (*Cynomys* and *Spermophilis* spp.) and American badger (*Taxidea taxus*) (Oberbillig n.d.). These fertile rangelands are important to mule deer and elk (*Cervus canadensis*). As always the loss of habitat and the prevention of large scale alterations to the natural cycling of nutrients are vital to protecting the ecological integrity and biodiversity of the region. Coordination to prevent the degradation of grassland habitat for native species like the common kingsnake (*Lampropeltis getula*) and burrowing owl (*Athene cunicularia*) should be important, along with a comprehensive approach to maintain the integrity of native grasslands in the region (Oberbillig n.d.).

Northern Great Plains Spring Wheat Region (Region F)

This region encompasses portions of Montana, North Dakota, South Dakota, and Wisconsin and is characterized by undulating terrain, incised river valleys, coulees and in the east, the Red River valley (Figure 3.2-1). Approximately 96 percent of the region is privately owned.

Crops are generally grown without irrigation (NRCS 2006). Spring wheat is the primary crop grown in the region. Other crops include: spring-planted grains, flax, and hay. The Red River Valley can support growing potatoes, sugar beets, soybeans, and corn (NRCS 2006).

Vegetation

Grasses and forbs compose the majority of the vegetation (32 percent); native vegetation consists primarily of mixed and tall prairie grasses including wheatgrass (*Agropyron* spp.), needlegrass (*Stipa* spp.), big bluestem (*Andropogon* spp.), little bluestem (*Schizachyrium* spp.) and grama (*Bouteloua* spp.) (NRCS 2006). Deciduous trees, primarily cottonwood (*Populus* *deltoides*), green ash (*Fraxinus pennsylanica*), basswood (*Tilia* spp.), elm (*Ulmus* spp.), and bur oak (*Quercus macrocarpa*), have limited distribution (one percent) (Table 3.2-2).

Wildlife

Very little public land exists in this region, which under the BCAP program will mean that it is vital for private landowners to be presented with conversion options that protect the native habitat. This is the region known best for prairie habitat from one end of the horizon to another. Whether it is the sweet sound of Baird's sparrow (*Ammodramus bairdii*), the endless flocks of migrating Canada geese (*Branta canadensis*) and mallard (*Anas platyrhynchos*), or the playful antics of Richardson's ground squirrel (*Spermophilus richardsonii*) (Oberbillig n.d.). Region F is a place of open spaces and rolling grasslands that relies upon the tools and options given to private farmers and land owners for the continued maintenance and prosperity of the regions biodiversity. Noxious weeds need to be held in check, native prairie preserved, natural hydrology maintained, and an effort to maintain large blocks of connected grasslands. Native wildlife from the white-tailed deer (*Odocoileus virginianus*) to the cottontail rabbit (*Sylvilagus floridanus*) will benefit from a synergistic approach to management (Oberbillig n.d.).

Western Great Plains Range and Irrigated Region (Region G)

This region encompasses portions of ten states, from New Mexico and to Montana, comprising a significant part of the Great Plains (Figure 3.2-1). Characteristic land features include rolling high plains and black hills in the north to arid highlands, high plains, and river valleys in the south (NRCS 2006). Approximately 88 percent of the region is privately owned.

Cattle and some sheep grazing are the predominant uses of the land. Limited amounts of winter wheat and other small grain is raised without irrigation for cash or feed (NRCS 2006). Corn, alfalfa, forage crops, and sugar beets are grown with irrigation near major streams.

Vegetation

Grasses and forbs compose the majority of the vegetation (72 percent). Tall prairie grasses predominate in the northern areas; mixed native grasses, forbs and shrubs predominate in the central areas, and mixed short and mid prairie grasses predominate in the southern areas (NRCS 2006). Ponderosa pine, pinion and juniper communities occur on higher elevations (NRCS 2006). Boxelder (*Acer negundo*), green ash, willow (*Salix* spp.) and plains cottonwood (*Populus deltoides* ssp. *monilifera*) are prevalent in riparian areas (Table 3.2-2).

Wildlife

This is another region where the largest portion of land is privately owned and managed, and is comprised of various shortgrass and tallgrass prairie/ Species closely associated with these areas include the American bald eagle (*Haliaeetus leucocephalus*), scaled quail (*Callipepla squamata*), sandhill crane (*Grus canadensis*) and mule deer. Grazing is a large portion of the type of use these extensive lands are subjected to, and it will benefit native wildlife to ensure the fluid communication and sharing of information between private, public and agricultural land managers (Oberbillig n.d.). The establishment of a system that ensures long-term ecological sustainability will be the best way to benefit wildlife like the coyote (*Canis latrans*), black-tailed prairie dog (*Cynomys ludovicianus*), and black-footed ferret (*Mustela nigripes*). Fragmentation can negatively affect many of the native wildlife species like sharp-tailed (*Tympanuchus phasianellus*) and Greater sage grouse (*Centrocercus urophasianus*) found in the region (Oberbillig n.d.).

Central Great Plains Winter Wheat and Range Region (Region H)

This region encompasses seven states with the majority of acreage in Kansas (NRCS 2006). Hills, plains, and prairies characterize this region; nearly level to gently rolling fluvial plains are common in the north, with more eroded plateaus and entrenched streams in the south (Figure 3.2-1).

Most of the agricultural land in this region is used for beef cattle production. Winter wheat is raised in the region without irrigation. Corn, alfalfa, and other forage crops are grown with water from nearby major streams. Approximately 99 percent of the region is privately owned.

Vegetation

Grasses and forbs compose the majority of the vegetation (44 percent), with vegetation dominated by native short, mid, and tall prairie grasses including big and little bluestem, and grama grasses (NRCS 2006). Winter wheat is prevalent in northern areas and indiangrass (*Sorghastrum* spp.) and switchgrass (*Panicum virgatum*) are prevalent in southern areas. Cottonwood is limited to riparian areas throughout this region (NRCS 2006). In southern areas, woody species, predominately shin oak (*Quercus harvardii*), sage (*Salvia* spp.), and skunkbush sumac (*Rhus trilobata*) form oak-savannahs (Table 3.2-2).

Wildlife

This dry, continental climate region supports a variety of wildlife, and again the majority is privately owned land used for grazing. If species that inhabit the short-grass prairie's like lesser prairie chicken (*Tympanuchus pallidicinctus*), Ferruginous hawk (*Buteo regalis*), and loggerhead shrike (*Lanius ludovicianus*), are to be provided sufficient habitat then the cooperation and communication between public and private conservation managers is paramount (Oberbillig n.d.). The amount of land in the region under agricultural usage will only intensify in future years, and species like the northern bobwhite quail (*Colinus virginianus*) and mourning dove (*Zenaida macroura*) will depend upon sufficient biodiversity to continue to persist within the region (Oberbillig n.d.). The short-grass prairie is a diverse ecosystem, and all levels of the native wildlife of the region from the small mammals that provide a critical prey base for the swift fox (*Vulpes velox*) and long-tailed weasel (*Mustela frenata*) to the Texas horned lizard (*Phrynosoma cornutum*) rely upon the integrity of these grasslands.

Southwest Plateaus and Plains Range and Cotton Region (Region I)

This region of approximately 72,340 sq miles is found entirely in the state of Texas. It includes portions of the coastal plain and Rio Grande River valley as well as lands north of the Rio Grande marked by canyons, mesas, and valleys (NRCS 2006) (Figure 3.2-1). Approximately 99 percent of the region is privately owned.

Grazing is the dominant land use in most of the region, but wheat, grain sorghum, and other small grain crops are grown in areas where the soils, topography, and moisture supply are favorable. Irrigated cotton is an important crop in the southeastern part of the region. Citrus fruits and winter vegetables are grown in the lower Rio Grande Valley.

Vegetation

Shrubland composes the majority of the vegetation (57 percent), followed by grasses and forbs (18 percent) (Table 3.2-2). Predominant grasses include grama, little bluestem, paspalum (*Paspalum* spp.), switchgrass, Indiangrass, and trichloris (*Trichloris* spp.) (NRCS 2006). Dominant tree and shrub genera include: scrub oaks (*Querus Cornelius-mulleri* spp.), mesquite (*Prosopis* spp.), curly mesquite (*Hilaria* spp.), juniper, hackberry (*Celtis* spp.), and saltbush.

Wildlife

Lying entirely within the state of Texas, this region is heavily held in private ownership. This makes it critical for private landowners to be equally vested in wildlife and native habitat conservation, including but not limited to restoration of native habitat for species like the white-tailed deer, javelina (*Pecari tajacu*), raccoon (*Procyon lotor*) and wild turkey (*Meleagris gallopavo*) (Oberbillig n.d.). Common native species like the Cassin's sparrow (*Aimophila cassinii*) and eastern box turtle (*Terrapene carolina carolina*) rely upon the integrity of these native prairies.

Southwestern Prairies Cotton and Forage Region (Region J)

This region ranges from the Wichita Mountains through cross timbers to the Texas Great and Blackland Plains (Figure 3.2-1). The northern and western parts of this region consist of gently rolling to hilly uplands dissected by numerous streams, and the rest of the region is mainly a nearly level to gently sloping, dissected plain. The Arbuckle and Wichita Mountains are in the northern part of the region (NRCS 2006). Approximately 98 percent of the region is privately owned.

Grazing by beef cattle is the dominant land use in most of the region, but hay, grain sorghum, and small grains are grown in areas where the soils, topography, and moisture supply are favorable (NRCS 2006). Other locally important crops include corn, cotton, and peanuts. Pecans are grown on well drained soils that are not flooded very often and are on the higher terraces along many of the major rivers crossing the region (NRCS 2006). Vegetables are grown in areas where irrigation water is available. The major resource concerns are overgrazing and the invasion of undesirable plant species.

Vegetation

Grasses and forbs (21 percent) and deciduous trees (20 percent) compose the majority of the vegetation (Table 3.2-1). Mid and tall prairie grasses, little and big bluestem, Indiangrass, grama, and switchgrass, are interspersed with trees consisting primarily of oaks but also elm, maple (*Acer* spp.), cottonwood, hackberry, and pecan (*Carya illinoinensis*) (NRCS 2006). The southern part of this region has increasing diversity of shrubs and forbs. This is a transitional region blending Great Plains with more eastern vegetation. Grasslands include mixtures of range, pasture, and improved pasture (NRCS 2006).

<u>Wildlife</u>

This area is characterized by private ownership and a matrix of western and eastern habitat types, a transition zone between two distinct regions, and along with this comes a large overlap of western and eastern wildlife species (Oberbillig n.d.). These areas are inhabited by prairie warblers (*Dendroica discolor*), scissor-tailed flycatchers (*Tyrannus forficatus*), long-tailed weasels (*Mustela frenata*) and bats (*Myotis* spp.). Whether it is the graceful Mississippi kite (*Ictinia mississippiensis*) overhead or the lumbering American black bear (*Ursus americanus*), this region is rich with biodiversity (Oberbillig n.d.).

Northern Lake States Forest and Forage Region (Region K)

This region is in the Central Lowland areas south and west of the western Great Lakes. It is a glaciated region with numerous lakes and wetlands (Figure 3.2-1). Approximately 90 percent of the region is privately owned (NRCS 2006). Federal land is primarily designated national forest.

Important crops include corn, wheat, alfalfa, oats, barley, and soybeans. Much of the forage and feed grain grown in the region is used by onsite dairy and beef cattle industries (NRCS 2006). Other locally important crops include sunflowers, potatoes, edible beans, sweet corn, peas, berries, and fruit. Water erosion, especially on cropland, is a major resource concern (NRCS 2006). Wind erosion is a hazard in areas of silty and sandy soils. Soil wetness, fertility, and tilth and protection of water quality are additional resource concerns.

<u>Vegetation</u>

Deciduous trees compose the majority of the vegetation (41 percent); this is a historically forested region characterized by mixed northern hardwood and coniferous forests, white pine-red pine (*Pinus strobus*-*Pinus resinosa*) forests, aspen-birch (*Populus* spp.-*Betula* spp.) forests, xeric pine savannas, oak barrens, oak savannas, coniferous wetlands, and jack pine (*Pinus banksiana*) barrens (NRCS 2006) (Table 3.2-2). The unforested land is composed of converted cropland and a small amount of prairie grassland (grasses and forbs compose only 1 percent of the vegetation).

<u>Wildlife</u>

The majority of this region is forested, and is home to such well known species as the white-tailed deer, American woodcock (*Scolopax minor*), eastern gray squirrel (*Sciurus carolinensis*), and snowshoe hare (*Lepus americanus*). A history rich in fur trading, furbearers abound from the red fox (*Vulpes vulpes*) and bobcat (*Lynx rufus*) to the mink (*Neovison vison*), river otter (*Lontra canadensis*), fisher (*Martes pennanti*), and the ubiquitous beaver (*Castor canadensis*) (Oberbillig n.d.). Bird species are diverse in nature, but none is more tied to the sights and sounds of this regions biodiversity than the oft pursued ruffed grouse (*Bonasa umbellus*).

Lake States Fruit, Truck Crop, and Dairy Region (Region L)

This region predominantly covers western and southwestern Michigan, northern Indiana, and land adjacent to the Great Lakes and Finger Lakes area (NRCS 2006) (Figure 3.2-1). Approximately 99 percent of the region is privately owned.

The soils and climate favor agriculture, and the region has a wide variety of agricultural enterprises; row crops account for 47 percent of the land use (NRCS 2006). Dairy farming is important, and some beef cattle are produced. Canning crops, corn, soft winter wheat, beans, and sugar beets are among the leading crops (NRCS 2006). Fruits, especially sour cherries, are important in a narrow belt adjacent to the Great Lakes, and wine grapes are grown in the Finger Lakes area. Much of the cropland near the larger cities is being subdivided and developed for urban uses.

Vegetation

Northern hardwood forests dominate this region (24 percent of the vegetation). Upland communities typically support mixed oak/pine communities (Table 3.2-2). The varied wetland plant communities are composed of forests dominant in eastern hemlock (*Tsuga canadensis*), speckled alder (*Alnus incana* ssp. *rugosa*), and black spruce (*Picea mariana*) or forests of northern white-cedar (*Thuja occidentalis*), black ash (*Fraxinus nigra*), red maple (*Acer rubra*), and aspen (NRCS 2006).

Wildlife

This region is comprised of large tracts of public land, and its primary function is dairy production. Water in the form of thousands of lakes, rivers and streams dominate the landscape, and the mesic conditions associated with this region thus mean a rich biodiversity of mammal, bird, and invertebrate species. The brilliant Karner blue butterfly (*Lycaeides melissa samuelis*) decorates the prairies and savannahs, Kirtland's warblers (*Dendroica kirtlandii*) annually return to the same areas of jack pine forest to nest, the Eastern meadowlark (*Sturnella magna*) sings atop the grasslands in springtime, and the Fowler's toad (*Bufo fowleri*) makes it's presence known after warm late spring rainstorms (Oberbillig n.d.). This is an area that comes alive with biodiversity.

Central Feed Grains and Livestock Region (Region M)

Approximately 99 percent of the region is privately owned. This region produces most of the corn, soybeans, and feed grains produced in the U.S. (Figure 3.2-1). Some specialty crops are grown near markets in the metropolitan areas (NRCS 2006). Much of the cropland near the larger cities is being subdivided and developed for urban uses. Small areas in the parts of this region in southern Indiana and in Illinois are strip-mined for coal (NRCS 2006).

The soils and climate in this region are favorable towards agriculture, row crops account for 57 percent of the land use; grains and hay grown in the region commonly are fed to beef cattle.

Vegetation

The native vegetation (NRCS 2006) for this region consists of oak-hickory-maple and mixed mesic hardwood forests and prairie vegetation composed of big bluestem, little bluestem, Indiangrass, green needlegrass (*Nassella viridula*), and switchgrass in lowlands and grama, muhly (*Muhlenbergia* spp.), lovegrass (*Eragrostis* spp.), and wheatgrass in uplands (Table 3.2-2). Forbs are diverse in many areas of this region.

Wildlife

This region is the heartland of America, the center of grain production, and therefore the regal fritillaries (*Speyeria idalia*) flit about the fields of switchgrass, which later in the year provide an abundant source of prey for red fox (Oberbillig n.d.). Known for its potholes lakes and sinuous river bottoms, the region has a very diverse collection of waterfowl that utilize its resources as a vital stopover point during migration, and include the blue-winged teal (*Anas discors*), northern shoveler (*Anas clypeata*), and northern pintail (*Anas acuta*) (Oberbillig n.d.).

East and Central Farming and Forest Region (Region N)

Diversity of topography and climate gives rise to a wide range of natural ecosystems and limits the amount of land available for production agriculture (NRCS 2006). This region lies in a number of states, ranging from Arkansas and Missouri to the west and through the Ohio River Basin northwards, staying on the western side of the Appalachian Mountains into Pennsylvania (Figure 3.2-1). Approximately 93 percent of the region is privately owned. The crops that are grown in this region include cotton, soybeans, corn, and wheat (NRCS 2006).

Vegetation

Deciduous trees compose the majority of the vegetation (54 percent), with oak/hickory forests a common community type throughout the region. At the highest elevations, however, coniferous forests (seven percent) are evident. Grasses and forbs compose 20 percent of the vegetation; glades in the knob, basin, and highland areas of the western portion of the region support warm-season grasses and are often invaded by eastern redcedar (*Juniperus virginiana*) (Table 3.2-2). Shortleaf and loblolly pine (*Pinus echinata* and *Pinus taeda*) dominate much of this area, especially at higher elevations. Relatively open oak savannas, white oaks (*Quercus alba*.), red oaks (*Quercus* spp.) and hickory (*Carya* spp.) overstory and warm-season grasses in the understory, are found in the Arkansas Valley and Ridges (NRCS 2006). Cove forest species begin to dominate in the Kentucky and Indiana sandstone and shale hills and valleys where beech (*Fagus grandifolia*), maples and yellow-poplar (*Liriodendron tulipifera*) are abundant. In the bottomland hardwood flood plain areas of the eastern portion of this region, cottonwood, sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), and river birch (*Betula nigra*) are common (NRCS 2006). Yellow-poplar and pine species become more important in the eastern part of the region with Virginia pine (*Pinus virginiana*), pitch pine (*Pinus rigida*), red spruce (*Picea rubens*) and eastern hemlock dominant at higher elevations. At the northern end of the Blue Ridge Mountain range, Appalachian red and white oaks are abundant. In the southern end of the Blue Ridge Mountains, oak/hickory forests dominate lower elevations and grade into pine, red spruce and Fraser fir (*Abies fraseri*) communities at the highest elevations at over 5,000 feet (NRCS 2006). Rare, shade-intolerant herbaceous and shrub species are found on heath balds at the highest points of the mountain range. Forestry is an important industry. Oak, yellow-poplar, and pine are the dominant trees harvested (NRCS 2006).

Wildlife

Many different habitats support a wide range of biodiversity in this region, and in this region biodiversity is managed to be maximized (Oberbillig n.d.). Highland forests are littered in springtime with migratory songbirds like the Cerulean warbler (*Dendroica cerulea*) and American redstart (*Setophaga ruticilla*). The region boasts a healthy population of white-tailed deer, wild turkey, and American bald eagles. The key here is to minimize the impacts of fragmentation on native wildlife, ensuring a continued richness of biodiversity (Oberbillig n.d.).

Mississippi Delta Cotton and Feed Grains Region (Region O)

This region is on smooth terraces and flood plains along the Mississippi River, with major tributaries south of the Mississippi's confluence with the Ohio River; the majority of this region consists of river alluvium and flood plain terraces (Figure 3.2-1). Approximately 97 percent of the region is privately owned (NRCS 2006).

Row crops are the predominant use of the land (73 percent); the diverse array of crops grown in the region includes cotton, soybeans, milo, corn, rice, sugarcane, and wheat.

Vegetation

Bottomland hardwood communities dominant in oaks and hickories transition to flooded swamps rich in species such as bald cypress (*Taxodium distichum*) and tupelo (*Nyssa* spp.) (Table 3.2-2). Floodplains along the Southern Mississippi River are dominant in yellow-poplar, white ash (*Fraxinus Americana*), and cottonwood. Loblolly and shortleaf pine are typically dominant overstory species on upland ridges (NRCS 2006).

Wildlife

No species is brighter or more recognizable in the region than the painted bunting (*Passerina ciris*). This region holds one of the last remaining strongholds of the eastern spotted skunk (*Spilogale putorius*), a curious and charismatic cousin of the also present striped skunk (*Mephitis mephitis*). The alluvial plain is fertile ground, and the diverse flora of the region brings with it a likewise diverse array of invertebrates including the clubtail dragonflies (*Gomphidae* spp.) (Oberbillig n.d.). As is the case throughout North America where agriculture of any type creates areas of expansive monoculture, the white-tailed deer has become highly adaptable and closely associated with the region.

South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region (Region P)

This region encompasses the coastal plain, valley, sandhills, and prairie landforms across the Southeastern U.S. (Figure 3.2-1). Approximately 97 percent of the region is privately owned. The diverse array of crops includes cotton, soybeans, peanuts, corn, rice, sugarcane, and wheat (NRCS 2006).

Vegetation

Loblolly, longleaf (*Pinus palustris*), slash, and shortleaf pine species are common throughout most of the region, with evergreen trees composing 24 percent of the vegetation (NRCS 2006). Coastal plain vegetation consists of pine-hardwood communities dominant in loblolly pine, longleaf pine, yellow-poplar, and red oaks. The western coastal plain area supports similar deciduous hardwood species with few pine species (Table 3.2-2). The unique soil and topography of the Carolina and Georgia sandhills creates conditions favorable for longleaf pine, turkey oak (*Quercus laevis*), blackjack oak (*Quercus incana*), bluejack oak (*Quercus marilandica*), and sand live oak (*Quercus geminate*). Ridges and ravines in southern Mississippi host beech-magnolia-holly (*Fagus* spp. – *Magnolia* spp.-*Ilex* spp.) forests (NRCS 2006). Overstory species in the floodplains of this area are dominant in yellow-poplar, white ash, and swamp chestnut (*Quercus michauxii*). In the Alabama and Mississippi Blackland Prairie, mixed oak and loblolly pine grow on acidic soils and floodplains while eastern redcedar dominates alkaline hillsides (NRCS 2006).

<u>Wildlife</u>

This region is one of the most biologically diverse in the nation. No habitat is more unqiue or biodiverse than the longleaf pine system (Oberbillig n.d.). Species in this ecosystem are closely tied to the towering tree species presence in the region, including the red-cockaded woodpecker (*Picoides borealis*), northern bobwhite quail, dozens of reptile and amphibian species including the marbled salamander (*Ambystoma opacum*) and eastern hognose snake (*Heterodon platirhinos*), and mammals like the raccoon and bobcat (Oberbillig n.d.).

Northeastern Forage and Forest Region (Region R)

Plateaus, plains, and forested mountains characterize this New England region (Figure 3.2-1). The climate is generally cool and humid and most of the land in this region, especially the land in the steeper areas, is forested. Approximately 98 percent of the region is privately owned (NRCS 2006). In areas where markets, climate, and soils are favorable, fruits, tobacco, potatoes, and vegetables are important crops.

<u>Vegetation</u>

Deciduous trees compose the majority of the vegetation (42 percent), with primary forest types including northern beech-birch-sugar maple (*Fagus* spp. – *Betula* spp. – *Acer saccharum*) forest, northern hardwood, and mixed northern red spruce-eastern hemlock-balsam fir (*Tsuga* spp. – *Abies balsamea*) (Table 3.2-2). Mesophytic oak-sugar maple, oak, and hemlock-pine-cedar stands occur on wetter soils (NRCS 2006). Abandoned agricultural lands in this region have been re-established by pine and birch forests (NRCS 2006).

<u>Wildlife</u>

Cooler climate and mesic conditions precipitate a host of forest associated species in this ecoregion. The black bear, mink, porcupine (*Erethizon dorsatum*), eastern cottontail (*Sylvilagus floridanus*) and beaver are all commonly found in the regions environment. Recreational opportunities from the wild turkey, ring-necked pheasant and ruffed grouse are important parts of the biodiversity and regional culture (Oberbillig n.d.). The region is a matrix of public and private land, but also has a larger density of people than many other parts of the country and therefore is inhabited by species like the Virginia opossum (*Didelphis virginiana*) and white-tailed deer that tolerate and thrive in a human dominated landscape.

Northern Atlantic Slope Diversified Farming Region (Region S)

This region ranges from New Jersey to Western Virginia, characterized by coastal lowland, coastal plain, piedmont, and ridge and valley land features (Figure 3.2-1). Forested mountains and valleys are common in the western and central portions, with lowlands and sandy dunes in the east. The climate is temperate and humid. Approximately 92 percent of the region is privately owned.

Farming is highly diversified, from crops raised for the canning and frozen food industries by large-scale corporate farms to truck crops, fruits, and poultry; these are important sources of income, particularly on the coastal plains (NRCS 2006). Forage crops, soybeans, and grain for dairy and beef cattle also are important. Many landowners are part-time farmers, earning the majority of their living in the cities. Sites less suited for farming have been developed into rural residences, and throughout the region, urban areas are encroaching on farmland (NRCS 2006).

Vegetation

Vegetation dominated by hardwood forests (47 percent) and coastal plain species. With the exception of the northeast coastal lowland, primary woody species found throughout this region are deciduous hardwoods such as ashes (*Fraxinus* spp.), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), red oak (*Quercus rubra*), white oak, hickories, tulip-poplar (*Liriodendron tulipifera*) and evergreen pines including eastern white pine (*Pinus strobus*), loblolly pine, shortleaf pine and Virginia pine (NRCS 2006) (Table 3.2-2). Black cherry (*Prunus serotina*), eastern redcedar, pitch pine, red maple, sugar maple (*Acer saccharum*), southern red oak (*Quercus falcata*) and willow oak (*Quercus phellos*) are common further east. Dunes in the coastal lowland areas support American beach grass (*Ammophila breviligulata*), bayberry (*Morella cerifera*), sassafras (*Sassafras albidum*) and American holly (*Ilex opaca*) (NRCS 2006).

Wildlife

Disturbance and urban development have fragmented this regions biodiversity, but in areas where farmland is the most common natural habitat generalist species like the muskrat (*Ondatra zibethicus*), red fox and American woodchuck (*Marmota monax*) thrive. There remain some large areas of intact forest, and these areas are home to species like the wood thrush (*Hylocichla mustelina*), white-tailed deer and raccoon (Oberbillig n.d.). Important game birds include ruffled grouse, ring-necked pheasant and mourning dove.

Atlantic and Gulf Coast Lowland Forest and Crop Region (Region T)

This region is characterized by coastal lowlands, coastal plains, and the Mississippi River Delta on the Gulf coast and coastal lowlands, coastal plains, drowned estuaries, tidal marshes, islands, and beaches along the Atlantic coast (Figure 3.2-1). Approximately 94 percent of the region is privately owned.

Marketable commodities include tourism and significant deposits of salt in domes, natural gas, and petroleum buried beneath the Gulf coast surface (NRCS 2006). Recreation is a major industry, with the region's populace concentrated along the Gulf and Atlantic coasts. Loss of wetlands, cropland, and forestland due to urban development is a growing concern in these areas (NRCS 2006). Due to the high water table and predisposition to flooding, less than 10 percent of this region is farmed.

Vegetation

Evergreen tree species compose the majority of the vegetation (33 percent), followed by deciduous trees (ten percent), with grasses more typical of the southwestern portion. Predominant woody species indicative of the flatwood and coastal plain areas in the east and south central portions include deciduous hardwoods such as black oak, post oak (*Quercus stellata*), southern red oak, Atlantic white cedar (*Chamaecyparis thyoides*), blackgum (*Nyssa sylvatica*), red maple, sweetgum; and evergreen pines such as loblolly pine, longleaf pine, pitch pine, and Virginia pine (NRCS 2006) (Table 3.2-2). Bald cypress is common in the lowlands. Common understory species are blueberry (Vaccinium spp.), greenbrier (*Smilax* spp.), holly (*Ilex* spp.), sassasfras, sweet pepperbush (*Clethra alnifolia*), and wax myrtle. Little bluestem, indiangrass, switchgrass, and big bluestem are dominant grass species distributed throughout most of the region. Typical freshwater marsh vegetation includes alligatorweed (*Alternanthera philoxeroides*), spikerush (*Eleocharis* spp.), cutgrass (*Leersia* spp.), and bulltongue (*Sagittaria lancifolia*); brackish and saltwater vegetation is represented by saltgrass (*Distichlis spicata*), cordgrass (*Spartina* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.), and pickleweed (*Salicornia* spp.) (NRCS 2006).

Wildlife

A great deal of this regions biodiversity is associated with the costal plains and forests. Meadow jumping mice (*Zapus hudsonius*) and Henslow's sparrows (*Ammodramus henslowii*) can be seen in these habitats, along with bobcat, eastern cottontail rabbit, American alligator (*Alligator mississippiensis*) and the occasional black bear. Along with wild turkey and bobwhite quail, migratory waterfowl and neotropical songbirds winter in this area, making it a vital center for avian biodiversity in the contiguous 48 states (Oberbillig n.d.).

Florida Subtropical Fruit, Truck Crop, and Range Region (Region U)

This region is entirely in Florida and is characterized by low, flat coastal plains; swamps and marshland comprise more than half of this region (Figure 3.2-1). Approximately 90 percent of the region is privately owned.

Marketable commodities and important sources of income are citrus fruits, truck crops and some sugarcane; only about 10 percent of the region is cropland, most of which is used for citrus farming (NRCS 2006). Management of the water table is a primary concern during the summer; however irrigation for many crops may also be required during the fall and winter seasons, which are generally dry (NRCS 2006).

Vegetation

Evergreen tree species compose the majority of vegetation (29 percent); oaks and pines are the predominant forest species; oaks found throughout most of the region include turkey oak, bluejack oak, and live oak (*Quercus virginiana*); prevalent pines are longleaf pine and slash pine (*Pinus elliottii*) (NRCS 2006). Grasses and forbs compose 27 percent of the vegetation with typical understory species represented by grasses such as bluestems, panicums, and wiregrasses (*Aristida* spp.); and woody species such as cabbage palm (*Sabal palmetto*) and saw palmetto (*Serenoa repens*) (Table 3.2-2). The southern tip of the region supports freshwater marsh and swamp vegetation, predominated by sawgrass (*Cladium* spp.), pickleweed, willow, buttonbush (*Cephalanthus* spp.), and maidencane (*Amphicarpum* spp.) (NRCS 2006). Mangrove trees (*Rhizophora* spp.) grow in saltwater swamps along the eastern, southern, and southwestern coasts (Table MLRA regional acreages).

Wildlife

Located entirely in the state of Florida, the wildlife associated with this region are dominated by white-tailed deer. Over half of the region consists of swamps and marsh which are filled with wading birds like the American white ibis (*Eudocimus albus*) and great blue heron (*Ardea herodias*) (Oberbillig n.d.). The playful antics of river otter can be observed here. This is one of the richest areas for reptiles in eastern North America and common inhabitants include the spotted turtle (*Clemmys guttata*) and water moccasin (*Agkistrodon piscivorus*).

3.3 AIR QUALITY

3.3.1 Definition of the Resource

The Clean Air Act (CAA) requires the maintenance of National Ambient Air Quality Standards (NAAQS). NAAQS, developed by the EPA to protect public health, establish limits for six criteria pollutants: (ozone) O_3, nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), and inhalable particulates (course particulate matter (PM) greater than 2.5 micrometers and less than ten micrometers in diameter [PM_{10}] and fine particles less than 2.5 micrometers in diameter [$PM_{2.5}$]). The CAA requires states to achieve and maintain the NAAQS within their borders. Each State may adopt requirements stricter than those of the National standard. Each State is required by EPA to develop a State Implementation Plan (SIP) that contains strategies to achieve and maintain the National standard of air quality within the State. Areas that violate air quality standards are designated as non-attainment areas for the relevant pollutants.

3.3.2 Existing Conditions

Current management of agriculture and forest lands represent baseline conditions. Baseline conditions affect air quality in the following ways:

- Agricultural crops and forest trees take up CO_2 and release oxygen.
- Management of croplands and forests contribute to greenhouse gas emissions.

Implementation of BCAP, and the subsequent planting of bioenergy crops or removal of biomass for bioenergy use, can alter the uptake and release of CO_2. Crops that generate more biomass take up more CO_2. However, carbon in crops is emitted back to the atmosphere as CO_2 following the decomposition, burning, or processing of crop biomass. Carbon in crops therefore cycles through the atmosphere over a one to three year time period and is thereby considered to have net zero CO_2 emissions (West and Marland 2002a). Forest products used for bioenergy purposes are considered to have a similar cycle, except that carbon in standing trees will be sequestered from the atmosphere for a longer time period. CO_2 taken up and emitted by the growth of crop and forest biomass is hereby considered net zero, and is not further considered.

Greenhouse gas (GHG) emissions can be altered by changes in carbon dioxide emissions resulting from fossil-fuel combustion, by nitrous oxide (N_2O) emissions associated with the application of nitrogenous fertilizers, by conversion of biomass to biofuels, by fossil-fuel offsets, and by indirect land-use change associated with the planting and harvesting of bioenergy crops. Indirect land-use change can contribute to the reduction or augmentation of GHG emissions. Indirect land-use occurs when, for example, corn is replaced in the U.S. with a switchgrass crop, causing subsequent deforestation and the growing of corn in another country. The economic relationships involved in international land-use change are currently being debated (Kline and Dale 2008; Kline *et al.* 2009). It is evident that consensus has not been reached regarding the impacts of indirect land-use change on greenhouse gas emissions, and this topic is therefore not further considered.

CO_2 emissions from fossil-fuel combustion are associated with on-site land management (West and Marland 2002b; Nelson *et al.* 2009), with off-site or upstream emissions associated with the production and transport of agricultural inputs (West and Marland 2002b; Nelson *et al.* 2009), and with off-site emissions from the handling, transport, and processing of biomass for bioenergy purposes (Adler *et al.* 2007). CO_2 can be released or sequestered in the soil, depending on how the soil is managed. For example, changes in tillage intensity and in the quantity and quality of crop residue remaining after harvest can affect soil carbon decomposition rates and can impact net carbon dioxide emissions from the soil (West *et al.* 2008). N_2O is emitted from the soil following application of nitrogeneous fertilizers, and N_2O emissions will change based on fertilizer application rates and land management.

All of the aforementioned emissions of CO_2 and N_2O can change following a move from traditional cropping practices to cropping practices that include dedicated biomass feedstocks or removal of residue (herbaceous or woody) for biofuel purposes. While there exists numerous analyses on the net energy balance of corn grain-to-ethanol conversion (Shapouri *et al.* 2002), there are limited analyses on net GHG balances of biofuels, particularly cellulosic-based biofuels. Adler *et al.* (2007) analyze total net changes in GHG emissions associated with switchgrass, corn/soybean rotation, and hybrid poplar cropping systems. Considering changes in soil carbon, fossil-fuel emissions, other CO_2 and N_2O emissions, and fossil-fuel offsets, it was concluded that all bioenergy cropping systems reduce net GHG emissions compared to the current use of gasoline or diesel. Dedicated bioenergy crops, like switchgrass and poplar, reduce GHG emissions two to three times more than corn-based rotations. Reductions in GHG emissions are even greater when biofuels are used for electricity generation instead of for liquid fuel production.

The primary impact to air quality from the implementation of the BCAP program will be a reduction of GHG emissions. Net GHG reductions will depend greatly on the crop grown, management of the crop, and which fossil-fuel type is being displaced. Net GHG emissions will change across climate regimes, because land management practices change according to environmental variables.

3.4 SOIL QUALITY

Soil is defined as “the unconsolidated mineral and organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants” (Soil Science Society of America [SSSA] 2009). It consists of partially mineral and partially organic surface layers (3 to 5 feet) of the earth that have undergone weathering processes and have chemical and microbiological activity. The soil serves many purposes including growing plants, storing carbon, and providing habitat for a large proportion of the species of the earth. Due to differences in parent material, the material the soil formed from, climate such as temperature and rainfall and many other environmental factors, soils differ greatly in inherent productivity.

3.4.1 Definition of the Resource

To analysis the potential for affects to soil quality, including fertility and inherent conditions, the NRCS Land Resource Regions of the United States (NRCS 2006). The LRR is considered the greatest level of generalization of the land resource hierarchy as defined by the NRCS. The LRR is generally considered to be at an approximately map scale of 1:7,500,000. There are 28 LRR roughly estimating broad agricultural market regions. Given the broad-scale of the program, the LRR level was chosen to broadly define the soil orders in the regions where biomass production may occur.

3.4.1.1 Primary Proposed Energy Crop Regions

The soils that are most conducive for production of dedicated herbaceous energy crops, such as switchgrass; woody biomass, such as SRWC; forest residues after harvest operations, are located in the North Central, South Central, and Southeastern regions of the United States (Graham 1994). Graham (1994) utilized the American Forestry Association regional divisions of the United States combined with Soil Conservation Service (SCS), now NRCS, soil capability classes to indicate those areas of the United States that would provide the highest potential for herbaceous energy crops (HEC) and SRWC without irrigation. The Rocky Mountain region and parts of the North Central Region were excluded due to a lack of rainfall necessary for biomass production under unirrigated conditions. Table 3.4-1 indicates the estimated potential in the five regions with the potential for biomass production.

Table 3.4-1. Regional Production Potential

Region	HEC	SRWC
Millions of Hectares		
Pacific Coast	0.77	0.66
North Central	67.5	52.0
South Central	34.1	18.7
Northeast	15.5	10.0
Southeast	13.2	9.9
Millions of Metric Tonnes (Mg) Per Year		
Pacific Coast	9.7	13.1
North Central	1,214.7	741.5
South Central	504.1	270.0
Northeast	228.6	131.7
Southeast	240.7	138.3

Source: Adapted from Graham 1994

Because of a preponderance of corn and other agronomic crops in the North Central Region, these areas are more suitable, at present, as areas where crop residue removal as biomass for bioenergy conversion could be most prevalent (De La Torre Ugarte *et al.* 2007, English *et al.* 2006). Most of the area suitable for residue removal under unirrigated conditions is in Region M. Under irrigated conditions it could include Regions F, G, and H. In these areas removal of wheat residue for biomass could be common.

Second generation biofuels will be produced using crop and forestry harvest residues as biomass feedstocks (Biomass Research and Development Board [BRDB] 2008). Harvesting crop residues can lead to variable impacts on soil and water quality depending on climate, soil, crop grown, and the extent which aboveground biomass is removed. The environments most likely to be impacted by use of crop residues as biomass and the intensity of the impacts are thus related to the geography of crop production. While any land planted to a Title I crop could potentially be a source of biomass, it is most likely that BCFs and other consumers of biomass will be located in areas where feedstocks are readily abundant. The low bulk density of crop residues and the consequent high transportation cost will preclude their shipment over long distances. Therefore, it is reasonable to anticipate that markets will develop in areas where feedstocks are produced in high quantities.

The National Renewable Energy Laboratory (NREL) published a study on biomass resource availability related to crop geography (Milbrandt 2005). The study defines potential biomass resource availability for a number of crops for which the residues remaining after harvest could be collected for biomass. It is reasonable to assume that areas most likely to be affected by the BCAP will be those with the highest density of residues available. In general, the region with the highest concentration of available residues is located in the Upper Midwest (Figure 3.4-1).

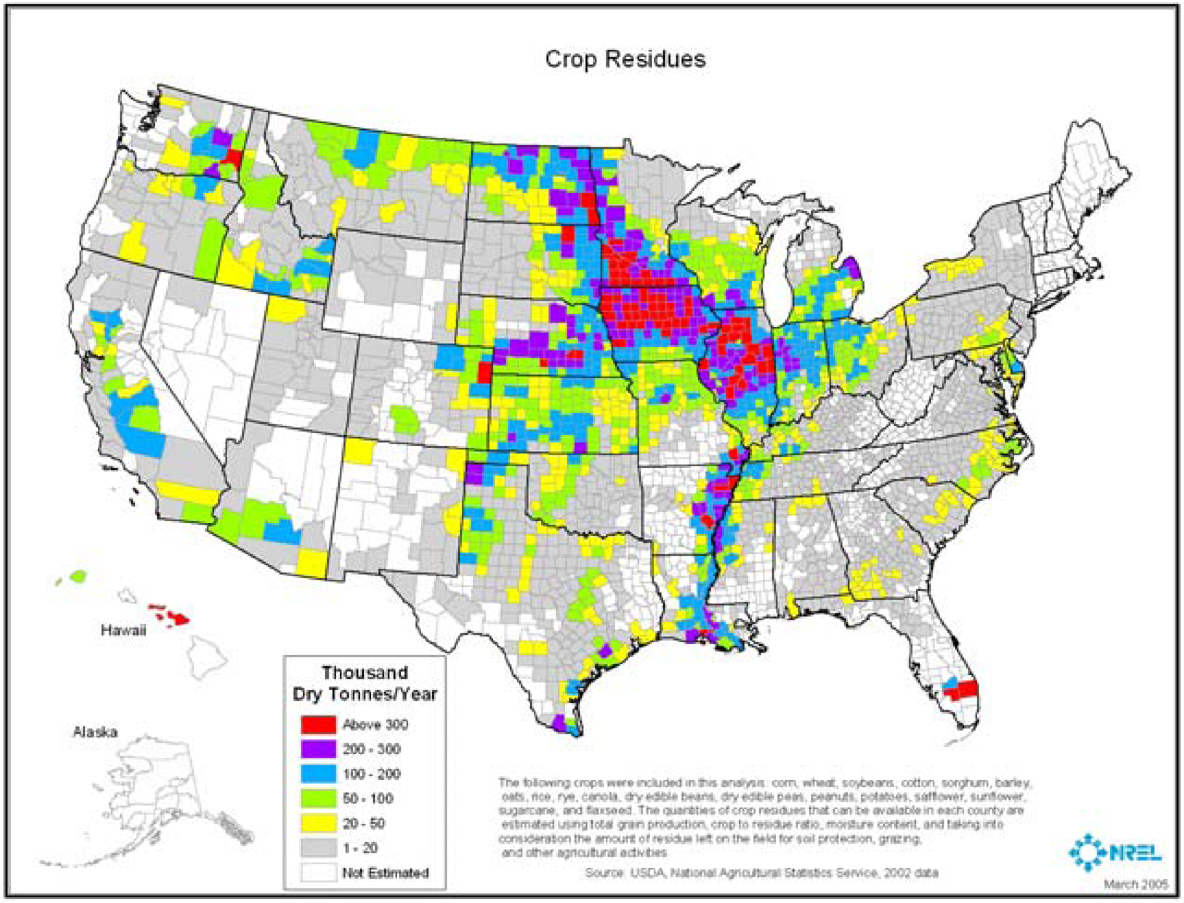


Figure 3.4-1. Primary Crop Residue Areas within the United States

Of the Title I crops, residues of corn, sorghum, soybean, and wheat represent the largest potential sources of biomass. Using 2001 as a baseline, the USDA and DOE reported that these four crops produce 225.0, 12.4, 80.2, and 115.8 million dry tons of residues per year (Perlack *et al.* 2005). However, of these four crops, only corn and wheat produced large amounts of biomass that could be harvested sustainably under present production practices. Changes in production practices for these crops such as reduced tillage and use of cover crops could significantly increase residues available for use as biomass. Of these crops, corn stover represented by far the largest potential source of crop residue derived biomass under any scenario studied.

Corn production is largely centered in the upper Midwest with Iowa, Illinois, Nebraska, Minnesota, and Indiana representing the top five corn producing states (see map) corresponding to Region M. Of these five states, Nebraska (Region G) is the only one with a significant acreage of irrigated corn. The other four states are located in the humid temperate region and generally receive ample precipitation for dryland corn production. Wheat production is most concentrated in the Central and Northern Great Plains. Kansas, North and South Dakota, Montana, and Oklahoma are the top five wheat producing states corresponding to Regions H and F. Sorghum production is largely centered in Region H. Sorghum is more tolerant of moisture stress than corn so it is generally grown further west than corn, but a significant proportion of sorghum is grown under irrigation. The top five sorghum producing states are Kansas, Texas, Oklahoma, Nebraska, and Colorado. The distribution of soybean production is similar to that of corn (Region M) but extends further south into the Mississippi delta corresponding to Region O (USDA 2009b, c, d, e).

3.4.1.2 Secondary Energy Crop Regions

The West Coast Regions consist of Regions A and B. Excessive crop residue removal can have negative effects on soil organic matter storage and potentially increase water and wind erosion. These would have detrimental effects on soil in these regions and also impact surface water from sediment or nutrient movement into water bodies. Increased irrigation in these areas for more acreage of row crops and subsequent crop residue removal could impact groundwater supplies and enhance salt accumulation problems from irrigation.

The East Coast Region consists of Regions N; P, and O. Clearly, regions somewhat west and southwest of these regions and north of these regions and some coastal areas adjoining Region P may be suitable for some production of biomass crops, forest residues, and others. There are a diverse array of crops grown across this region including corn, cotton, soybeans, grain sorghum, winter wheat, and some rice and sugarcane. The amount of land area in each crop is variable from year to year in the areas as a response to weather, crop price, etc. Most of the crop acreage before about 30 years ago was in tilled scenarios, which left the soil bare for extended periods, with resulting severe water erosion and loss of soil organic matter and crop productivity (Tyler *et al.* 1994). Forest residues from either SRWC, fast growing tree species harvested every five to seven years specifically for biomass, wood residues after timber operations and other forest resource possibilities are summarized by Perlack *et al.* (2005). The conversion of these crop lands to biomass crops, especially perennial crops and the increased utilization of forest residues could have large effects on the environment. Carbon sequestration could be affected, as well as overall soil quality and water quality.

3.4.2 Existing Conditions

3.4.2.1 Primary Proposed Energy Crop Regions

Region M is comprised of parts of Iowa, Illinois, Missouri, Minnesota, Indiana, Kansas, Nebraska, Ohio, Wisconsin, South Dakota, Oklahoma, and Michigan. Also, very small parts of North Dakota and Kentucky are located in this region. The region makes up 282,450 square miles, which is dominated by the soil orders of Alfisols, Entisols, Inceptisols, and Mollisols (Table 3.4-2) (NRCS 2006). The major soil resource concerns are water erosion, wetness, maintenance of the content of organic matter, and productivity of soils. Based on the soils and climate of Region M, agriculture is the favored industry. This region produces most of the United States' corn, soybeans, and feed grain. Generally, this is viewed as one of the most productive areas of the country.

Region F is made up of parts of North Dakota, Montana, South Dakota, and Minnesota. The total square miles of this region are 143,225 (NRCS 2006). The topography has been impacted and smoothed by continental glaciations. There are several deposits and sediment that are evidence of ancient glacial lakes present in this region. The geology of the area consists of sediment that has been weathered from sedimentary rocks. Most of the soils are Mollisols with dominate suborders of Ustolls and Aguolls (Table 3.4-2). Wind and water erosion can be a major threat to this region. The soils are fertile and relatively flat but are limited in agricultural use due to low rainfall and short growing seasons. The main crop is spring wheat, which is grown by dry farming methods (NRCS 2006). Also, potatoes, sugar beets, soybeans, and corn are important crops in the Red River Valley.

Region G is located in parts of Montana, New Mexico, South Dakota, Colorado, Nebraska, Wyoming, North Dakota, and Texas, with very small portions in Oklahoma and Kansas. This region makes up 213,945 square miles (NRCS 2006). This region formed along the foothills of the Rocky Mountains, on the edge of the Great Plains. The topography is generally sloping with common flat-topped, steep-sided buttes rising out of the landscape. The soils in this region are dominated by Entisols and Mollisols (Table 3.4-2). Wind erosion and some water erosion are the main resource concerns of this region. The dominate land use in this region is grazing by cattle and sheep. Some winter wheat and small grains are grown for cash or feed crops.

Table 3.4-2. Soil Order Descriptions

Soil Order	Description	LRR
Alfisols	A dark surface horizon mineral soil, similar to mollisols however, lacking the same level of fertility and more acidic.	M, N, P, H, A
Andisols	Soils of recent volcanic origin having cinders and volcanic glass. Typically found in the northwest and in Alaska.	A
Aridisols	These soils are found in the arid regions of the US. Typically high in calcium, Magnesium, potassium and sodium. The soils have an alkaline pH.	B
Entisols	This soil order is relatively un-weathered. These soils have no diagnostic horizon development. Often found on floodplains, glacial outwash areas and other areas receiving alluvial materials.	M, G, N, H, A, P
Inceptisols	Soils of the humid and sub humid region. Weathering has created minimal diagnostic differentiation in the soil column.	N, M, H, A, P
Mollisols	Dark colored mineral soils developed under grassland conditions. Rich in nutrients, very fertile. Associated with America's corn belt.	M, F, G, H, B
Spodosols	These soils have undergone significant weathering. Organic carbon, aluminum and often iron has been translocated to a lower horizon referred to a spodic horizon. These soils are acidic and may have deleterious levels of aluminum in the subsoil.	A
Ultisols	Highly weathered soils found in hot, moist regions. Typically acidic and low in available nutrients.	A, N, P
Vertisols	Soils having significant amounts of expanding clay content. Soils typically crack when dry and swell when wet.	P

Source: Adapted from Brady 1990

Rain is low and irrigation is necessary for crops such as corn. Other crops include alfalfa, forage crops, and sugar beets (NRCS 2006). Some dryland farming is done with winter wheat and other small grains.

Region H consists of parts of Texas, Kansas, Oklahoma, Nebraska, New Mexico, and Colorado and a very small part of Wyoming. This region accounts for approximately 219,740 square miles (NRCS 2006). This area is generally level to gently sloping and most of the soils are Mollisols but significant acreages of Alfisols, Entisols and Inceptisols are also present (Table 3.4-2). Overgrazing and wind and water erosion are the major resource concerns in this area. The production of beef cattle is the primary agricultural enterprise for this region but Region H also has almost as much cropland as it has grassland. Some winter wheat and small grains are grown for cash or feed crops and irrigation crops are grown along the streams. These crops include corn alfalfa, forage crops, and sugar beets.

3.4.2.2 Secondary Energy Crop Regions

Region A consists of parts of Oregon, Washington, and California being approximately 90,165 square miles (NRCS 2006). The topography of this region is defined by steep mountains and sloping valleys with two mountain ranges, The Coast Range and The Cascade Mountains. About 44 percent of this region is Federal land, in national forests. This region is heavily forested allowing timber production to be the major industry (NRCS 2006). Also, in valleys that receive rainfall, the dairy farming industry is very prevalent.

Region B is located in Idaho, Washington, and Oregon, with a very small part in Utah, accounting for approximately 81,255 square miles (NRCS 2006). This region is located on the lee side of the Cascade Mountain and extends into the Snake River Plains. This region is a mixture of cropland and grazing land. The major crop of this region is wheat but oats, barley, lentils and pears are also important crops (NRCS 2006). The major crop in the western part of this region is apples. Grazing mainly occurs in the drier parts of the region.

The dominate soil orders in Region A are Alfisols, Andisols, Entisols, Inceptisols, Spodosols, and Ultisols (Table 3.4-2). These soil orders vary greatly depending location in the region, parent material, and moisture and temperature regime they formed under. Region B differs in that it is mostly Mollisols and Aridisols formed from a mixture of loess and ash deposits.

Region N consist of parts of Kentucky, Missouri, Tennessee, Arkansas, West Virginia, Pennsylvania, Alabama, Ohio, Oklahoma, North Carolina, Virginia, Indiana, Georgia, and Illinois and in very small are of Kansas, Maryland, New York, and South Carolina, being 236,415 square miles (NRCS 2006). The region consists of a wide range of topography and climate that has led to many diverse natural ecosystems and agriculture production. The soils of this region are dominantly Alfisols, Entisols, Inceptisols, or Ultisols (Table 3.4-2). Many of these soils were formed from limestone, shale or sandstone. Soil depth varies from very shallow to very deep. The inherent fertility is greatly determined by the parent material with the limestone soils generally being much more fertile than those from sandstone or shale. Forestry is very important industry due to the native deciduous forests. The dominant trees harvested are oak, yellow-poplar, and pine. The crops grown in this region are varied and can include cotton, soybeans, corn and wheat (NRCS 2006).

Region P includes parts of Georgia, Mississippi, Alabama, North Carolina, Texas, Louisiana, South Carolina, Virginia, Arkansas, Florida, Tennessee, Kentucky, and Oklahoma and very small portions of Illinois and Missouri, being 26,095 square miles (NRCS 2006). The soils of this region are quite variable in nature and productivity. They are generally Alfisols, Entisols, Inceptisols, Ultisols or Vertisols (Table 3.4-2). Some are formed in windblown loess, others formed from alluvial clays deposits and some are derived from granite. They vary greatly in productivity but, because of slope and parent material, most soils tend to be highly erodible. The loess soils have some of the highest soil erosion rates from water erosion in the country. The high moisture and long growing season increase agricultural production. The diverse array of crops grown in this region includes cotton, soybeans, peanuts, corn, rice, sugarcane, and wheat (NRCS 2006).

Region O includes parts of Arkansas, Louisiana, Mississippi, Missouri, and Tennessee, accounting for approximately 38,865 square miles along the floodplains and terraces of the Mississippi River (NRCS 2006). This is a region of fertile soils, though drainage is often required to lower the inherent water table associated with this Delta region. The dominate soils are Alfisols, Vertisols, Inceptisols, or Entisols. The native vegetation of the region was primarily deciduous bottomland hardwood forests. The crops types currently grown are diverse and include cotton, soybeans, milo, corn, rice, sugarcane, and wheat (NRCS 2006).

3.4.2.3 Soil Carbon Sequestration

Carbon is an extremely important component of most soils and has a strong influence on their functional properties. It increases the soil water and nutrient supplying capacity to crops. Most of the carbon in soils is in the soil organic matter. Soil organic matter, partially decomposed plant and animal remains; serve as a food source for soil bacteria and other soil organisms such as earthworms. Organic matter also improves the ability of the soil to resist movement from wind and water erosion and improves the rate at which water can move into the soil instead of running off the soil surface.

Carbon sequestration or storage of carbon in cropping systems involves storage in non-removed crop residues and below ground root systems, as well as carbon being stored in the soil as organic matter in varying stages of decomposition. Some of this soil organic matter goes into more decomposition resistant fractions which results in increases in soil carbon storage depending on the tillage system, crop grown, etc. A transition from a tilled row crop to a no-tilled row crop can enhance the amount of carbon stored since crop residues on the soil surface after harvest remain on the surface and decompose more slowly than if mixed in the soil with tillage. This surface cover also results in less soil erosion (Shelton *et al.* 1983). These same scenarios could be enhanced with perennial crops, where not only would surface residue increase, but below ground root biomass would not decompose from one year to the next as is common with annual row crops such as corn. This increased carbon storage above and below ground potentially results in overall improvements in the productive quality of the soil.

One aspect of soil quality is reduced erosion and better surface aggregation, the enhanced stability of the soil surface and its ability to allow water to infiltrate into the soil as compared to running off. This runoff water can carry sediment and accompanying nutrients and pesticides into surface water, resulting in impaired water quality.

Many of the streams in all of the Land Resource Regions mentioned in this paper have impaired stream systems from sediment, nutrients, etc. (EPA 1998). Any change in sediment loss in land conversion from one crop management system to another could have potential environmental effects. The change in amounts of pesticides or nutrients used in biomass cropping and forest residue systems when compared to the existing land use could also have effects on water quality.

3.5 WATER QUALITY AND QUANTITY

3.5.1 Definition of the Resource

Freshwater is necessary for the survival of most terrestrial organisms, and is required by humans for drinking and agriculture, among other uses; however, less than one percent of Earth's water is in the form of freshwater that is not bound in ice caps or glaciers. The Water Pollution Control Act of 1972, or CWA, Safe Drinking Water Act, and the Water Quality Act are the primary Federal laws that protect the nation's waters. The principal law governing pollution of the nation's surface water resources is the CWA. The Act utilizes water quality standards, permitting requirements, and monitoring to protect water quality. The EPA sets the standards for water pollution abatement for all waters of the U.S. under the programs contained in the CWA but, in most cases, gives qualified States the authority to issue and enforce permits. For this analysis, water resources include surface water quality (including lakes, rivers and associated tributaries, and estuaries), groundwater quality, and water use/quantity of both surface and groundwater.

Surface water, as defined by the EPA are waters of the United States, such as rivers, streams, creeks, lakes, and reservoirs, supporting everyday life through uses such as drinking water and other public uses, irrigation, and industrial uses. Of all the water used in the United States in 2000 (about 408 billion gallons per day), about 74 percent came from fresh surface water sources (USGS 2008). Surface runoff from rain, snow melt, or irrigation water, can affect surface water quality by depositing sediment, minerals, or contaminants into surface water bodies. Surface runoff is influenced by meteorological factors such as rainfall intensity and duration, and physical factors such as vegetation, soil type, and topography.

Groundwater is the water that flows underground and is stored in natural geologic formations called aquifers. It is ecologically important because it sustains ecosystems by releasing a constant supply of water into wetlands and contributes a sizeable amount of flow to permanent streams and rivers (FSA 2003). In the U.S. more than 50 percent of water consumed daily, approximately 50 billion gallons, is groundwater. More than two-thirds of this amount is used for irrigation, and the remainder is used for drinking water and other domestic uses.

3.5.2 Existing Conditions

3.5.2.1 Surface Water Quality

Surface water quality is determined by the natural, physical, and chemical properties of the land that surrounds the water body. The topography, soil type, vegetative cover, minerals, and climate, all influence water quality. When land use affects one or more of these natural physical characteristics of the land, water quality is almost always impacted. These impacts may be positive or negative, depending on the type and extent of the change in land use. Agricultural practices have the potential to substantively affect water quality due to the vast amount of acreage devoted to farming nationwide and the great physical and chemical demands that agricultural use has on the land. The most common types of agricultural pollutants include excess sediment, fertilizers, animal manure, pesticides and herbicides.

Fertilizers and pesticides have been found to be in excess in many water bodies in the U.S. (EPA 2008a). EPA has documented over 3 million acres of water bodies and over 75,000 miles of rivers and streams and large areas of bays and wetlands with excess nitrogen and phosphorus pollution. These two nutrients, when in excess, create harmful blooms of algae and other water plants which deplete oxygen and can result in many detrimental effects including fish kills. The use of biomass crops could have numerous implications for water quality including effects on fertilizer nutrient leaching and runoff, and soil erosion and sedimentation (National Academy of Sciences 2007)

Nutrient leaching and runoff will be affected by biomass choice. The use of corn or wheat residue for biomass will probably have little impact on leaching of nutrients toward groundwater, but if soil cover is not adequate, runoff could increase resulting in greater losses of nitrogen and phosphorus to surface water increasing the potential for excessive nutrient loading, and resulting oxygen depletion. The use of dedicated energy crops generally requires less nutrient applications than corn or wheat. Presently, recommendations for the potential biomass crop switchgrass are about one-third that for corn in the Southeast U.S. (Garland 2008). The amount of phosphorus is also generally lower than recommended for corn. This reduced nutrient use could have positive effects on water quality.

Normal, routine, and continuous agricultural activities such as plowing, cultivating, and harvesting crops, maintenance of drainage ditches, and construction and maintenance of irrigation ditches, farm or stock ponds, and farm roads in accordance with best management practices (BMPs) are exempt from CWA permitting requirements.

3.5.2.2 Groundwater Quality

Groundwater use has many societal benefits. It is the source of drinking water for about half the nation and nearly all of the rural population, and it provides over 50 billion gallons per day in support of the Nation's agricultural economy (USGS 2003). Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Some of the major sources of these products, called contaminants, are storage tanks, septic systems, hazardous waste sites, landfills, and the widespread use of road salts, fertilizers, pesticides and other chemicals.

Groundwater has been seriously affected by various nutrient and pesticide pollutants as reported by the EPA's Report on the environment for 2008 (EPA 2008b). The BCAP could mean a distinct land use change from traditional row crops such as corn or wheat, which could supply residue for biomass to dedicated bioenergy crops such as switchgrass. Corn or wheat residue removal would be expected to have minor effects on groundwater quality but the land conversion to perennial crops such as switchgrass could have major impacts. These might include reduced transport of nitrogen due to lower use than with corn (Garland 2008) and enhanced use efficiency due to a greater perennial deep root system compared to corn. Preliminary data is indicating this in comparisons of corn to switchgrass and Miscanthus (Czapar 2008). Nitrate leaching was reduced with switchgrass or Miscanthus compared to corn.

3.5.2.3 Water Use/Quantity

Water use changes with programs such as BCAP could be important. The estimated water usage for different purposes has been summarized by Hutson *et al*. (2004). Excluding irrigation agriculture only directly uses about 1 percent of the water withdrawals. Thermoelectric power uses 48 percent and irrigation uses 34 percent. BCAP would greatly influence total use if it brought non-irrigated land into production in biomass cropping systems that would require irrigation. Increased acreages of corn or wheat grown for biomass removal and replacing other non-irrigated crops is not likely given the high costs associated with irrigation. Dedicated biomass energy crops such as switchgrass or Miscanthus could require irrigation if grown in semi-arid and arid areas of the U.S. The economics of this scenario are not favorable and BCAP will not likely produce this.

The U.S. Geological Survey (USGS) publishes estimated water use in the U.S. every five years, with data going back to 1950 (Hutson *et al*. 2004). The latest publication of *Estimated Use of Water in the United States* was in 2000, which indicated that approximately 408 billion gallons per day (Bgal/d) of water was used in the U.S. (Hutson *et al.* 2004). Of the total withdrawals, freshwater accounted for about 85 percent, while saline water accounted for the remaining 15 percent. California, Texas, and Florida were the largest users of water in 2000. Total surface-water withdrawals were 323 Bgal/d, while total groundwater withdrawals were 84.5 Bgal/d. Texas and California were estimated to have the largest surface water withdrawals, using over 20 Bgal/day but only California withdrew more than 10 Bgal/day of groundwater (Hutson *et al*. 2004).

The total water withdrawals have increased from 180 Bgal/d in 1950 to 408 Bgal/day in 2000 (Figure 3.5-1 and Table 3.5-1). Groundwater (fresh) has increased from 34 Bgal/d to 83.3 Bgal/d from 1950 to 2000 (9 percent change over 50 years). Surface water (fresh) withdrawals increased from 140 Bgal/d to 262 Bgal/d from 1950 to 2000. Withdrawals for irrigation increased by more than 68 percent from 1950 to 1980 (from 89 Bgal/d to 150 Bgal/d) then from 1985 to 2000 withdrawals stabilized to 134 to 137 Bgal/d. This decrease can be attributed to climate, crop type, advances in irrigation efficiency, and higher energy costs.

Water use in the U.S. was determined from estimates of water withdrawals for eight categories, public supply, domestic, irrigation, livestock, aqua-culture, industrial, mining, and thermoelectric power (Hutson *et al.* 2004). For 2000, the largest water withdrawals were for thermoelectric power and irrigation. Irrigation remained the largest use of freshwater in the U.S. and totaled 137 Bgal/d for 2000 (40 percent of total freshwater withdrawals) (Table 3.5-2). California, Nebraska, Texas, Arkansas, and Idaho accounted for 53 percent of total irrigated acreage. Estimates of total irrigation withdrawals for 2000 were about 2 percent more than during 1995. When 2000 irrigation was separated by source, surface water withdrawals decrease by 5 percent when compared to 1995 while groundwater withdrawals increased by 16 percent.

About 61,900 thousand acres were irrigated in 2000. The estimated number of irrigated acres has also increase by 7 percent in when compared to 1995.

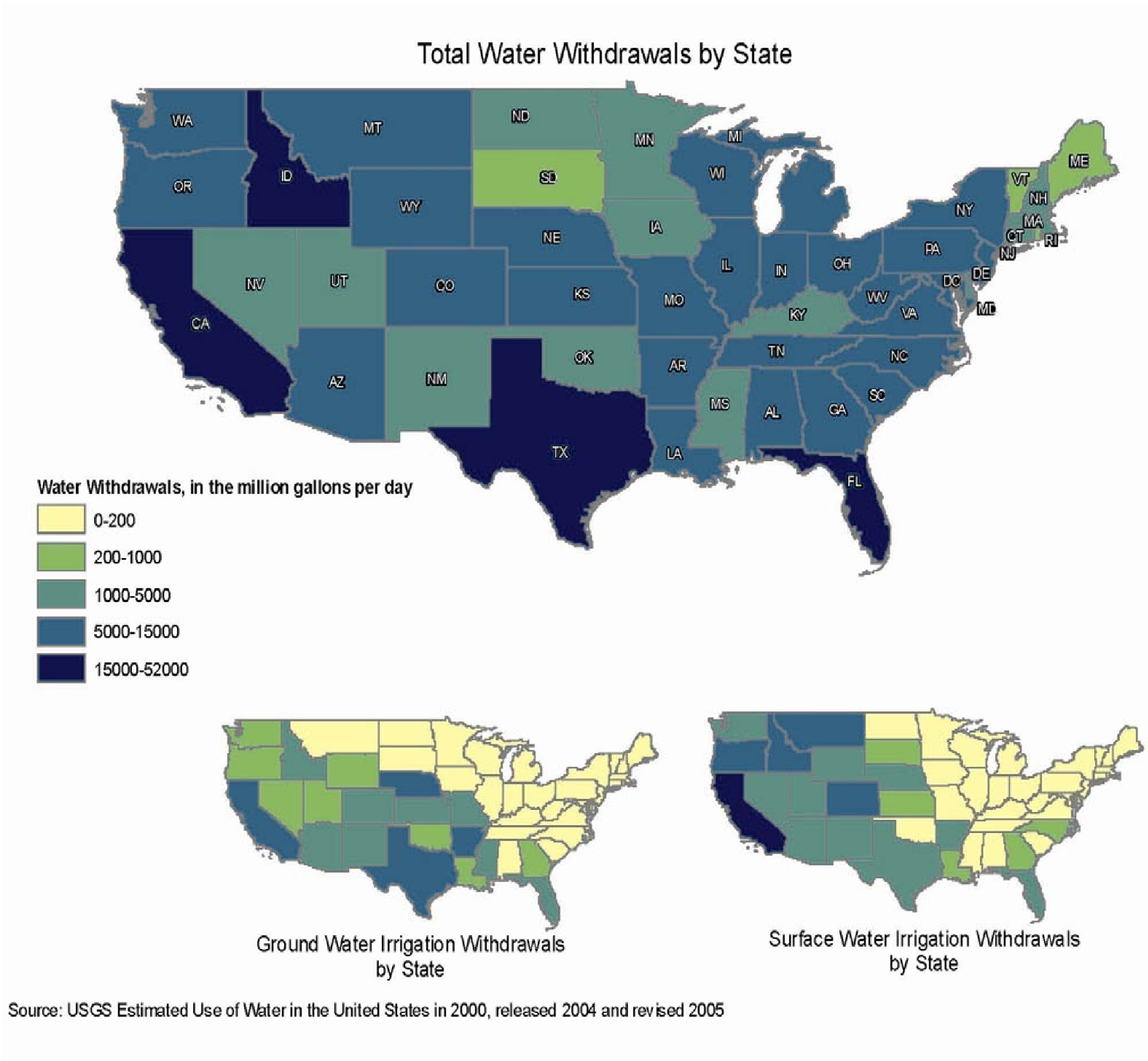


Figure 3.5-1. Water Withdrawals for Irrigation

Table 3.5-1. Water Withdrawals from 1950 to 2000

	Year											Percentage change
	[1]1950	[2]1955	[3]1960	[4]1965	[4]1970	[3]1975	[3]1980	[3]1985	[3]1990	[3]1995	[3]2000	1995-2000
Population, in millions	150.7	164.0	179.3	193.8	205.9	216.4	229.6	242.4	252.3	267.1	285.3	+7
Off-stream use:												
Total withdrawals	180	240	270	310	370	420	440	399	408	402	408	+2
Public supply	14	17	21	24	27	29	34	36.5	38.5	40.2	43.3	+8
Rural domestic and livestock:												
Self-supplied domestic	2.1	2.1	2.0	2.3	2.6	2.8	3.4	3.32	3.39	3.39	3.59	+6
Livestock and aquaculture	1.5	1.5	1.6	1.7	1.9	2.1	2.2	[5]4.47	4.50	5.49	([6])	—
Irrigation	89	110	110	120	130	140	150	137	137	134	137	+2
Industrial:												
Thermoelectric power use	40	72	100	130	170	200	210	187	195	190	195	+3
Other industrial use	37	39	38	46	47	45	45	30.5	29.9	29.1	([7])	—
Source of water:												
Ground:												
Fresh	34	47	50	60	68	82	83	73.2	79.4	76.4	83.3	+9
Saline	([8])	0.6	0.4	0.5	1.0	1.0	0.9	0.65	1.22	1.11	1.26	+14
Surface:												
Fresh	140	180	190	210	250	260	290	265	259	264	262	-1
Saline	10	18	31	43	53	69	71	59.6	68.2	59.7	61	+2

[1] 48 States and District of Columbia, and Hawaii
[2] 48 States and District of Columbia
[3] 50 States and District of Columbia, Puerto Rico, and U.S. Virgin Islands
[4] 50 States and District of Columbia, and Puerto Rico
[5] From 1985 to present this category includes water use for fish farms
[6] Data not available for all States; partial total was 5.46
[7] Commercial use not available; industrial and mining use totaled 23.2
[8] Data not available
Source: Hutson *et al.* 2004

Figure 3.5-2. Figure Irrigation Withdrawals for Each State by Source

STATE	IRRIGATED LAND (in thousand acres)				WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)			APPLICATION RATE (in acre-feet per acre)
	By type of irrigation			Total	By source		Total	By source		Total	
	Sprinkler	Micro-irrigation	Surface		Ground water	Surface water		Ground water	Surface water		
Alabama	68.7	1.30	0	70.00	14.5	28.7	43.1	16.2	32.2	48.4	0.69
Alaska	2.43	0	0.07	2.50	0.99	0.02	1.01	1.11	0.02	1.13	0.45
Arizona	183	14.0	779	976	2,750	2,660	5,400	3,080	2,980	6,060	6.21
Arkansas	631	0	3,880	4,510	6,510	1,410	7,910	7,290	1,580	8,870	1.97
California	1,660	3,010	5,470	10,100	11,600	18,900	30,500	13,100	21,100	34,200	3.37
Colorado	1,190	1.16	2,220	3,400	2,160	9,260	11,400	2,420	10,400	12,800	3.76
Connecticut	20.6	0.39	0	21.0	17.0	13.4	30.4	19.0	15.0	34.0	1.62
Delaware	81.1	0.71	0	81.8	35.6	7.89	43.5	39.9	8.84	48.7	0.60
District of Columbia	0.32	0	0	0.32	0	0.18	0.18	0	0.20	0.20	0.63
Florida	515	704	839	2,060	2,180	2,110	4,290	2,450	2,370	4,810	2.34
Georgia	1,470	73.8	0	1,540	750	392	1,140	841	439	1,280	0.83
Hawaii	16.70	105	0	122	171	193	364	191	216	407	3.35
Idaho	2,440	4.70	1,300	3,750	3,720	13,300	17,100	4,170	15,000	19,100	5.10
Illinois	365	0	0	365	150	4.25	154	168	4.76	173	0.47
Indiana	250	0	0	250	55.5	45.4	101	62.2	51.0	113	0.45
Iowa	84.5	0	0	84.5	20.4	1.08	21.5	22.9	1.21	24.1	0.28
Kansas	2,660	2.14	647	3,310	3,430	288	3,710	3,840	323	4,160	1.26
Kentucky	66.6	0	0	66.6	1.14	28.2	29.3	1.28	31.6	32.9	0.49
Louisiana	110	0	830	940	791	232	1,020	887	261	1,150	1.22
Maine	35.0	0.95	0.03	36.0	0.61	5.23	5.84	0.68	5.86	6.55	0.18
Maryland	57.3	3.32	0	60.6	29.8	12.6	42.4	33.4	14.1	47.6	0.78
Massachusetts	26.6	2.35	0	29.0	19.7	106	126	22.1	119	141	4.88
Michigan	401	8.67	4.87	415	128	73.2	201	144	82.0	226	0.54
Minnesota	546	0	26.9	573	190	36.6	227	213	41.1	254	0.44
Mississippi	455	0	966	1,420	1,310	99.1	1,410	1,470	111	1,580	1.11
Missouri	532	1.43	792	1,330	1,380	48.1	1,430	1,550	53.9	1,600	1.21
Montana	506	0	1,220	1,720	83.0	7,870	7,950	93.0	8,820	8,920	5.18
Nebraska	4,110	0	3,710	7,820	7,420	1,370	8,790	8,320	1,540	9,860	1.26
Nevada	192	0	456	647	567	1,540	2,110	635	1,730	2,360	3.65
New Hampshire	6.08	0	0	6.08	0.50	4.25	4.75	0.56	4.76	5.32	0.88
New Jersey	109	15.7	3.70	128	22.8	117	140	25.5	131	156	1.22
New Mexico	461	7.17	530	998	1,230	1,630	2,860	1,380	1,830	3,210	3.22
New York	70.0	8.73	1.84	80.6	23.3	12.1	35.5	26.1	13.6	39.8	0.49
North Carolina	193	3.70	0	196	65.8	221	287	73.8	248	322	1.64
North Dakota	200	0	26.7	227	72.2	73.2	145	80.9	82.1	163	0.72
Ohio	61.0	0	0	61.0	13.9	17.8	31.7	15.6	19.9	35.5	0.58
Oklahoma	392	1.50	113	507	566	151	718	635	170	804	1.59
Oregon	1,160	4.02	1,000	2,170	792	5,290	6,080	887	5,920	6,810	3.14
Pennsylvania	28.9	7.17	0	36.0	1.38	12.5	13.9	1.55	14.0	15.6	0.43
Rhode Island	4.48	0.29	0.05	4.82	0.46	2.99	3.45	0.52	3.35	3.87	0.80
South Carolina	166	3.66	17.5	187	106	162	267	118	181	300	1.60

Figure 3.5-2. Figure Irrigation Withdrawals for Each State by Source (cont'd)

STATE	IRRIGATED LAND (in thousand acres)				WITHDRAWALS (in million gallons per day)			WITHDRAWALS (in thousand acre-feet per year)			APPLICATION RATE (in acre-feet per acre)
	By type of irrigation			Total	By source			By source		Total	
	Sprinkler	Micro-irrigation	Surface		Ground water	Surface water		Ground water	Surface water		
South Dakota	276	0	78.3	354	137	236	373	153	264	418	1.18
Tennessee	51.2	5.35	3.96	60.5	7.33	15.1	22.4	8.22	16.9	25.1	0.41
Texas	4,010	89.4	2,390	6,490	6,500	2,130	8,630	7,290	2,390	9,680	1.49
Utah	526	1.68	880	1,410	469	3,390	3,860	526	3,800	4,330	3.08
Vermont	4.95	0	0	4.95	0.33	3.45	3.78	0.37	3.87	4.24	0.86
Virginia	64.3	13.9	0	78.2	3.57	22.8	26.4	4.00	25.6	29.6	0.38
Washington	1,270	49.9	252	1,570	747	2,290	3,040	837	2,570	3,400	2.16
West Virginia	2.21	0	0.98	3.19	0.02	0.02	0.04	0.02	0.02	0.04	0.01
Wisconsin	355	0	0	355	195	1.57	196	218	1.76	220	0.62
Wyoming	190	4.73	964	1,160	413	4,090	4,500	463	4,580	5,050	4.36
Puerto Rico	15.5	33.0	5.35	53.8	36.9	57.5	94.5	41.4	64.5	106	1.97
U.S. Virgin Islands	0.20	0	0	0.20	0.29	0.21	0.50	0.33	0.24	0.56	2.80
TOTAL	28,300	4,180	29,400	61,900	56,900	80,000	137,000	63,800	89,700	153,000	2.48

Source: Hutson *et al.* 2004

3.6 RECREATION

3.6.1 Definition of the Resource

Lands used for or suited for agricultural use and forests are also suited for outdoor recreational activities, key among them hunting and wildlife activities. In 2008, the U.S. Fish and Wildlife Service published the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USDOI and USDC 2008). Details of the survey were conducted at national and state levels. The 2006 Survey found that approximately 87.5 million U.S. residents older than 16 participated in fishing, hunting, or wildlife watching activities. It was estimated that 33.9 million persons either fished, hunted, or both and that 71.1 million persons took part in wildlife watching activities. Some persons participated in more than one of these activities and participants spent approximately 122.3 billion on wildlife related recreation in 2006. Anglers spent on average $1,400 per person with an average trip expenditure of $35 per day. Hunters spent on average $1,830 per person with an average per trip expenditure of $30 per day. Wildlife watching participants spent on average $642 per person with an average per trip expenditure per day of $37. The 2006 survey indicated that the majority of hunters (58 percent) participated in hunting activities on only private lands. Approximately 15 percent of hunters hunted on only public lands and 24 percent hunted on a combination of public and private lands.

The majority of hunters in the U.S. hunted big game species 85 percent. Small game, including upland game birds, were hunted by 38 percent of hunters, followed in popularity by migratory birds (18 percent) and other animals (9 percent). Data indicates that a subset of hunters hunted more than one class of game during the year.

3.6.2 Existing Conditions

The USDA NRCS has identified Land Resource Regions which are described in Section 3.2.2.1. Each region may be contained within one state, or the region may be comprised of parts of several states. The 2006 Survey was conducted at the state level; and the data cannot be broken apart and then re-combined to match the Land Resource Regions. To identify the existing conditions and analyze the impacts of the proposed action and alternatives, a representative state has been chosen in each region. Major types of wildlife are identified for each land resource region in section 3.2.2.1.

Table 3.6-1 shows the total number of participants in wildlife associated activities and the number of participants involved in fishing, hunting, or wildlife watching activities. These are shown for the nation as a whole, and for the representative state of each of the Land Resource Regions.

Table 3.6-1. Number of Persons Participating in Wildlife Related Activities

NRCS Region - Representative State	Persons that participated in fishing, hunting, or wildlife watching activities (000s)	Number persons that fished (000s)	Number persons that hunted (000s)	Number persons took part in wildlife watching activities (000s)
United States	87,465	29,952	12,510	71,132
A—Northwestern Forest, Forage, and Specialty Crop Region - OR	1,837	576	237	1,484
B—Northwestern Wheat and Range Region - ID	1,005	350	187	754
C—California Subtropical Fruit, Truck, and Specialty Crop Region - CA	7,385	1,730	281	6,270
D—Western Range and Irrigated Region - AZ	1,546	422	159	1,277
E—Rocky Mountain Range and Forest Region - MT	950	291	197	755
F—Northern Great Plains Spring Wheat Region - ND	279	106	128	148
G—Western Great Plains Range and Irrigated Region - NM	947	248	99	787
H—Central Great Plains Winter Wheat and Range Region - KS	1,107	404	271	816
I—Southwest Plateaus and Plains Range and Cotton Region - TX	6,029	142	63	686
J—Southwestern Prairies Cotton and Forage Region - TX	6,029	2,527	1,101	4,225
K—Northern Lake States Forest and Forage Region - WI	2,913	1,394	697	2,039
L—Lake States Fruit, Truck Crop, and Dairy Region - MI	4,217	1,394	753	3,227

Table 3.6-1. Number of Persons Participating in Wildlife Related Activities (cont'd)

NRCS Region - Representative State	Persons that participated in fishing, hunting, or wildlife watching activities (000s)	Number persons that fished (000s)	Number persons that hunted (000s)	Number persons took part in wildlife watching activities (000s)
M—Central Feed Grains and Livestock Region - IA	1,455	438	251	1,205
N—East and Central Farming and Forest Region - KY	1,906	721	291	1,475
O—Mississippi Delta Cotton and Feed Grains Region - AR	1,419	655	354	1,011
P—South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region - GA	2,773	1,107	481	1,987
R—Northeastern Forage and Forest Region - NY	4,595	1,153	566	3,852
S—Northern Atlantic Slope Diversified Farming Region - PA	4,663	994	1,044	3,947
T—Atlantic and Gulf Coast Lowland Forest and Crop Region - LA	1,221	702	270	738
U—Florida Subtropical Fruit, Truck Crop, and Range Region - FL	5,886	2,767	236	4,240
V—Hawaii Region - HI	366	157	18	262
W1—Southern Alaska - AK	691	293	71	496

Source: USDOI and USDC 2008

Table 3.6-2 shows information on the total amount spent on fishing-related expenditures and the amount spent in total and per day when away from home by fishermen. The number of days spent fishing are also shown. These are shown for the nation as a whole, and for the representative state of each of the Land Resource Regions.

Table 3.6-2. Fishing Related Expenditures

NRCS Region - Representative State	Amount spent on fishing activities ($000s)	Average amount spent by Anglers per person per year (dollars)	Trip related expenditures for fishing ($000s)	Days of fishing in state where activity took place (000s)	Average trip expenditure of per angler per day (dollars)
United States	42,011,124	1,403	17,878,559	516,781	35
A—Northwestern Forest, Forage, and Specialty Crop Region - OR	496,941	863	258,474	8,384	31
B—Northwestern Wheat and Range Region - ID	282,972	808	173,993	4,301	40
C—California Subtropical Fruit, Truck, and Specialty Crop Region - CA	2,420,503	1,399	1,203,244	19,394	62
D—Western Range and Irrigated Region - AZ	802,405	1,901	245,741	4,156	59
E—Rocky Mountain Range and Forest Region - MT	226,349	778	149,800	2,927	51
F—Northern Great Plains Spring Wheat Region - ND	93,729	884	39,076	953	41
G—Western Great Plains Range and Irrigated Region - NM	301,101	1,214	128,413	2,596	49
H—Central Great Plains Winter Wheat and Range Region - KS	242,444	600	127,996	5,314	24
I—Southwest Plateaus and Plains Range and Cotton Region - TX	144,634	1,019	61,390	1,526	40

Table 3.6-2. Fishing Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on fishing activities ($000s)	Average amount spent by Anglers per person per year (dollars)	Trip related expenditures for fishing ($000s)	Days of fishing in state where activity took place (000s)	Average trip expenditure of per angler per day (dollars)
J—Southwestern Prairies Cotton and Forage Region - TX	3,237,212	1,281	1,563,994	41,141	38
K—Northern Lake States Forest and Forage Region - WI	1,647,035	1,182	747,312	20,823	36
L—Lake States Fruit, Truck Crop, and Dairy Region - MI	1,671,114	1,199	584,030	24,822	24
M—Central Feed Grains and Livestock Region - IA	322,648	737	140,617	6,215	23
N—East and Central Farming and Forest Region - KY	855,417	1,186	237,430	9,231	26
O—Mississippi Delta Cotton and Feed Grains Region - AR	420,571	642	272,160	10,812	25
P—South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region - GA	1,020,411	922	370,743	17,375	21
R—Northeastern Forage and Forest Region - NY	925,701	803	584,644	17,060	34
S—Northern Atlantic Slope Diversified Farming Region - PA	1,291,211	1,299	298,610	17,967	17

Table 3.6-2. Fishing Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on fishing activities ($000s)	Average amount spent by Anglers per person per year (dollars)	Trip related expenditures for fishing ($000s)	Days of fishing in state where activity took place (000s)	Average trip expenditure of per angler per day (dollars)
T—Atlantic and Gulf Coast Lowland Forest and Crop Region - LA	1,006,136	1,433	337,363	11,204	30
U—Florida Subtropical Fruit, Truck Crop, and Range Region - FL	4,308,583	1,557	1,973,985	46,311	43
V—Hawaii Region - HI	110,516	704	72,728	1,471	49
W1—Southern Alaska - AK	516,749	1,764	362,019	2,687	135

Source: USDOI and USDC 2008

Table 3.6-3 shows information on the total amount spent on hunting-related expenditures and the amount spent in total and per day when away from home by hunters. The number of days spent hunting are also shown. These are shown for the nation as a whole, and for the representative state of each of the Land Resource Regions.

Table 3.6-3. Hunting Related Expenditures

NRCS Region - Representative State	Amount spent on hunting activities ($000s)	Average amount spent by Hunters per person per year (dollars)	Trip related expenditures for hunting ($000s)	Days of hunting in state where activity took place	Average trip expenditure of per hunter per day (dollars)
United States	22,893,156	1,830	6,678,614	219,925	30
A—Northwestern Forest, Forage, and Specialty Crop Region - OR	373,613	1,576	116,690	2,729	43
B—Northwestern Wheat and Range Region - ID	259,718	1,389	100,218	2,117	47
C—California Subtropical Fruit, Truck, and Specialty Crop Region - CA	230,873	822	88,210	3,376	26
D—Western Range and Irrigated Region – AZ	322,739	2,030	92,363	1,509	61
E—Rocky Mountain Range and Forest Region - MT	310,540	1,576	132,808	2,142	62
F—Northern Great Plains Spring Wheat Region - ND	129,114	1,009	72,445	1,344	54
G—Western Great Plains Range and Irrigated Region - NM	164,308	1,660	93,052	852	109
H—Central Great Plains Winter Wheat and Range Region - KS	248,674	918	121,162	3,017	40
I—Southwest Plateaus and Plains Range and Cotton Region - TX	129,080	2,049	39,574	615	64

Table 3.6-3 Hunting Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on hunting activities ($000s)	Average amount spent by Hunters per person per year (dollars)	Trip related expenditures for hunting ($000s)	Days of hunting in state where activity took place	Average trip expenditure of per hunter per day (dollars)
J—Southwestern Prairies Cotton and Forage Region - TX	2,222,298	2,018	873,928	14,050	62
K—Northern Lake States Forest and Forage Region - WI	1,312,128	1,883	275,268	10,059	27
L—Lake States Fruit, Truck Crop, and Dairy Region - MI	915,884	1,216	262,326	11,905	22
M—Central Feed Grains and Livestock Region - IA	288,324	1,149	110,756	3,849	29
N—East and Central Farming and Forest Region - KY	423,439	1,455	83,591	5,429	15
O—Mississippi Delta Cotton and Feed Grains Region - AR	813,239	2,297	788,575	7,882	100
P—South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region - GA	677,762	1,409	237,162	8,228	29
R—Northeastern Forage and Forest Region - NY	715,707	1,265	201,631	10,289	20
S—Northern Atlantic Slope Diversified Farming Region - PA	1,609,045	1,541	274,158	16,863	16

Table 3.6-3 Hunting Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on hunting activities ($000s)	Average amount spent by Hunters per person per year (dollars)	Trip related expenditures for hunting ($000s)	Days of hunting in state where activity took place	Average trip expenditure of per hunter per day (dollars)
T—Atlantic and Gulf Coast Lowland Forest and Crop Region - LA	525,505	1,946	205,355	5,979	34
U—Florida Subtropical Fruit, Truck Crop, and Range Region - FL	377,394	1,599	155,116	3,769	41
V—Hawaii Region - HI	21,098	1,172	10,736	420	26
W1—Southern Alaska - AK	125,112	1,762	48,905	854	57

Source: USDOI and USDC 2008

Table 3.6-4 shows information on the total amount spent on wildlife watching-related expenditures and the amount spent in total and per day when away from home by participants. The number of days spent watching wildlife away from home are also shown. These are shown for the nation as a whole, and for the representative state of each of the Land Resource Regions.

Sullivan *et al*. (2004), in *The Conservation Reserve Program: Economic Implications for Rural America,* indicated that conservation practices under CRP could increase the value of some wildlife related activities under the assumption that improved habitat under CRP practices would provide a more favorable environment for game and non-game species, increasing the recreational availability to those active in wildlife related activities. Specifically, they examined the estimated nonmarket benefits from wildlife viewing and pheasant hunting. They examined 10 farm production regions, showing a benefit per acre ranging from $1 in the Mountain and Pacific regions to $52 in the Lake States and Corn Belt. Of the benefits in their study, approximately 88 percent were attributed to increased wildlife viewing. The results from the study are assumed by the authors to underestimate the benefits because for hunting, only a single species was examined, and it was examined in only 13 states, those of the Corn Belt, Lake States, and Northern Plains regions, plus Montana. The benefits per acre for each region are shown in Table 3.6-5.

Table 3.6-4. Wildlife Watching Related Expenditures

NRCS Region - Representative State	Amount spent on wildlife watching activities ($000s)	Average amount spent by wildlife watchers per person per year (dollars)	Trip related expenditures for wildlife watching ($000s)	Days of wildlife watching away from home in state where activity took place (000s)	Average trip expenditure per wildlife watcher per day (dollars)
United States	45,654,960	642	12,875,152	352,070	37
A—Northwestern Forest, Forage, and Specialty Crop Region - OR	776,414	523	262,425	8,162	32
B—Northwestern Wheat and Range Region - ID	265,383	352	193,468	5,165	37
C—California Subtropical Fruit, Truck, and Specialty Crop Region - CA	4,179,583	667	1,997,551	45,010	44
D—Western Range and Irrigated Region – AZ	838,307	656	376,256	5,281	71
E—Rocky Mountain Range and Forest Region - MT	376,451	499	302,625	3,081	98
F—Northern Great Plains Spring Wheat Region – ND	22,913	155	4,952	*264	19
G—Western Great Plains Range and Irrigated Region - NM	297,174	378	208,278	5,429	38
H—Central Great Plains Winter Wheat and Range Region - KS	156,185	191	52,778	3,244	16
I—Southwest Plateaus and Plains Range and Cotton Region - TX	362,229	528	158,935	2,298	69

Table 3.6-4. Wildlife Watching Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on wildlife watching activities ($000s)	Average amount spent by wildlife watchers per person per year (dollars)	Trip related expenditures for wildlife watching ($000s)	Days of wildlife watching away from home in state where activity took place (000s)	Average trip expenditure per wildlife watcher per day (dollars)
J—Southwestern Prairies Cotton and Forage Region - TX	2,939,018	696	424,197	13,120	32
K—Northern Lake States Forest and Forage Region - WI	744,689	365	260,166	5,547	47
L—Lake States Fruit, Truck Crop, and Dairy Region - MI	1,622,521	503	339,188	10,043	34
M—Central Feed Grains and Livestock Region - IA	318,006	264	54,411	4,013	14
N—East and Central Farming and Forest Region - KY	542,059	367	116,113	4,155	28
O—Mississippi Delta Cotton and Feed Grains Region - AR	607,073	600	114,879	4,148	28
P—South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region - GA	1,615,316	813	146,722	4,097	36
R—Northeastern Forage and Forest Region - NY	1,567,629	407	695,724	13,521	51
S—Northern Atlantic Slope Diversified Farming Region - PA	1,442,681	366	324,990	11,972	27

Table 3.6-4. Wildlife Watching Related Expenditures (cont'd)

NRCS Region - Representative State	Amount spent on wildlife watching activities ($000s)	Average amount spent by wildlife watchers per person per year (dollars)	Trip related expenditures for wildlife watching ($000s)	Days of wildlife watching away from home in state where activity took place (000s)	Average trip expenditure per wildlife watcher per day (dollars)
T—Atlantic and Gulf Coast Lowland Forest and Crop Region – LA	312,430	423	61,822	*3,199	19
U—Florida Subtropical Fruit, Truck Crop, and Range Region - FL	3,081,496	727	887,942	16,551	54
V—Hawaii Region - HI	210,414	803	185,100	1,109	167
W1—Southern Alaska - AK	581,051	1,171	511,602	4,126	124

Source: USDOI and USDC 2008

Table 3.6-5. Estimated CRP Benefits of Selected Wildlife Related Practices

Farm Production Region	Annual Wildlife Benefit per Acre
Northeast	$45
Lake States	$52
Corn Belt	$52
Northern Plains	$7
Appalachia	$41
Southeast	$40
Delta	$40
Southern Plains	$27
Mountain	$1
Pacific	$1
U.S.	$22

Source: Sullivan *et al.* 2004

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 SOCIOECONOMICS AND LAND USE

4.1.1 Significance Thresholds

Economics for this analysis will incorporate the impacts that are likely to occur if provisions of BCAP were implemented to both the agricultural sector and rural communities. Variables of significance will vary depending on the Alternative and will include:

- Net farm income
- Farm prices (only in Alternative 1)
- Government Payment
- Land use shifts
- Direct, indirect, and induced economic impacts as a result of changes in government payments, net farm income, commodity prices, and land uses

Economic impacts will occur as a result shifts in land uses, as a result of BCAP implementation, and as the result of increasing the intensity of production.

4.1.2 Methodology

The economy wide impacts will be estimated using IMPLAN, while the economic impacts on the agricultural sector would be estimated using Policy Analysis System (POLYSYS). Economics of a region or sector are greatly influenced by profits, investments, prices, costs of production, and transactions between industries within the region. The current economic environment of agriculture can be displayed through net farm income at the national level. However, various agricultural sectors are at different levels of economic viability. Economic viability also varies by location. Agricultural producers are price takers both in their product and with their inputs. Comparison of the economic environment as it exists or is expected to exist with and without the BCAP provisions will determine whether the affected environment is improved within the agricultural sector. Changes in regional development are also expected to occur and will be measured by changes in economic activity within the region/regions under analysis. Under Alternative 2, it is expected that there will be farm price impacts. These impacts may affect financial viability and, potentially, consumer costs of food throughout the country.

4.1.2.1 Model Details

The changes to the region's economy can be measured using IMPLAN, a model which employs a regional social accounting system and used to generate a set of balanced economic/social accounts and multipliers (MIG 2004). The social accounting system is an extension of input-output analysis. The model uses regional purchase coefficients (RPC's) generated by econometric equations that predict local purchases based on a region's characteristics. Descriptive output variables created by IMPLAN include total industry output (TIO), employment, and value-added for 500 plus industries within the regional economy being evaluated. There are three types of impacts – direct, indirect, and induced.

This study uses Type I and Type Social Accounting Matrix (SAM) multipliers. Type I multipliers are calculated by dividing direct plus indirect impacts by the direct impacts. Type SAM multipliers are calculated by adding direct, indirect, and induced impacts and then dividing by the direct impacts. The Type SAM multipliers take into account the expenditures resulting from increased incomes of households as well as inter-institutional transfers resulting from the economic activity. Therefore, Type SAM multipliers assume that, as final demand changes, incomes increase (decrease) along with inter-institutional transfers. Increased (decreased) expenditures by people and institutions lead to increased demands from local industries.

A variety of economic impacts will result with a land use shift towards the production of a new crop such as a dedicated energy crop. There are numerous annual impacts that occur to the agricultural sector as a result of projected changes in crop acreage, crop prices, and government payments by POLYSYS, transportation of the energy feedstock, and the actual production and harvesting of a dedicated energy crop. Knowledge of the available infrastructure and the methods (for example, truck, train, or barge) used to transport the commodities are needed before impacts to the economy as a result of energy transportation can be determined. While the operation of the bioenergy conversion facilities also has an annual impact on the economy, this is beyond the scope of this activity.

The POLYSYS model is a framework that was developed over the past three years in order to combine research on full carbon accounting (FCA) at Oak Ridge National Laboratory with the POLYSYS agricultural economics model developed at the University of Tennessee. This framework is capable of estimating changes in land management, crop production, farm income, and commodity prices, and of calculating the energy and carbon dynamics associated with these changes.

The POLYSYS model is a variant of an equilibrium displacement model that is capable of estimating annual changes in land use, environmental quality, prices, income, and government payments as a result of a policy scenario. The POLYSYS modeling framework was developed to simulate changes in economic policy, agricultural management, and natural resource conditions and to estimate the resulting impacts from these changes on the US agricultural sector (De La Torre Ugarte *et al.*, 1998, 2003, 2007; De La Torre Ugarte and Ray 2000; Ray *et al.* 1998). At its core, POLYSYS is a system of interdependent modules that simulate (a) crop supply for the continental US, (b) national crop demands and prices, (c) national livestock supply and demand, and (d) agricultural income. Variables that drive these modules include planted and harvested areas, production inputs, yields, exports, production costs, demand by use, farm prices, government program outlays, and net realized incomes. Among the issues analyzed with POLYSYS are the potential effects of farm bill changes, bioenergy supply, El Nino events, elimination of CRP, erosion benefits of alternative management plans, and free trade agreements.

4.1.2.2 Definition of Types of Impacts

Direct impacts measure the response of a given industry to a change in final demand for the industry. They include the backward linkages in the economy from the increase (decrease) in economic activities that occur from changes in inter-industry intermediate input demands within the region.

Indirect impacts represent the response by all industries in the economy to a change in final demand for a specific industry. As changes in economic activity occur, changes in final demand occur.

Induced impacts represent the response by all industries in the economy to increased expenditures of new household income and inter-institutional transfers generated from the direct and indirect impacts of the change in final demand for a specific industry.

Final demand is defined as employment compensation, proprietor income, returns to other property, and indirect business taxes

4.1.2.3 Model Variables

To estimate the likely location of BCAP potential project locations, first the regional availability of feedstock and different price levels will be estimated. This was done using the county version of POLYSYS, which included switchgrass as a dedicated energy crop at the national level. It also included corn and wheat residues.

Next, with the help of a Geographical Information System (GIS) system, and land use maps at high levels of resolution, areas were identified that have the potential for a higher density of feedstock concentration. This then allowed for the identification of broad areas where dedicated energy crops could be potentially located and their area of influence regarding the feedstock production.

For Alternative 1, all counties within a 50-mile radius of a proposed BCF based on feedstock availability were created in IMPLAN, generating proposed BCAP project areas for analysis within this document. Fifty miles is chosen as the average maximum radius for which feedstock can be economically provided to a BCF. The analysis incorporated projected land use and proprietor income changes, government payment changes, along with an increase in transportation and the development of a dedicated energy crop. The economic activity that results from these changes will be estimated for the region.

For Alternative 2, economic impacts resulting from national policy changes can be evaluated using state IMPLAN models. Numerous publications have taken results from a national model and used those results in IMPLAN to show what impacts would occur to a state or a region's economy. However, in this study, there is a need to take the impacts from an interregional multi-state model that is national in scope and project the potential impacts changes in policy on the nation's economy. The interface program, the POLYSYS/IMPLAN Integrator (PII 1), developed at The University of Tennessee, takes POLYSYS acreage, price, and changes in government programs and makes two major types of changes to IMPLAN databases. First, the program adds an energy crop sector to IMPLAN based on production and cost information supplied by the POLYSYS results for each of the 48 contiguous states. Next, agricultural impacts that occur as a result of projected changes in the agricultural sectors are placed in each state's IMPLAN model incorporating POLYSYS projected changes in crop production, prices, and income.

The integrator, PII 1, written in Visual Basic and taking advantage of IMPLAN's data structure, provides the user a means to solve IMPLAN at the state level and determine regional economic impacts as a result of changes in agricultural production practices, policies, prices, government payments, and/or technology adoption. The resulting reports generated from the analysis summarize, via graphs and maps, the economic impacts as measured by changes in total industry output, employment, and value added. In addition, tabular information is presented for use in the analysis. For the purposes of this report, three impacts are reported: (a) the impacts to the agricultural sector, (b) the impacts as a result of increased transportation requirements and (c) the impacts that occur as a result of interstate commerce. The impacts that occur from interstate commerce cannot be allocated to any particular state and, consequently, the maps do not incorporate these impacts. They occur as a result of input purchases across state lines, as well as the impacts that occur as a result of a flow of income from one state to another.

4.1.2.4 Assumptions and Data Limitations

The 2008 Farm Bill provides the guidelines for the feedstock eligible to participate in BCAP. In summary, crops known as Title I crops are not eligible to receive the benefits of BCAP for establishment and annual payments; this is the case of corn and soybeans, and even the use of sorghum and wheat for the production of biofuels. Dedicated energy crops like switchgrass, Miscanthus and other grasses and crops are eligible, as well SRWC planted for energy purposes. The use of crop and forest residues could also be eligible to participate in BCAP as part of the CHST component. Dedicated energy crops and SRWC are eligible for establishment and feedstock producers' payments, in addition of CHST payments. On the other hand residues (agricultural and forest) are eligible for CHST matching payments only.

The POLYSYS model currently incorporates switchgrass, crop and forest residues as BCAP eligible feedstock. However it is important to note that switchgrass can be seen as a generic dedicated energy crop, which would be representing the land use requirements, implicit in the use of other energy crops for which data is not readily available. The use of switchgrass as a model crop representing other energy crops, could underestimate the production potential of feedstock that has a yield that could be significantly larger than switchgrass, and consequently underestimate the potential of specific regions of the country as candidates locations for potential BCAP projects locations.

Although SRWC are not directly included because lack of updated cost and yield data, results from previous POLYSYS studies (De La Torre Ugarte *et al.* 2003) indicate that SRWC may have a comparative advantage in the Pacific Northwest and in the Northeast.

The economic analysis began with the identification of potential BCAP project areas. Due to the exponentially growing number of sites under Alternative 2, and the complexities it brings, no specific site selection analysis was done.

There were several criteria used to select the BCAP project areas:

1. The selection is driven by the availability of feedstock in the region;
2. To account for the larger number of projects we assume a plant size of 15 million gallons of ethanol production in a year. Ethanol facilities were chosen as the example BCF due to the amount of data available associated with these facilities. A plant size of 15 million gallons was determined to be a commercial-sized facility based on industry information

associated with facilities currently under construction and in the planning stages. The commercial-sized facility was modeled specifically for the conditions of Alternative 1;

3. The projects were selected based on minimizing the cost for the BCAP program. This included developing scenarios where the limited funding would create the highest overall return to the national economy.
4. Competition for the same feedstock for closely located projects was avoided.

Given the limited BCAP funding that would be available for establishment of dedicated energy crops for Alternative 1 – enough for about two commercial-scale projects- the POLYSYS model was modified to perform a national level analysis of potential feedstock, but without generating a feedback impact in agricultural prices. The analysis included prices for switchgrass ranging from $35 to $80 per dry ton. The US$60 per dry ton analysis provided a good regional coverage of feedstock potential supply, and consequently was selected to perform the GIS analysis to locate the potential BCAP projects.

The analysis examined two paths to select BCAP project locations. The first was to select the top five project locations based on the cost to the BCAP project. This would also identify locations in which the regional supply of feedstock is abundant and has a relatively lower price. The second was to select the potential BCAP top project in every state in which potential feedstock production was large enough to sustain a BCF, noting that even if a specific BCF is located in a particular state, its area of influence for gathering feedstock could go beyond the state borders.

The starting place for the economic analysis in each scenario is the identification of the potential BCAP project locations. Since the No Action Alternative represents the absence of the BCAP program, the site selection was only performed for Alternative 1.

Two selection paths were followed for Alternative 1. First, the top five sites based on the above-mentioned criteria specified were selected. Second, to represent regional diversity, a top site in every state was selected from the regions suitable for locating a potential BCAP project location assuming dedicated energy crops were the source of cellulosic feedstock. It is noted that these five top sites were selected based upon minimizing costs to the BCAP program, operating a plant of a specific size, and available feedstock appropriate for a plant of that size. This provides five representative sites for economic/socioeconomic analysis. However, site selections for any new BCFs will be based upon many other factors, including availability of other feedstock, proximity to transportation and customers, regional and local economic development plans, financing availability, environmental constraints, and public acceptability. Any potential sites will have to undergo appropriate NEPA review, this PEIS being one step in that process. As such, the selection for economic/socioeconomic analysis of these sites in no way pre-judges the ultimate selection of sites for new BCFs created as a result of the implementation of the BCAP program. Neither does the selection of these generic sites limit the analytical approach of other resource areas in this PEIS.

This process resulted first in the selection of the top five sites for potential BCAP project locations based on availability of feedstock to supply a potential BCF. For the top site in each state, regional competition for feedstock was not enforced, as one of the objectives was to emphasize multiple state projects. Moreover, it is important to have in mind that projects were selected independent of each other, and that feedstock demand would be at a very low national level. Therefore in this alternative, it was assumed that there were no price impacts associated with the implementation of the alternative.

For Alternative 2, the analysis was conducted at both a regional and national level. However, the objective of this alternative was to produce sufficient feedstock to meet the legislative requirements of EISA, both from corn (15 billion gallons) and from dedicated energy crops. The analysis focused on the impacts to net farm income; farm prices; government payments; land use shifts; and direct, indirect, and induced economic impacts as a result of changes in the aforementioned variables. The analysis assumed that farmers or land owners would receive $45/ton in payment through BCAP plus a match from the plant demanding the cellulosic feedstock.

4.1.3 Action Alternative 1

The selection process discussed above resulted in the selection of the top five sites presented in Figures 4.1-1 and 4.1-2, where the general locations and specific counties of influence are shown. The process also identified the top BCAP project site for each state as shown in Figure 4.1-3. In the selection of the top BCAP project site for each state (Figure 4.1-3), the regional competition for feedstock was not enforced, as one of the objectives was to emphasize multiple state projects.

4.1.3.1 Direct Impacts

Realized Net Farm Income at the national under Alternative 1 would be expected to remain unchanged from the baseline conditions due to the limited funding assumption under Alternative 1; therefore, there would not be expected national level effects. Net Returns at the farm level would be likely to improve for those producers selected as part of the project area for BCAP under this alternative. The production of a dedicated energy crop would be expected to create a higher valued opportunity for producers or those producers would not have selected to participate in BCAP. Depending on the overall acres in a county involved in the BCAP, the net returns for agriculture for that county or region could see significant gains under Alternative 1.

.

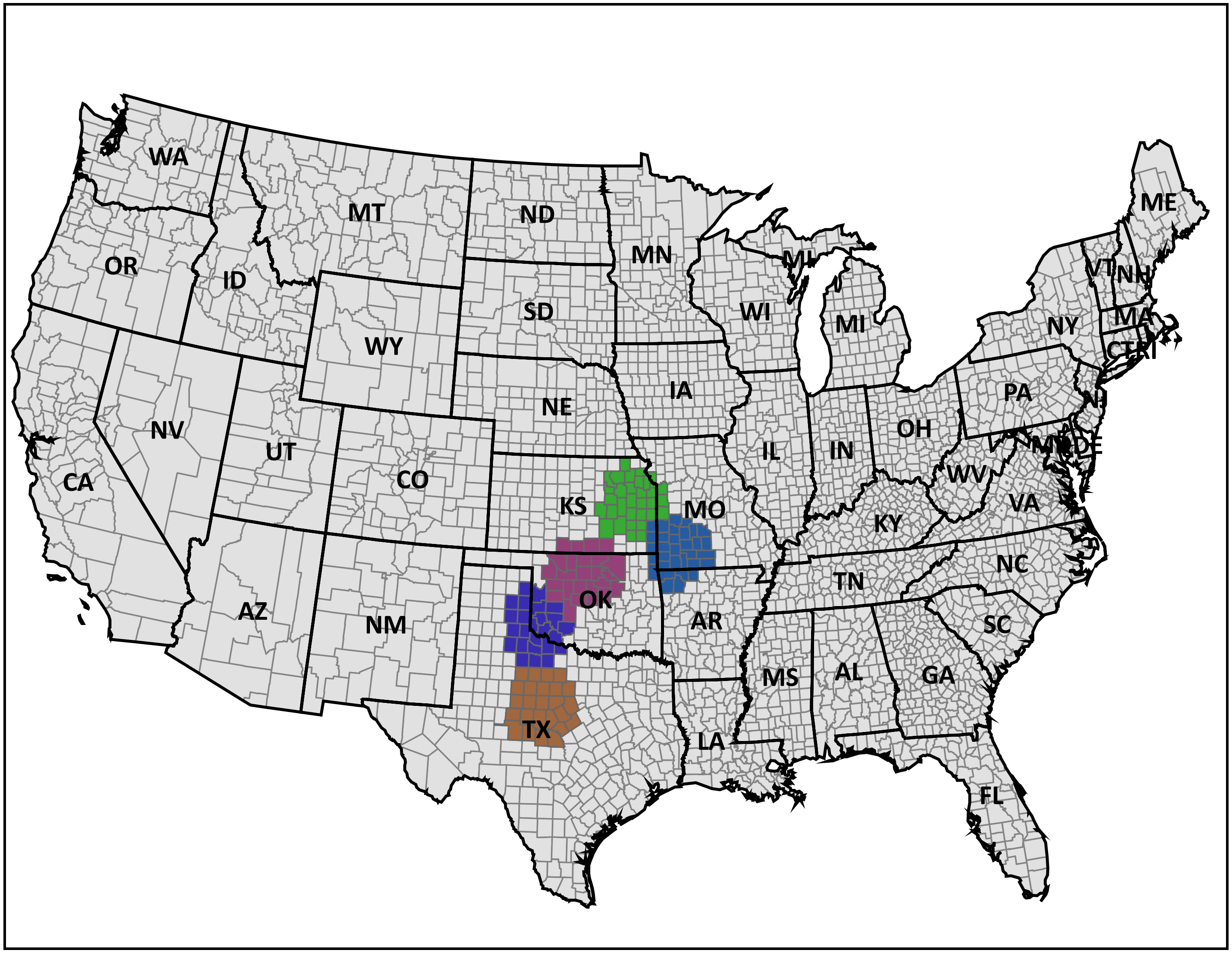


Figure 4.1-1. Location of the Top 5 BCAP project sites in the Nation

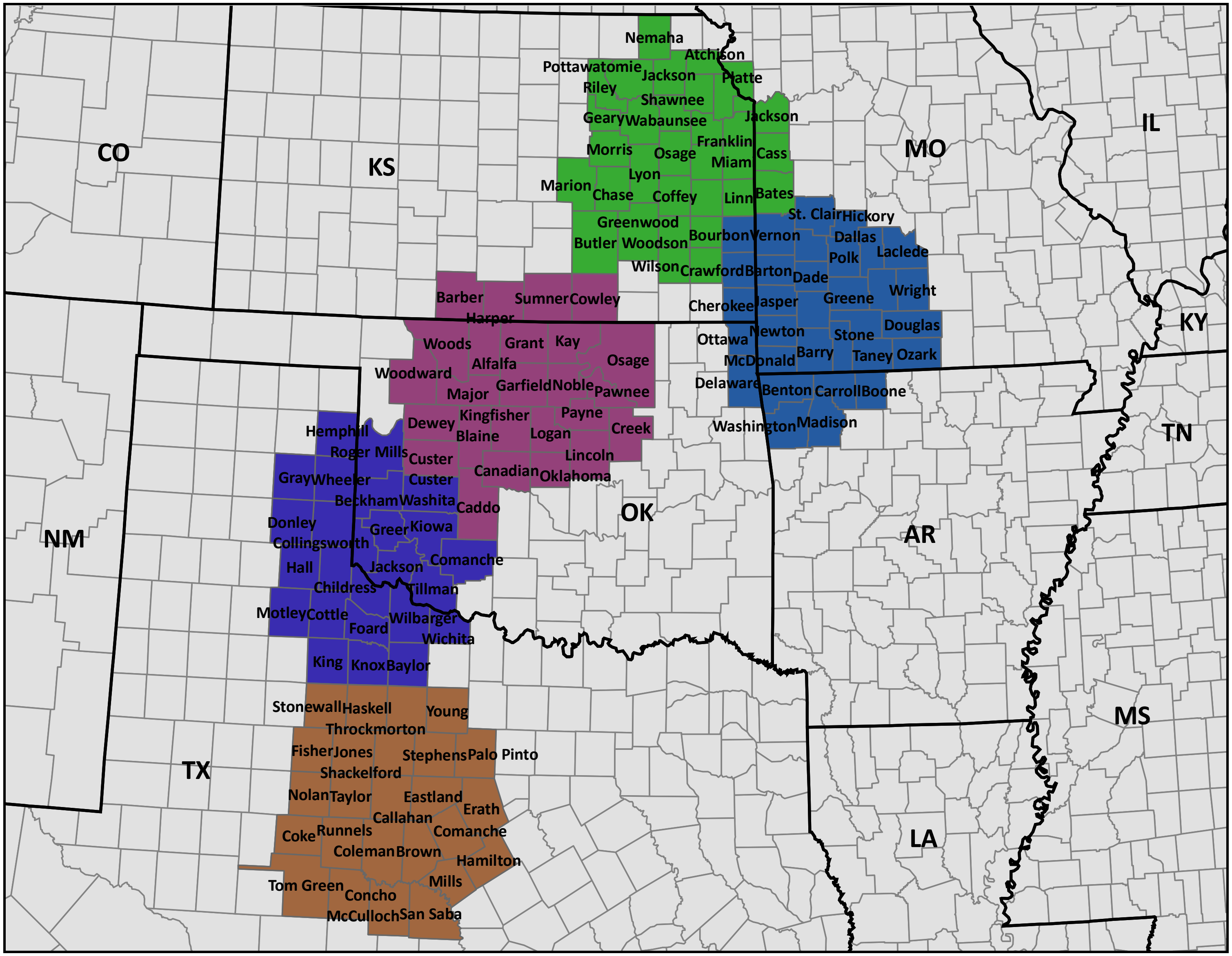


Figure 4.1-2. The Top 5 BCAP projects and the detailed area of influence

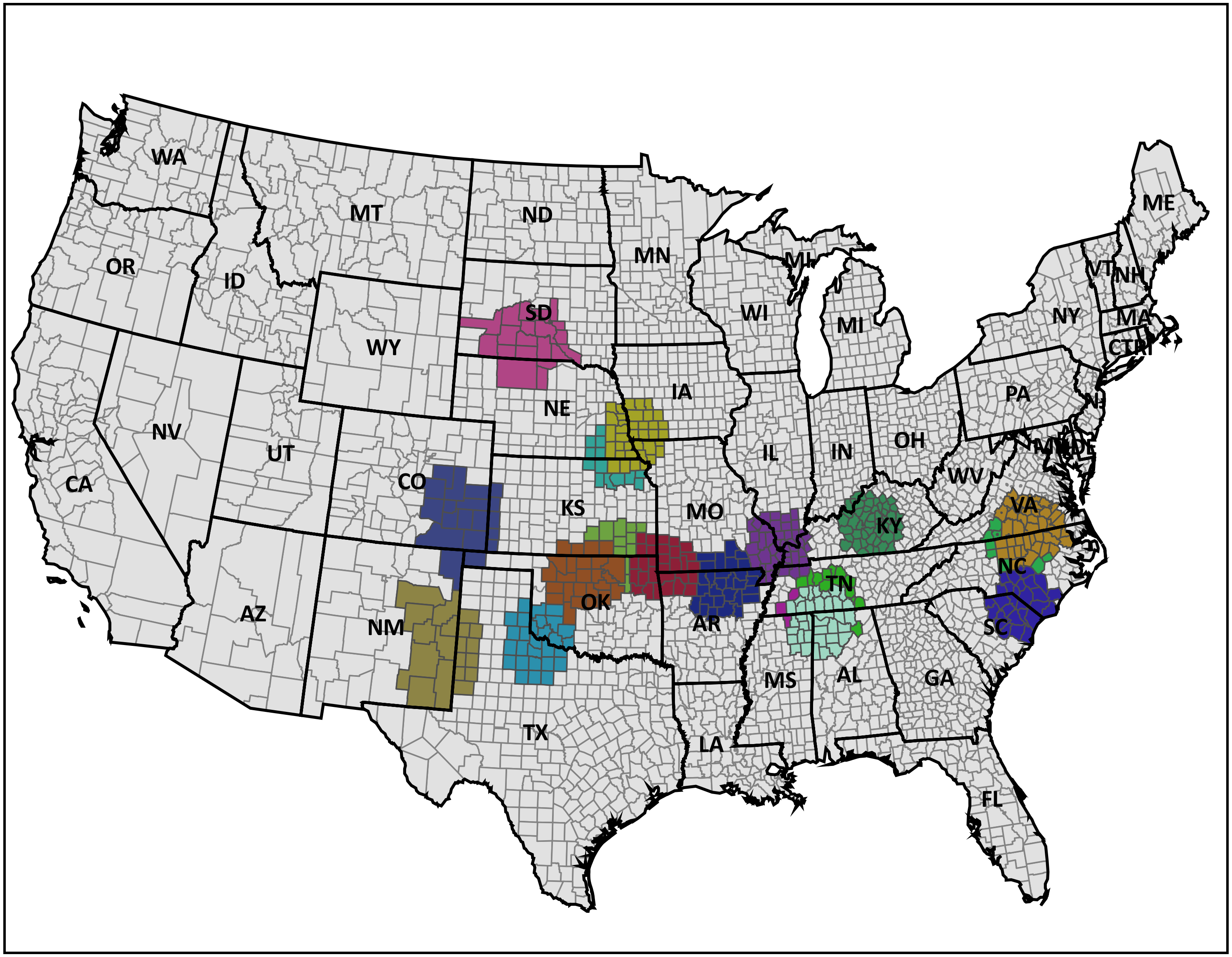


Figure 4.1-3. Top BCAP project site in States with enough Feedstock Production Potential

The information in Table 4.1-1 indicates the impact on total net returns in the agricultural sector generated by the potential BCAP projects under this alternative. Table 4.1-1 shows which projects are one of the top five sites in the nation based on the model configuration, and which sites have been identified as the top in the state location. The county and state for each of the potential locations are provided.

The information in Table 4.1-1 is presented in three different areas, each representing each of the key stages of the BCAP project. The first column in each year is labeled “Total Crop Net Returns,” and it represents the loss of net revenues resulting from utilizing land previously planted in other crops and now dedicated to a BCAP project. The next columns show results by year. In “YEAR 1” the project receives the initial establishment payment and is subject to payments for 75 percent of the establishment cost and the farmer is eligible for a payment reflecting the opportunity cost of the land. If producers are under contract with the BCF and they could have received a payment from the BCF, this potential payment is not included in the calculations. The last column in each YEAR summarizes the overall impact in Total Net Returns to the Agricultural Sector. In YEAR 2 there are not any establishment payments, and in YEAR 3 there are no BCAP payments for the producers of the feedstock.

Table 4.1-1 shows that in most potential project locations the impact on Total Net Returns are positive, and only in one they are marginally negative. The loss of Total Net Returns in Fremont, Iowa, is an indication that while it was the top location in a state, it would not have been considered one of the top locations for a BCAP project.

The results in YEAR 3 are of special importance, because they are an indication of the long term viability of the BCAP project in terms of supplying a BCF with the required feedstock. It is also important to remember that each BCAP project is of the same size, i.e., one that is large enough to supply feedstock to a conversion facility capable of producing one million gallons of ethanol a year.

Farm prices are mostly affected by changes in the supply and demand conditions of the market, and of markets of related goods. Given the limited size of BCAP under Alternative 1, the impacts would not be felt by national markets and farm prices would not be affected. However, as BCAP supports the existence of a BCF, it is possible that the creation of this market (closely linked to the farms that produce feedstock) could create an environment in which the farm prices received for the feedstock would increase locally, as the marketing and transactions costs are reduced.

To trigger any of the government payments linked to price and/or production, BCAP would have to affect the overall level of prices and or production for the major crops eligible for those payments. However, payments are only available if prices fall below some level of the loan rate, or if they are below the target prices, or the calculated state revenue. USDA’s long term projections, the baseline for this analysis, describe a situation, in which farm prices and state revenue are likely to be above the trigger levels, consequently the level of these government payments would be likely to be close to zero. We do not expect that either of the two BCAP scenarios would impact this type of payments.

Table 4.1-1. Impact on Net Returns (constant U.S. dollars) by BCAP location area and source

			YEAR 1					YEAR 2			YEAR 3		
Top 5	Top State	Location	Total Crop Net Returns	BCAP Establishment Payments	BCAP Farm Payments	Total BCAP Payments	Total Returns	Total Crop Net Returns	BCAP Farm Payments	Total Returns	Total Crop Net Returns	Plant Payments	Total Returns
	X	Mellette, SC	(1,641,690)	4,095,473	4,822,496	8,917,969	7,276,280	(276,532)	4,822,496	4,545,964	(276,532)	5,588,766	5,312,234
X		Osage, KS	(2,751,117)	2,224,754	4,048,212	6,272,966	3,521,849	(2,009,533)	4,048,212	2,038,679	(2,009,533)	4,861,579	2,852,047
	X	Fremont, IA	(5,939,410)	2,431,183	6,266,385	8,697,568	2,758,158	(5,129,015)	6,266,385	1,137,370	(5,129,015)	4,468,732	(660,283)
	X	Pawnee, NE	(3,758,923)	2,341,154	5,768,385	8,109,539	4,350,616	(2,978,538)	5,768,385	2,789,847	(2,978,538)	4,881,491	1,902,952
	X	Roosevelt, NM	(3,569,303)	4,194,605	3,857,666	8,052,270	4,482,967	(2,171,102)	3,857,666	1,686,564	(2,171,102)	3,914,484	1,743,382
	X	Bent, CO	(3,798,755)	3,869,690	3,773,441	7,643,131	3,844,376	(2,508,858)	3,773,441	1,264,583	(2,508,858)	4,413,223	1,904,365
	X	Chautauqua, KS	(2,712,654)	2,456,119	3,156,309	5,612,428	2,899,774	(1,893,948)	3,156,309	1,262,361	(1,893,948)	4,523,190	2,629,242
X	X	Garfield, OK	(2,422,113)	3,073,736	2,548,157	5,621,892	3,199,779	(1,397,534)	2,548,157	1,150,622	(1,397,534)	4,239,042	2,841,508
X		Callahan, TX	(2,709,821)	4,559,252	1,961,225	6,520,477	3,810,656	(1,190,070)	1,961,225	771,155	(1,190,070)	4,048,396	2,858,326
	X	Hardeman, TX	(3,246,201)	3,904,936	2,143,638	6,048,574	2,802,373	(1,944,555)	2,143,638	199,083	(1,944,555)	4,051,794	2,107,239
X		Harmon, OK	(2,571,417)	3,807,243	2,220,001	6,027,244	3,455,827	(1,302,336)	2,220,001	917,665	(1,302,336)	4,141,552	2,839,215
	X	Tishomingo, MS	(2,924,858)	3,831,209	4,821,566	8,652,774	5,727,917	(1,647,788)	4,821,566	3,173,778	(1,647,788)	3,978,784	2,330,996
	X	Izard, AR	(3,388,097)	3,573,778	5,109,304	8,683,082	5,294,985	(2,196,838)	5,109,304	2,912,466	(2,196,838)	3,955,101	1,758,264
	X	McDonald, MO	(2,931,264)	2,392,151	3,416,636	5,808,787	2,877,523	(2,133,881)	3,416,636	1,282,756	(2,133,881)	4,181,668	2,047,788
X		Lawrence, MO	(3,032,872)	2,333,143	3,669,147	6,002,290	2,969,419	(2,255,157)	3,669,147	1,413,990	(2,255,157)	3,935,684	1,680,527
	X	Alexander, IL	(2,141,995)	3,736,676	5,323,162	9,059,838	6,917,843	(896,436)	5,323,162	4,426,725	(896,436)	4,141,500	3,245,064
	X	Marion, KY	(3,635,624)	3,918,671	5,174,460	9,093,131	5,457,507	(2,329,400)	5,174,460	2,845,060	(2,329,400)	3,975,677	1,646,277
	X	Lawrence, TN	(2,820,556)	3,878,054	4,929,530	8,807,584	5,987,028	(1,527,871)	4,929,530	3,401,659	(1,527,871)	3,815,371	2,287,500
	X	Colbert, AL	(1,280,741)	3,828,920	4,770,575	8,599,495	7,318,754	(4,434)	4,770,575	4,766,141	(4,434)	3,936,001	3,931,567
	X	Dillon, SC	(3,933,044)	4,229,016	3,863,558	8,092,574	4,159,530	(2,523,372)	3,863,558	1,340,186	(2,523,372)	4,286,742	1,763,370
	X	Mecklenburg, VA	(4,186,338)	3,989,092	3,778,366	7,767,457	3,581,120	(2,856,640)	3,778,366	921,725	(2,856,640)	4,330,902	1,474,262
	X	Person, NC	(4,169,780)	4,013,331	3,550,328	7,563,660	3,393,879	(2,832,003)	3,550,328	718,325	(2,832,003)	4,411,100	1,579,097

The payments that could be affected are (a) the ones received from BCAP itself and (b) any payments that would result from driving acres enrolled in the CRP to exit the program before the contract expires.

As the BCAP projects are implemented the production of feedstock associated with the projects will induce a first level or direct shift as it displaces crops previously produced in those acres. If the displacements of acreage are large enough, market prices would be impacted and those changes in prices would induce a second level of land shifts in response to those new prices. Alternative 1 would introduce changes in land use at the very local level, i.e., at the county or multicounty region. Tables 4.1-2 and 4.1-3 indicate the land use in the areas of influence of each of the potential locations for BCAP projects. Table 4.1-4 summarizes the changes caused by implementing Alternative 1 from the No Action Alternative, and consequently indicates which crops are giving up area for the planting of switchgrass in each of the potential locations.

Table 4.1-2. Cropland Use (in acres) in the Selected Sites for BCAP projects under the No Action Alternative

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay	Cropland
	X	Mellette, SC	2,431,990	677,288	404,432	27,743	4,568,272	939,034	0	0	0	6,104,413	15,153,173
X		Osage, KS	3,760,735	1,220,849	0	0	2,968,153	5,991,283	0	0	0	5,474,073	19,415,091
	X	Fremont, IA	15,587,050	490,152	138,767	0	979,784	13,877,628	0	0	0	2,593,218	33,666,599
	X	Pawnee, NE	11,865,584	1,638,616	48,891	0	2,740,718	10,786,114	0	0	0	2,647,479	29,727,402
	X	Roosevelt, NM	1,122,062	1,904,271	67,447	0	5,399,690	75,552	4,349,833	0	0	1,277,229	14,196,083
	X	Bent, CO	1,864,526	1,607,163	0	2,889	7,166,664	13,437	0	0	0	1,133,963	11,788,642
	X	Chautauqua, KS	1,592,470	1,586,575	16,085	0	6,082,006	2,990,076	84,124	0	0	3,955,298	16,306,634
X	X	Garfield, OK	295,781	1,071,032	81,263	0	17,036,608	727,791	123,557	0	0	3,892,906	23,228,938
X		Callahan, TX	78,166	532,060	534,769	0	4,837,770	0	1,231,839	0	0	2,073,771	9,288,375
	X	Hardeman, TX	92,668	313,031	190,870	0	11,357,421	12,647	1,719,705	0	0	1,926,951	15,613,293
X		Harmon, OK	118,178	331,888	171,627	0	10,575,046	19,234	1,424,993	0	0	1,873,897	14,514,864
	X	Tishomingo, MS	824,125	49,278	0	0	231,679	1,597,926	811,356	0	0	1,883,976	5,398,339
	X	Izard, AR	479,407	115,647	0	0	607,765	3,972,979	575,449	2,574,182	0	2,888,300	11,213,728
	X	McDonald, MO	1,030,807	299,505	14,654	0	1,516,726	2,080,024	0	0	0	5,829,396	10,771,111
X		Lawrence, MO	1,063,085	210,995	0	0	1,215,803	1,957,836	0	0	0	6,785,648	11,233,366
	X	Alexander, IL	6,049,409	337,883	0	0	2,416,232	9,003,293	1,135,954	718,756	0	2,005,136	21,666,663
	X	Marion, KY	1,390,920	2,165	0	0	394,996	1,164,802	0	0	0	5,699,556	8,652,439
	X	Lawrence, TN	1,085,917	18,530	0	0	370,917	1,338,861	738,301	0	0	3,360,511	6,913,038
	X	Colbert, AL	896,415	18,134	0	0	272,015	1,550,236	773,860	0	0	2,572,521	6,083,181
	X	Dillon, SC	1,488,200	5,808	85,878	4,947	1,007,183	2,900,691	777,388	0	0	564,990	6,835,085
	X	Mecklenburg, VA	596,916	5,468	45,225	19,908	601,643	1,390,701	769,121	0	0	1,965,966	5,394,948
	X	Person, NC	464,235	4,963	67,093	24,902	600,011	1,318,574	531,512	0	0	2,047,205	5,058,495

Table 4.1-3. Cropland Use (acres) in the Selected Sites for BCAP projects under Alternative 1

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay	Cropland
	X	Mellette, SC	2,430,282	676,725	404,432	27,739	4,568,272	939,034	0	0	44,002	6,097,096	15,187,582
X		Osage, KS	3,754,775	1,217,675	0	0	2,962,105	5,991,283	0	0	23,366	5,471,024	19,420,228
	X	Fremont, IA	15,576,806	489,360	138,767	0	979,784	13,867,886	0	0	25,488	2,593,094	33,671,185
	X	Pawnee, NE	11,857,636	1,635,320	48,891	0	2,734,545	10,786,114	0	0	25,132	2,645,184	29,732,822
	X	Roosevelt, NM	1,121,799	1,903,051	67,447	0	5,378,726	75,541	4,345,190	0	33,529	1,277,035	14,202,319
	X	Bent, CO	1,862,893	1,601,509	0	2,889	7,137,179	13,437	0	0	38,331	1,132,404	11,788,642
	X	Chautauqua, KS	1,590,907	1,584,703	16,085	0	6,065,960	2,990,076	84,124	0	23,350	3,951,975	16,307,181
X	X	Garfield, OK	295,781	1,071,032	81,263	0	17,020,655	727,791	123,557	0	24,901	3,892,906	23,237,886
X		Callahan, TX	78,166	528,141	534,769	0	4,828,064	0	1,224,573	0	33,915	2,071,638	9,299,266
	X	Hardeman, TX	92,668	312,313	190,870	0	11,331,247	12,647	1,718,158	0	29,048	1,926,112	15,613,064
X		Harmon, OK	118,178	331,404	171,608	0	10,558,650	19,234	1,423,800	0	28,321	1,873,052	14,524,248
	X	Tishomingo, MS	819,811	48,422	0	0	230,358	1,597,926	808,072	0	23,290	1,868,573	5,396,451
	X	Izard, AR	478,869	112,937	0	0	599,522	3,972,979	569,674	2,573,282	24,302	2,882,163	11,213,727
	X	McDonald, MO	1,030,807	296,309	14,654	0	1,516,726	2,068,024	0	0	22,558	5,822,371	10,771,449
X		Lawrence, MO	1,063,085	208,294	0	0	1,215,803	1,945,936	0	0	22,498	6,777,689	11,233,304
	X	Alexander, IL	6,046,302	337,365	0	0	2,416,232	9,003,293	1,135,467	717,959	23,413	2,003,621	21,683,652
	X	Marion, KY	1,390,920	2,165	0	0	394,996	1,164,802	0	0	22,927	5,676,629	8,652,439
	X	Lawrence, TN	1,082,762	18,475	0	0	369,888	1,338,861	733,630	0	22,856	3,344,929	6,911,401
	X	Colbert, AL	896,415	18,088	0	0	272,015	1,550,236	773,860	0	23,190	2,567,014	6,100,818
	X	Dillon, SC	1,488,200	5,781	85,878	4,945	1,007,183	2,887,305	773,625	0	24,727	564,990	6,842,634
	X	Mecklenburg, VA	592,145	5,400	45,225	19,762	601,643	1,379,556	769,121	0	23,312	1,958,784	5,394,948
	X	Person, NC	460,188	4,963	67,093	24,818	600,011	1,308,934	527,596	0	23,453	2,041,439	5,058,495

Table 4.1-4. Change under Alternative 1 from the No Action Alternative in Cropland Use in the Selected Sites for BCAP projects

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay
	X	Mellette, SC	(1,708)	(563)	0	(4)	0	0	0	0	44,002	(7,317)
X		Osage, KS	(5,960)	(3,173)	0	0	(6,048)	0	0	0	23,366	(3,048)
	X	Fremont, IA	(10,244)	(792)	0	0	0	(9,742)	0	0	25,488	(124)
	X	Pawnee, NE	(7,948)	(3,296)	0	0	(6,173)	0	0	0	25,132	(2,294)
	X	Roosevelt, NM	(263)	(1,219)	0	0	(20,963)	(11)	(4,643)	0	33,529	(193)
	X	Bent, CO	(1,633)	(5,653)	0	0	(29,485)	0	0	0	38,331	(1,559)
	X	Chautauqua, KS	(1,563)	(1,872)	0	0	(16,046)	0	0	0	23,350	(3,323)
X	X	Garfield, OK	0	0	0	0	(15,953)	0	0	0	24,901	0
X		Callahan, TX	0	(3,919)	0	0	(9,706)	0	(7,266)	0	33,915	(2,133)
	X	Hardeman, TX	0	(718)	0	0	(26,174)	0	(1,547)	0	29,048	(839)
X		Harmon, OK	0	(484)	(19)	0	(16,396)	0	(1,193)	0	28,321	(845)
	X	Tishomingo, MS	(4,314)	(856)	0	0	(1,320)	0	(3,285)	0	23,290	(15,403)
	X	Izard, AR	(538)	(2,710)	0	0	(8,243)	0	(5,775)	(900)	24,302	(6,137)
	X	McDonald, MO	0	(3,196)	0	0	0	(12,000)	0	0	22,558	(7,025)
X		Lawrence, MO	0	(2,701)	0	0	0	(11,900)	0	0	22,498	(7,958)
	X	Alexander, IL	(3,107)	(518)	0	0	0	0	(487)	(797)	23,413	(1,515)
	X	Marion, KY	0	0	0	0	0	0	0	0	22,927	(23,294)
	X	Lawrence, TN	(3,155)	(56)	0	0	(1,029)	0	(4,671)	0	22,856	(15,583)
	X	Colbert, AL	0	(46)	0	0	0	0	0	0	23,190	(5,507)
	X	Dillon, SC	0	(27)	0	(2)	0	(13,386)	(3,764)	0	24,727	0
	X	Mecklenburg, VA	(4,771)	(68)	0	(145)	0	(11,145)	0	0	23,312	(7,183)
	X	Person, NC	(4,047)	0	0	(84)	0	(9,640)	(3,916)	0	23,453	(5,766)

4.1.3.2 Indirect Impacts

Economic impacts vary by plant location. The impacts of growing a dedicated energy crop in a region would impact several sectors. The agricultural sector, defined in broad terms which would include input suppliers, would be impacted by the creation of a new market for the dedicated energy crop and would also be impacted by changes in land use. Additional local transportation will be required to move the biomass from the farm gate to the BCF. Finally, it is assumed that a $45/ton payment would be made to farmers delivering biomass to the BCF to match the CHST payment of $45/ton. Since the biomass price used in the analysis was $60, a $30/ton impact is incorporated as an impact gain to farmer's (proprietor's) income. These impacts are estimated for the regions identified by POLYSYS.

<u>Direct Payments</u>

Under Alternative 1, it was assumed that approximately $10 million would be required for the establishment and CHST of enough switchgrass (166,667 tons X $60/ton) to supply a BCF. As shown in Tables 4.1-3 and 4.1-4 impacts would result from changes in land use. These changes would lead to increased direct transportation costs (approximately $1.3 million) in each state (Table 4.1-5) and for the top five BCAP project locations (Table 4.1-6).

The first impact estimated is the impact as a result of producing the dedicated energy crop. It was estimated that producers of the dedicated energy crop would require $60/dry ton (approximately $10 million total investment) to establish the crop. This is not a windfall, however, because to receive the $10 million, producers must convert some of their land producing traditional crops into the dedicated energy crop. This would result in negative impacts within the community as inputs for those traditional crops are not purchased. These costs depend on the community and the changes in land use required to meet the demand for dedicated energy crops. The range in direct costs for this land use impact ranged from a decline of $1.5 million for the Tennessee facility, to a decline of $5 million for the Iowa facility.

Table 4.1-5. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO and Jobs)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Oklahoma:											
$10,000,020	$416,840	$8,237,354	$18,654,214	($2,431,365)	($600,194)	($1,179,135)	($4,210,694)	$1,297,086	$595,759	$738,955	$2,631,800
224	5	82	311	-55	-6	-12	-73	10	4	7	22
South Dakota:											
$10,000,020	$409,186	$7,086,434	$17,495,640	($4,196,516)	($1,099,749)	($1,941,598)	($7,237,863)	$1,297,086	$466,044	$525,114	$2,288,244
134	5	76	215	-55	-10	-21	-86	11	4	6	21
Tennessee:											
$10,000,020	$457,124	$9,595,158	$20,052,302	($1,519,291)	($447,074)	($689,770)	($2,656,135)	$1,297,086	$554,976	$785,128	$2,637,190
180	4	83	268	-34	-5	-6	-45	10	4	7	21
Texas:											
$10,000,020	$368,186	$5,200,350	$15,568,556	($2,346,468)	($440,322)	($658,702)	($3,445,492)	$1,297,086	$447,603	$412,737	$2,157,426
329	5	59	393	-90	-4	-22	-108	10	3	5	19
South Carolina:											
$10,000,020	$459,690	$7,347,561	$17,807,271	($3,541,669)	($477,934)	($1,459,151)	($5,478,754)	$1,297,086	$430,699	$511,230	$2,239,015
128	5	85	218	-46	-5	-17	-68	11	4	6	21
Iowa:											
$10,000,020	$541,067	$9,502,505	$20,043,592	($5,071,460)	($1,305,457)	($2,860,976)	($9,237,893)	$1,297,086	$526,118	$860,763	$2,683,967
148	6	96	250	-69	-11	-29	-109	11	5	9	24
Kentucky:											
$10,000,020	$682,325	$9,170,480	$19,852,825	($2,329,400)	($528,761)	($1,339,671)	($4,197,832)	$1,297,086	$466,306	$665,893	$2,429,285
562	8	94	664	-131	-6	-14	-151	10	4	7	21
Colorado:											
$10,000,020	$510,445	$6,808,577	$17,319,042	($3,428,649)	($785,326)	($1,270,663)	($5,484,638)	$1,297,086	$590,370	$625,733	$2,513,190
141	5	69	215	-49	-7	-13	-68	12	5	7	23
Missouri:											
$10,000,020	$458,469	$7,817,574	$18,276,063	($2,259,658)	($507,921)	($1,090,376)	($3,857,955)	$1,297,086	$487,852	$760,241	$2,545,179
142	6	86	233	-34	-5	-12	-51	10	4	8	23
New Mexico:											
$10,000,020	$385,314	$6,323,308	$16,708,642	($3,746,230)	($1,253,428)	($1,395,489)	($6,395,147)	$1,297,086	$671,340	$554,692	$2,523,118
70	5	62	137	-37	-14	-14	-65	10	3	5	19
Kansas:											
$10,000,020	$364,657	$8,347,549	$18,712,226	($1,994,470)	($678,935)	($1,001,758)	($3,675,163)	$1,297,086	$802,016	$818,174	$2,917,276
195	4	77	275	-39	-5	-9	-52	11	4	8	23
Indiana:											
$10,000,020	$359,838	$5,998,776	$16,358,634	($1,974,802)	($375,430)	($606,917)	($2,957,149)	$1,297,086	$428,640	$509,089	$2,234,815
258	5	69	332	-45	-5	-7	-57	11	4	6	21
Mississippi:											
$10,000,020	$328,817	$6,140,522	$16,469,359	($2,845,438)	($651,393)	($853,779)	($4,350,610)	$1,297,086	$481,074	$493,507	$2,271,667
190	4	67	262	-113	-10	-10	-132	11	4	5	20
Alabama:											
$10,000,020	$352,869	$6,883,275	$17,236,164	($2,973,820)	($815,694)	($1,051,317)	($4,840,831)	$1,297,086	$473,965	$541,050	$2,312,101

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
168	5	70	242	-128	-11	-11	-150	10	4	6	20
Nebraska:											
$10,000,020	$452,677	$7,341,372	$17,794,069	($3,951,698)	($834,149)	($1,617,540)	($6,403,387)	$1,297,086	$408,857	$675,331	$2,381,274
149	6	84	239	-59	-11	-19	-88	9	3	8	21
Virginia:											
$10,000,020	$481,715	$10,069,458	$20,551,193	($2,793,087)	($957,975)	($1,675,053)	($5,426,115)	$1,297,086	$499,482	$825,602	$2,622,170
69	5	97	171	-32	-10	-16	-58	10	4	8	23
Arkansas:											
$10,000,020	$343,838	$6,334,260	$16,678,118	($1,789,866)	($365,579)	($653,065)	($2,808,510)	$1,297,086	$444,149	$578,819	$2,320,054
164	6	75	244	-29	-7	-8	-43	11	4	7	22
North Carolina:											
$10,000,020	$459,434	$10,179,516	$20,638,970	($3,250,226)	($1,003,907)	($2,227,711)	($6,481,844)	$1,297,086	$505,843	$818,303	$2,621,231
166	5	98	269	-47	-8	-22	-76	10	4	8	23

Table 4.1-6. Direct, Indirect, and Induced Economic Impacts by Five Top Potential Project Locations Year 3 (TIO and Jobs)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Plant #1:											
$10,000,020	$416,840	$8,237,354	$18,654,214	($2,431,365)	($600,194)	($1,179,135)	($4,210,694)	$1,297,086	$595,759	$738,955	$2,631,800
224	5	82	311	-55	-6	-12	-73	10	4	7	22
Plant #2:											
$10,000,020	$454,205	$7,661,983	$18,116,208	($2,286,062)	($502,071)	($1,044,922)	($3,833,055)	$1,297,086	$497,308	$766,527	$2,560,920
170	5	84	259	-41	-5	-12	-58	10	4	8	23
Plant #3:											
$10,000,020	$392,189	$5,831,789	$16,223,998	($2,086,956)	($509,445)	($703,033)	($3,299,434)	$1,297,086	$414,962	$478,589	$2,190,637
536	5	60	601	-98	-7	-7	-111	10	3	5	18
Plant #4:											
$10,000,020	$372,145	$5,364,405	$15,736,570	($2,450,100)	($481,741)	($717,434)	($3,649,275)	$1,297,086	$461,692	$429,537	$2,188,315
294	5	60	359	-70	-6	-8	-84	10	3	5	18
Plant #5:											
$10,000,020	$489,055	$9,011,816	$19,500,891	($2,887,710)	($1,051,196)	($1,496,225)	($5,435,131)	$1,297,086	$757,168	$937,563	$2,991,817
222	5	84	311	-64	-6	-14	-84	10	5	9	23

Transportation costs were estimated based on Brechbill and Tyner (2008). Their data indicate that transportation costs vary depending on distance from the plant. Their estimates ranged from $3.26/dry ton if the haul was within 5 miles from the plant to almost $10/ dry ton when the switchgrass requires 50 miles of transportation. Other estimates included a cost of $22.00/wet ton of switchgrass within a 50 mile region (Jackson 2009). Assuming the switchgrass was baled at 20 percent moisture, the cost to the plant would be estimated at $27.50/dry ton. Kumar and Sokhansanj (2007) estimate the cost per dry ton to be $21.19 in 2007 dollars. If this is inflated to 2009 using a consumer price index, then the cost per dry ton would exceed $22.40. To estimate the impacts we have chosen to use Brechbill and Tyner (2008). Using the area of each of the 5 mile increments as weights, a weighted cost of $7.78/dry ton is estimated. Multiplying this per ton cost by the number of tons required annually by the BCF, it was determined that transportation costs would approach $1.3 million for each BCF.

The final direct impact is a result of the $90/dry ton payment to "producers" ($45 CHST payment plus $45 from the BCF). Since the projected cost of the biomass was $60/ton, the farmer would receive a $30 enticement fee. In reality, this fee could be split among several economic entities. In this analysis, it is assumed that proprietors in the community would receive this. The value of $5 million was used for each of the regions.

Total Economic Impacts

Total economic impact ranges from $28 million in Tennessee to $19 million in South Dakota and New Mexico (Figure 4.1-4). Each of the top five plants has a net positive impact to their regions, averaging between $21 and 25 million. Land use changes would create negative impacts within a region. These negative impacts taken across all economic impacts (direct, indirect, and induced) range from nearly $10 million for the simulated plant located in Iowa to slightly more than $2.5 million for the plant located in southwest Tennessee (Figure 4.1-5). The largest positive impact within each of the study regions occurs in maintaining and harvesting the dedicated energy crop. The economic impact resulting from the $30/ton paid to individuals (proprietor's income) within the region for growing, harvesting, and collecting the material ranges from $6.2 million (Plant #3) to nearly $7.9 million (Plant #5) (Figure 4.1-5).

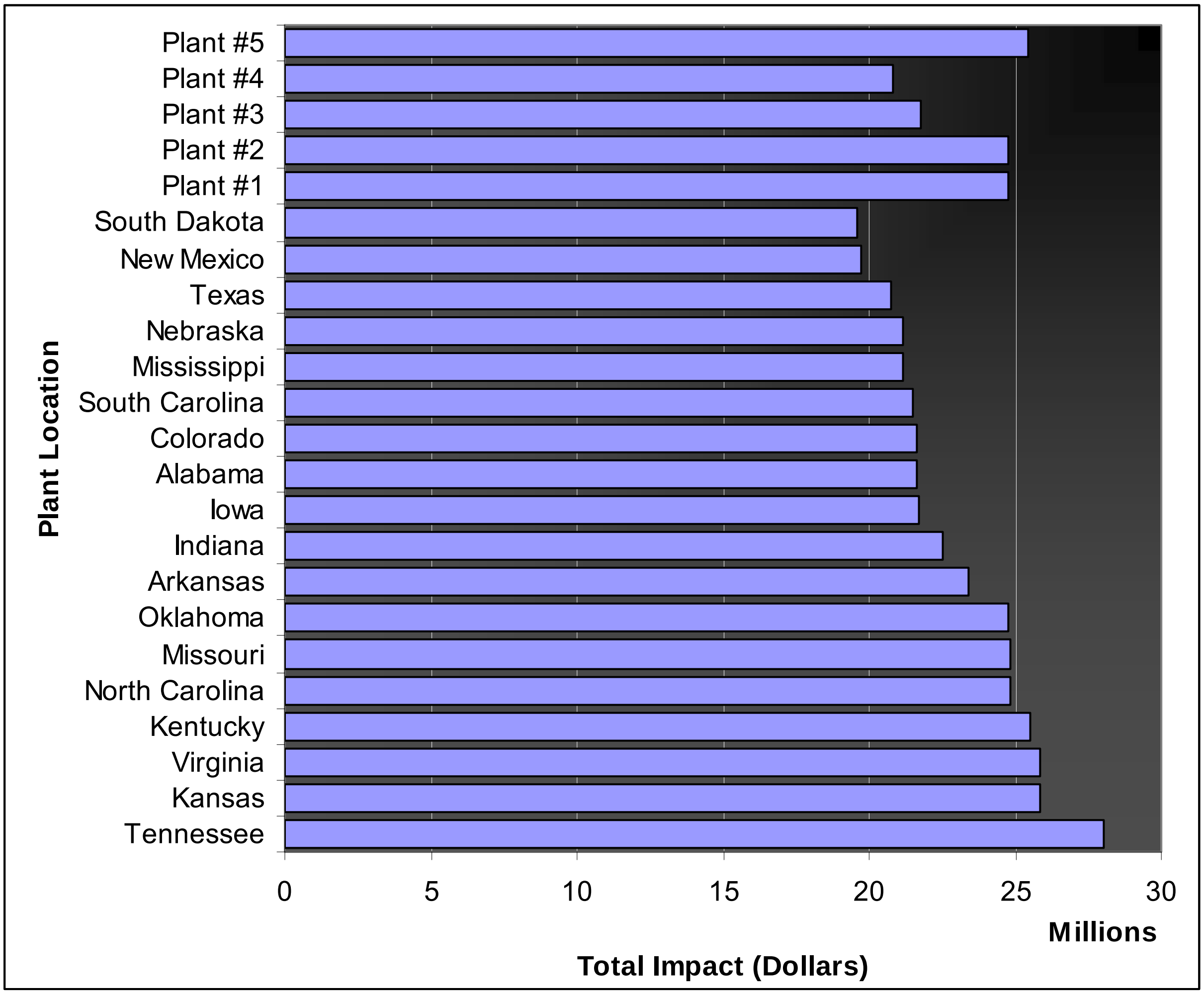


Figure 4.1-4. Direct, Indirect, and Induced Economic Impacts for Both the State and Top Five BCF Potential Project Locations

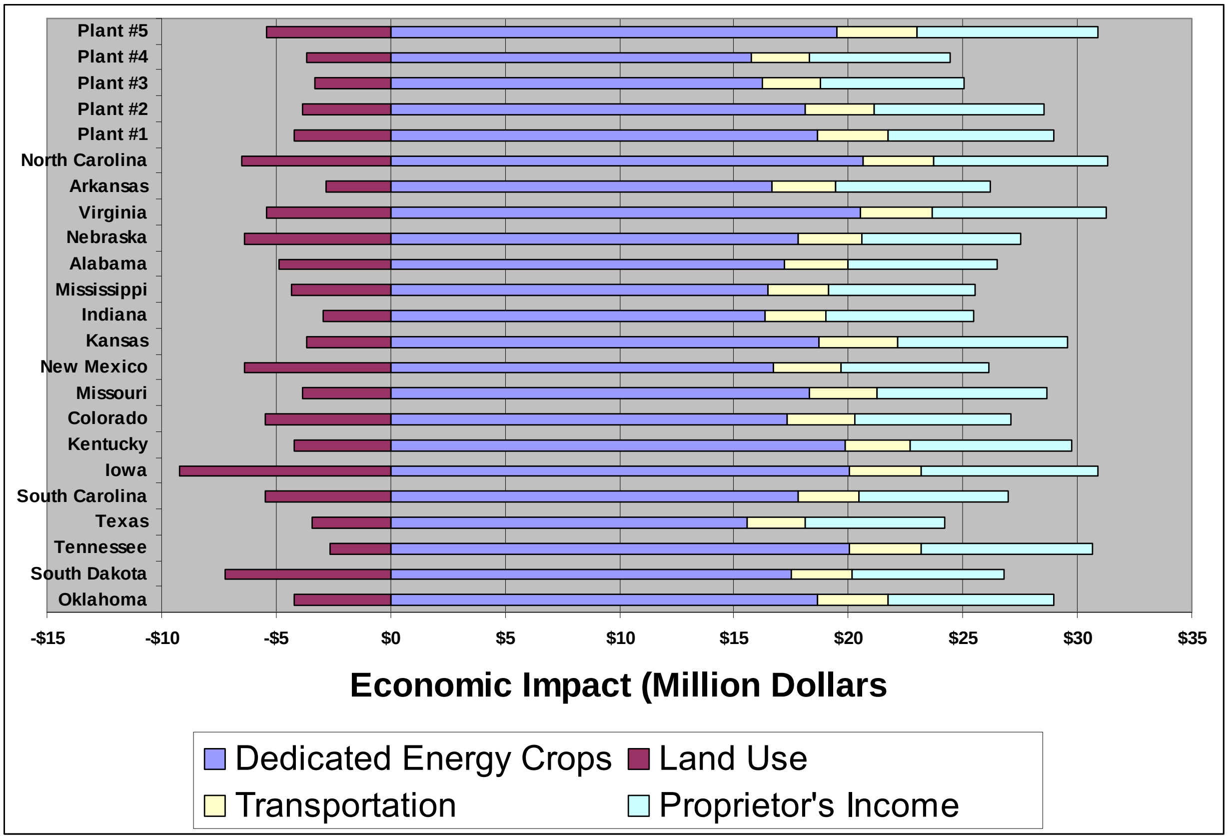


Figure 4.1-5. Economic Impacts for Each Type Estimated by Potential BCAP Project Location

4.1.4 Action Alternative 2

For the analysis of Alternative 2 no detailed location analysis is presented, as it is currently impractical to perform; however, geographic distribution of the feedstock would drive potential BCAP project locations.

Alternative 2 addresses the impacts of an expanded BCAP, in which the basic assumption would be that BCAP would play a key role in achieving the goals established by the EISA legislation for advanced biofuels. To model this, POLYSYS was used to estimate the quantity and price of feedstock necessary to achieve the EISA targets through 2023. To meet DOE goals of $1.76 per gallon of ethanol and $51 per dry ton of herbaceous feedstock by 2012 (Ferrel 2009), the role, size, and funding of a potential expanded BCAP was estimated, based on the estimated prices of feed stock.

4.1.4.1 Direct Impacts

Figure 4.1-6 illustrated the resulting contribution of the above-mentioned feedstock to achieve the EISA goals. One can observe the significant contribution that crop residues would make in the short term, while the contribution of dedicated energy crops would be essential to achieve the targets beyond 2016. When accounting for the contribution for forest residues, it would be expected that residues would make a significant portion of the feedstock supply and influence a reduction in feedstock prices.

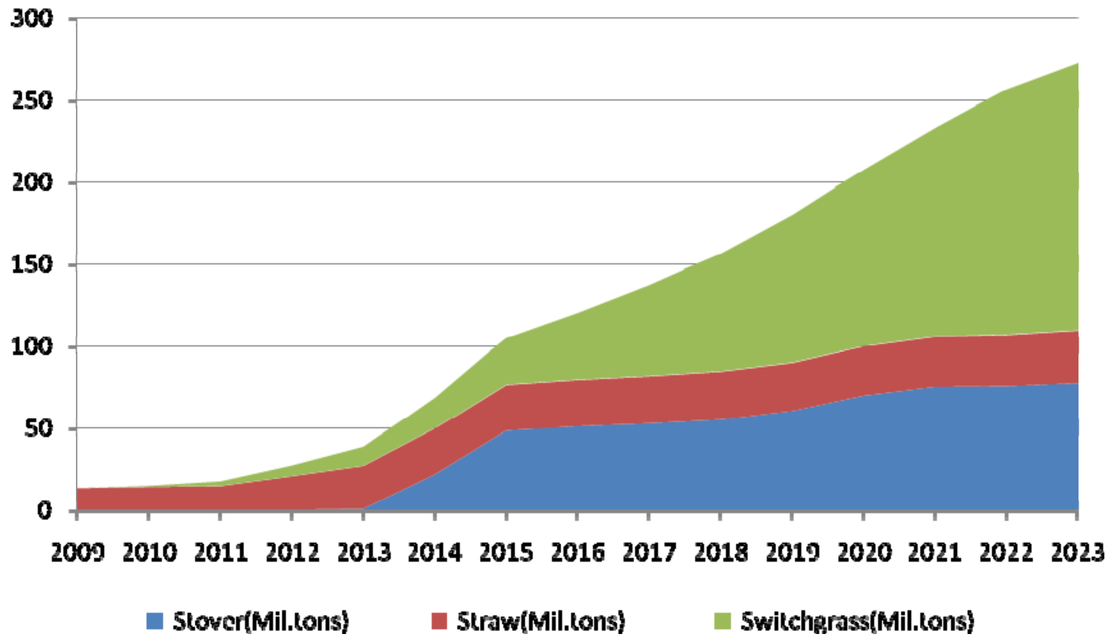


Figure 4.1-6. Feedstock Participation in Achieving EISA Target (Scenario 3) (Million of dry tons)

However, under the Alternative 2, an expanded BCAP, significant changes can be expected in net revenues as the value of the total revenues increase more than the cost of producing the feedstock, and as the increase of feedstock production reduces the supply of other crops and consequently increases their prices would be anticipated. Government commodity payments can also be expected to increase.

Under Alternative 2, it would be expected that the potential expansion of BCAP would have significant impacts in the production of the crops experiencing loss of acreage as a result of an expanding feedstock market under the BCAP program.

For Alternative 2, the aggregate impacts on the sector's Realized Net Farm Income are presented in Table 4.1-7. Table 4.1-7 presents the changes include the impacts on prices of the major commodities, the changes in land use, in government payments (except for now) BCAP payments, and the contribution of the value of the energy feedstock production. As POLYSYS does not have fully integrated hay sector, these figures may underestimate the impacts of increasing hay prices, due to the conversion of hay and the reconversion of cropland in pasture towards hay acreage.

Table 4.1-7. Aggregate Realized Net Farm Income for Alternative 2 as Compared to the No Action Alternative

Year	No Action Alternative	Alternative 2	Change
2009	$74,604	$76,751	$2,147
2010	$73,428	$78,267	$4,839
2011	$74,857	$81,366	$6,509
2012	$74,388	$81,760	$7,372
2013	$75,436	$83,956	$8,520
2014	$77,404	$86,909	$9,505
2015	$78,679	$87,467	$8,788
2016	$79,729	$87,782	$8,053
2017	$80,780	$88,022	$7,242
2018	$80,818	$88,419	$7,601
2019	$77,155	$86,320	$9,165
2020	$75,355	$85,717	$10,362
2021	$73,020	$84,177	$11,157
2022	$71,897	$82,964	$11,067
2023	$71,010	$81,886	$10,876

Under implementation of Alternative 2, changes in farm prices become a very important impact. Crop prices would be expected to increase due to the increase in the demand for cropland to plant energy crops. Price increases are most significant in wheat, corn and soybeans. From Table 4.1-8 shows that price changes are in the order of 15 to 20 percent at their highest level of impact. The addition of forestry resources as feedstock would reduce these price pressures, as less cropland would be needed to produce biomass from energy crops. Increases in crop yields would also reduce the price impacts, however, if crop yields increase too much while the impacts if farm prices could be reduced or even reversed, the impacts in realized net farm income could also be reduced and even reversed.

The price for feedstock starts at $38 per dry ton, and increase until reaching a level of $71 at the end of the period. Increases in the latter years show the need to increase the plantings of energy dedicated crops, to ensure that enough biomass would be made available to reach the EISA target.

Under Alternative 2, commodity government payments will increase due to price impacts triggered by the additional demand of cropland for the production of energy crops.

Given that the USDA baseline (No Action Alternative) provides an outlook of relatively high crop prices, the increase in prices does not trigger an across the board reduction in payments from commodity programs, since some are already at zero level. However, in this case, there are some reduction in payments are indicated in Table 4.1-9. The modest reductions are the result of decreases in counter cyclical payments, particularly in cotton.

Alternative 2 will cause land use shifts, particularly among the major crops. Wheat and soybeans are the most impacted, while corn, because of the increased revenues from the collection of stover is able to increase its acreage. The acreage of hay shows some minor reduction. As shown in Table 4.1-10, there is expected to be an increase in the total land under cropping. This increase indicates how many acres of cropland in pasture have left pasture to a higher value use. All of these changes are in response to the increase in the plantings of energy dedicated crops, which by 2023 reach over 30 million acres. The actual transition in acreage is that acreage currently in hay is shifted to energy dedicated crop production. As a result, the cropland currently in pasture will be planted in hay, which is a land use with a similar level of productivity.

The extent of the impacts of the shift of pasture in cropland to switchgrass would depend on the ability of ranchers to increase the forage productivity of the more than 350 million acres in pastureland. Increased forage productivity could be achieved by fertilization, and/or by increasing the management intensity of pastures. By the year 2023, 11 million acres in cropland pasture shift into a higher use; about 2 million acres to account for the loss of hay acreage and the other 9 million acres would shift to dedicated energy crop production. Given that the number of acres of cropland in pasture whose productivity would need to be accounted for, about 9 million acres, would not be very large, given the total amount of forage used, it would be possible that in many counties or multicounty areas, the negative effects would be easily overcome. Perhaps in some limited number of counties, livestock would have to be moved to neighboring areas.

Table 4.1-8. Crop and Feedstock Prices for Alternative 2 as Compared to the No Action Alternative

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
No Action												
Corn	4	3.9	3.8	3.7	3.65	3.7	3.75	3.75	3.75	3.62	4.06	3.71
Grain Sorghum	3.5	3.45	3.4	3.3	3.25	3.3	3.35	3.35	3.35	3.34	3.1	3.11
Oats	2.5	2.45	2.4	2.35	2.3	2.35	2.35	2.35	2.35	2.34	2.39	2.37
Barley	4.3	4.15	4	3.9	3.85	3.9	3.95	3.95	3.95	3.87	3.85	3.86
Wheat	5.75	5.6	5.5	5.35	5.3	5.4	5.45	5.45	5.45	5.45	5.54	5.54
Soybeans	8.85	8.75	8.75	8.7	8.6	8.7	8.75	8.75	8.75	8.64	8.75	8.87
Cotton ($/lb)	0.5	0.55	0.6	0.605	0.61	0.615	0.62	0.625	0.63	0.627	0.658	0.656
Rice ($/cwt)	12.5	11.45	10.9	10.6	10.8	11.03	11.27	11.52	11.78	11.74	12.08	12.26
Hay	136.82	131.8	129.4	129.23	129.78	131.7	134.49	136.6	139.08	139.08	139.08	139.08
Energy Crop	0	0	0	0	0	0	0	0	0	0	0	0
Alternative 2												
Corn	4.45	4.32	4.1	4.16	4.22	4.17	4.09	3.97	4	3.87	4.44	4.19
Grain Sorghum	3.53	3.52	3.55	3.54	3.58	3.72	3.86	3.97	4	3.87	4.18	4.2
Oats	2.58	2.59	2.57	2.72	2.72	2.65	2.64	2.62	2.62	2.61	2.84	2.76
Barley	4.3	4.18	4.07	4.07	4.17	4.46	4.59	4.6	4.46	4.58	4.43	4.68
Wheat	5.77	5.7	5.68	5.66	5.73	5.96	6.28	6.35	6.42	6.51	6.98	6.97
Soybeans	8.94	9.44	10.47	10.19	9.76	10.51	10.02	10.12	9.83	10.04	10.17	10.28
Cotton ($/lb)	0.5	0.553	0.609	0.619	0.628	0.639	0.653	0.667	0.675	0.676	0.719	0.726
Rice ($/cwt)	12.5	11.45	10.9	10.44	10.73	11.01	11.27	11.53	11.8	11.76	12.1	12.29
Hay	136.82	131.8	129.4	129.23	129.78	131.7	134.49	136.6	139.08	139.08	139.08	139.08
Energy Crop	38	38	38	39	47	49	50	50	50	50	51	53

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Change												
Corn	0.45	0.42	0.3	0.46	0.57	0.47	0.34	0.22	0.25	0.25	0.38	0.48
Grain Sorghum	0.03	0.07	0.15	0.24	0.33	0.42	0.51	0.62	0.65	0.53	1.08	1.09
Oats	0.08	0.14	0.17	0.37	0.42	0.3	0.29	0.27	0.27	0.27	0.45	0.39
Barley	0	0.03	0.07	0.17	0.32	0.56	0.64	0.65	0.51	0.71	0.58	0.82
Wheat	0.02	0.1	0.18	0.31	0.43	0.56	0.83	0.9	0.97	1.06	1.44	1.43
Soybeans	0.09	0.69	1.72	1.49	1.16	1.81	1.27	1.37	1.08	1.4	1.42	1.41
Cotton ($/lb)	0	0.003	0.009	0.014	0.018	0.024	0.033	0.042	0.045	0.049	0.061	0.07
Rice ($/cwt)	0	0	0	-0.16	-0.07	-0.02	0	0.01	0.02	0.02	0.02	0.03
Hay	0	0	0	0	0	0	0	0	0	0	0	0
Energy Crop	38	38	38	39	47	49	50	50	50	50	51	53

Table 4.1-9. Changes in Commodity Government Payments ($000s) Under Alternative 2

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Loan Deficiency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contract	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Counter Cyclical	0	-31	-94	-136	-175	-237	-326	-322	-272	-300	0	-10	-16	-40	-45
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Payments	0	-31	-94	-135	-175	-238	-326	-322	-272	-300	0	-10	-16	-40	-45

Table 4.1-10. Land Use Impacts of Alternative 2 as compared to the No Action Alternative (million acres)

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
No Action Alternative															
Corn	88	89	90	90	90	90	90	91	91	90	90	93	92	90	91
Grain Sorghum	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7
Oats	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Barley	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Wheat	61	61	61	61	60	60	60	60	60	60	60	60	60	61	61
Soybeans	74	73	72	72	72	71	71	71	71	71	71	70	71	71	70
Cotton ($/lb)	8	9	10	10	10	10	10	10	10	10	10	11	11	11	11
Rice ($/cwt)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Hay	62	62	62	62	61	61	61	61	61	61	61	61	61	61	61
Energy Crop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	311	311	312	311	311	310	310	310	310	310	309	312	312	311	311
Alternative 2															
Corn	88	91	93	92	93	94	93	93	92	92	90	93	92	90	90
Grain Sorghum	8	8	7	7	7	7	7	7	7	6	6	6	6	6	6
Oats	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Barley	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Wheat	61	60	60	59	58	57	55	55	54	53	52	52	51	51	51
Soybeans	74	72	71	71	71	70	70	70	70	69	69	68	67	66	65
Cotton ($/lb)	8	9	9	9	9	9	9	9	9	9	8	8	8	8	8
Rice ($/cwt)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Hay	62	61	61	61	60	60	60	60	60	60	60	60	60	59	59
Energy Crop	0	0	1	2	3	5	7	10	13	16	20	24	29	33	32
Total	311	311	312	312	311	311	312	313	314	316	316	321	322	322	321

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Change due to Alternative 2															
Corn	0	2	3	2	3	4	3	3	2	1	0	0	0	0	0
Grain Sorghum	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1
Oats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	0	-1	-1	-2	-2	-3	-4	-5	-6	-6	-7	-8	-9	-10	-10
Soybeans	0	-1	-1	0	0	-1	-1	-1	-1	-2	-2	-2	-4	-5	-5
Cotton ($/lb)	0	0	0	0	0	-1	-1	-1	-1	-2	-2	-2	-3	-3	-3
Rice ($/cwt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hay	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-2
Energy Crop	0	0	1	2	3	5	7	10	13	16	20	24	29	33	32
Total	0	0	0	0	1	1	2	3	4	5	7	9	10	11	11

This page intentionally left blank

4.1.4.2 Indirect Impacts

Direct Payments

The direct impacts of Alternative 2, as measured in the Year 2020, include $5.7 billion for the establishment and CHST of switchgrass (tons grown X $53/ton) and $5.3 billion for CHST of crop residues (tons of crop residues X $53/ton), the impacts resulting from changes in land use (a decline of $3.2 billion), the impacts of increased transportation ($1.6 billion), approximately $15.8 billion as a result of traditional crop price changes, and nearly $4.0 billion as a result of farmer payments of $37/ton above and beyond the cost of establishment and CHST of the dedicated energy crop ($90 - $53/ton) (Table 4.1-11).

The establishment and CHST of the dedicated energy crops would produce effects to producers, which would flow through the rest of the economy as increased economic output and additional employment positions. It was estimated that the producers of the dedicated energy crop feedstocks would require $53/dry ton or a total payment of $5.7 billion. Corn and wheat producers will provide 99.8 million tons of feedstock and would receive approximately $5.29 billion. It was estimated that CHST activities would create a total gain of an additional 280,000 jobs. This is not a windfall; however, because to receive the over $11 billion, producers must convert some of their land producing traditional crops into a dedicated energy crop. This will result in negative impacts within the community as inputs for those traditional crops are not purchased. These costs depend on the community and the changes in land use required to meet the demand for dedicated energy crops and crop residues. The direct costs for this land use change would be estimated at a decline of $3.2 billion with a loss of 41,000 jobs.

As in Alternative 1, transportation costs were estimated based on Brechbill and Tyner (2008). Using the area of each of the 5-mile increments as weights, a weighted cost of $7.78/dry ton was estimated. Multiplying this per ton cost times the number of tons required annually by the BCF, it was determined that transportation costs would be approximately $1.6 billion nationally and require 12,600 additional jobs.

A fourth impact occurs at the national scale due to commodity prices change. These price changes increase farm income and thus provide money to communities as producers spend that additional income. In this analysis, it was assumed that the producer consumption function would be similar to that of proprietors. Producers across the nation would receive an additional $15 billion as a result of increase commodity prices.

The final direct impact was a result of the $90/dry ton payment to “producers” ($45 CHST payment and $45 from the BCF). Since the projected cost of the biomass was $53/ton, the producer would receive a $37 enticement fee. In reality, this fee could be split among several economic entities. In this analysis, it was assumed that proprietors in the community would receive $3.99 billion. In total, approximately $29.2 billion is directly contributed to the nation’s economy creating 262,000 jobs.

Total Economic Impacts

Total economic impact is estimated to be $88.5 billion with a significant portion of this derived from induced or household expenditures. In addition, nearly 700,000 jobs would be created through the development of the cellulosic industry.

Table 4.1-11. National Economic Impacts Resulting from Achieving EISA (TIO and Jobs)

Direct	Indirect	Induced	Total
National Farm Impact as a result of producing dedicated energy crops:			
$5,713,400,000	$892,033	$13,821,586,568	$19,535,878,601
93,637	8	101,202	194,847
National Farm Impact as a result of collecting crop residues:			
$5,289,400,000	$1,600,030	$12,797,553,299	$18,088,553,329
86,688	15	93,704	180,407
National Farm Level Impacts as a result of changing land uses:			
($3,202,976,400)	($2,900,063,535)	($5,910,728,462)	($12,013,768,397)
-41,265	-18,500	-43,298	-103,063
National impacts as a result of transporting cellulosic materials:			
$1,615,128,000	$1,432,340,848	$3,275,528,986	$6,322,997,834
12,658	7,508	24,166	44,332
National impacts as a result of changing commodity prices:			
$15,803,976,400	$7,601,240,255	$21,780,238,019	$45,185,454,674
88,074	46,340	161,478	295,892
National impacts as a result of BCAP CHST payments:			
$3,988,600,000	$1,918,397,326	$5,496,885,975	$11,403,883,301
22,228	11,695	40,754	74,677
Total national impacts:			
$29,207,528,000	$8,054,406,957	$51,261,064,385	$88,522,999,342
262,019	47,066	378,007	687,092

4.1.5 No Action Alternative

Selecting the No Action Alternative would not result in significant changes to current land use, current farm prices, or current farm revenue measures. The No Action Alternative is the baseline, upon which both Alternatives 1 and 2 have been compared, previously. Under the No Action Alternative, in the short-term it would be unlikely that domestic production of biomass for bioenergy would meet the demand for EISA advanced biofuels components.

Under the No Action Alternative, BCAP would not be implemented for establishment and annual payments for dedicated energy crops; however, CHST would still be allowed as directed by the NOFA and associated rulemaking. Under the No Action Alternative, dedicated energy crops would be established only in limited demonstration-scale (e.g., Vonore demonstration plant in Tennessee) with other public and private funding sources. Commercial-scale production using dedicated energy crops would more than likely not occur in the short-term due the current lack of technological availability of processes to fully utilize cellulosic components into bioenergy products. Short term effects under the No Action Alternative would be a greater use of existing crop and forestry residues as feedstock for existing commercial-scale and demonstration-scale facilities as supplemented by CHST matching payments. Additionally, more residues could be utilized for co-generation of electricity or power generation at facilities that currently process forestry products or sugarcrops (e.g., bagasse).

4.2 BIOLOGICAL RESOURCES

4.2.1 Significance Thresholds

Impacts to biological resources would be considered significant if the alteration of environment by the implementation of Proposed Action directly or indirectly adversely affected or caused changes in the population size or distribution of wildlife or native vegetation on a regional or national scale.

4.2.2 Methodology

This section discusses potential impacts the implementation BCAP may have on terrestrial and animals species based on the Proposed Actions. To assess the relative impacts of the options of the No Action Alternative, Alternative 1, and Alternative 2 on plant communities and wildlife throughout the U.S., the affected environment was first described at the national scale and a GIS analysis was completed. Land currently producing vegetation appropriate for biomass conversion to fuel within close proximity to current BCF was identified. Changes in available and eligible biomass from the No Action Alternative to Alternative 1 and from the No Action Alternative to Alternative 2 were contrasted. The impacts on the ecological landscapes across the U.S. were considered in each situation.

Vegetation

The affected environment was first defined by describing landscapes with similar ecological features and resource concerns across the U.S. using the Land Resource Regions, as previously described (NRCS 2006). The amount acreage present for each of the 28 regions LRR was determined by vegetative land types using National Land Cover Database (NLCD Level 1) (Table 3.2-1). The resolution of this approach is considered suitable for regional and national analyses but inappropriate for county-level analyses or the interpretation of rare land-use occurrences. As discussed in Section 4.1, it is assumed that more detailed site specific analyses of vegetation would be required as a component of the NEPA and permitting process.

Existing BCF locations were identified across all regions. The Renewable Fuels Association (RFA) currently lists 211 biorefinery facilities either operation or under construction (n=24) across 26 states, with most centralized in the Midwest. Over 95 percent of the facilities manufacture ethanol primarily from corn, seed corn, and corn/grain mixtures. The remaining facilities process other products including beverage, brewery, potato, and wood waste, milo and wheat starch, cheese whey, and sugar cane bagasse (RFA 2009b). Additionally, the USDA Forest Service Forest Products Laboratory reported wood pellet mills across the country in 101 locations. This is increased the total number of BCFs analyzed to 312.

A 50-mile radius buffer was placed around each existing BCF to represent the maximum area from which biomass materials are anticipated to be harvested for each facility. The radial distance of 50 miles is widely accepted as the maximum buffer distance in which biomass transportation costs do not exceed value of the fuel produced from that commodity in the facility (see Section 4.1.2.3. ORNL 2009; English *et al.* 2008; Zeman 2007). Hence, the buffer defines the potential reach of a BCF or its land resource footprint (Figure 4.2-1). To calculate the current acreage for each of the vegetative land types that fall within each BCFs land resource footprint a GIS shapefile was created that was then overlaid on NLCD using GIS (Table 4.1-1). All acreage defined in this process falls within regions previously defined by NRCS (2006).

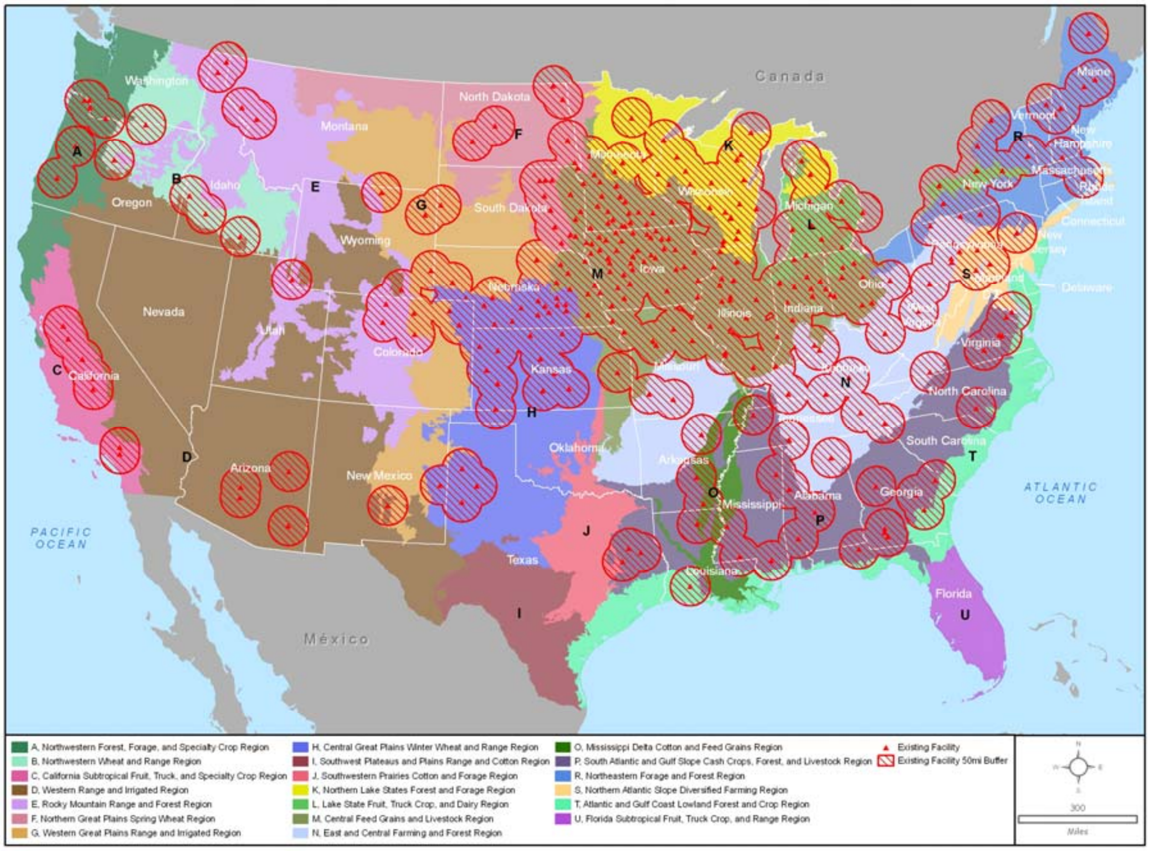


Figure 4.2-1. Locations of Existing BCFs in United States with 50-mile Buffer

Alternative 1 includes the establishment of 2 (commercial) to 5 (demonstration) BCFs within 18 proposed geographic locations in accordance with limitations of a targeted BCAP. Economic analysts determined the locations for the BCFs based upon the presence of necessary feedstocks and infrastructure to support the associated operations. The potential locations of these newly established BCFs were entered to the GIS database (Figure 4.2-2). As with existing BCFs, a 50-mile radius was placed around each of these proposed BCFs, and the amount of vegetative land types within this 50-mile radius for each facility was calculated. Alternative 1 represents the best opportunity to establish BCFs with the least capital input. Differences between available and eligible land resources between the No Action and Alternative 1 were compared. Specifically, detailed comparisons were made to determine if the addition of the proposed BCFs had a significant impact on the available land resources with a region, and whether the cumulative impact the proposed BCF and existing BCFs may have on the LRR. Understanding these proportional changes in the amount of available vegetative land types within a region allowed for the statistical determination of significant thresholds.

Alternative 2 includes the establishment of additional BCFs in accordance with broad implementation of BCAP. Economic analysts provide some guidance as to when and where these BCFs may be located based on trends in the agricultural commodities, available feedstocks, and infrastructure to support the associated operations. Using the findings from Alternative 1, differences between available and eligible land resources between the No Action and Alternative 2 were compared in order to determine significant impacts.

Wildlife

Using the methodologies developed for vegetation, analyses were developed to determine the local (within the 50-mile radius) and regional (cumulative impact within the LRR) effects on wildlife resources. One of the key difficulties in assessing the effects of conversion of vegetative land types may have on wildlife is the inability to quantitatively measure and assess the changes to biodiversity as a result of the action. The analysis of feedstock impacts on wildlife must take into account a number of factors. These factors include land resource scale, landscape patterns, landscape complexity, resource interspersion and juxtaposition, and temporal relationships. The impact of these variables also is conditioned by the life needs and capabilities of the wildlife species themselves. These details are best analyzed on a project specific basis.

For Alternatives 1 and 2 changes in available and eligible vegetative land types from the No Action Alternative to Alternative 1 and from the No Action Alternative to Alternative 2 were contrasted. Potential outcomes on wildlife were then analyzed using current available to literature and reviewing habitat management strategies and concerns identified within representative SWAPs (see Section 3.2).

4.2.3 Action Alternative 1

4.2.3.1 Vegetation

Under Alternative 1, the economic analyses indicated that given a limited funding supply under BCAP, BCAP would be able to support two to five BCFs on 18 potential project areas based on scale of the BCF, demonstration or commercial-scale.

Direct Impacts

Alternative 1 would be implemented on a more restrictive or targeted basis. BCAP project areas would be authorized for those projects that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands shall be allowed to enroll in the program from BCAP crop production. Similar to the CRP administered by FSA, the number of acres enrolled in BCAP project areas for crop production shall be limited to no more than 25 percent of the cropland in a given county.

In order to meet these criteria and ensure that there would adequate feedstocks to support the proposed BCFs, switchgrass and agricultural residues were identified as the most likely resources within the 50-mile radius buffer described in the methodology. Using these dedicated energy crops as one of the drivers for the selection of top BCAP project sites and specific counties of influence, Table 4.1-3 illustrates that the total number of acres of switchgrass within the proposed sites would never exceed 44,002 acres in the 50-mile radius buffer.

Considering a radius buffer composes approximately 5.02 million acres and these analyses are unable to identify how switchgrass would be spatially and temporally distributed within a buffer area, we expect that the impact of implementing Alternative 1 in any of the selection would not have a significant impact on either a local or regional scale.

However, it is expected that the production of a dedicated energy crop would create a higher valued opportunity for producers or those producers would not have selected to participate in BCAP. Depending on the overall acres in a county or region involved in the BCAP, the net returns for agriculture for the area could see significant gains under Alternative 1, and shift more acreage into energy crops, such as switchgrass. It is also expected that BCFs would become more sufficient in their conversion of biomass and increase capacity to meet demands.

With a limited amount of land cover types available within each LRR, analyses that compare how these potential increases in resource needs within existing or proposed BCFs buffers could impact land cover types are necessary prior to implementation of BCAP. Hence, the differences between available and eligible land resources between the No Action and Alternative 1 were compared. Specifically, detailed comparisons were made to determine if the addition of the proposed BCFs had a significant impact on the available land resources with a region, and whether the cumulative impact the proposed BCF and existing BCFs may have on the LRR.

A summary of these findings are:

Of the approximately 27.0 million acres of vegetative land cover within a 50-mile radius of existing BCFs in Region D, a cumulative acreage of approximately 27.4 million acres could be directly affected with the addition of the proposed new BCFs (Table 4.2-1). This includes a substantial amount of shrublands (approximately 17.4 million acres) that could potentially be harvested and converted to other agricultural uses, although row crop agriculture would be limited in this arid region (Table 4.2-1). However, the most significant shift was in the amount of grassland acres that might be altered within the 50-mile radius if the BCF wants to maximize the amounts of feedstock available (Table 4.1-2). While perennial grasses would potentially respond well in this LRR there would inherently be loss of species diversity as these grassland habitats were converted to grassland monocultures.

Table 4.2-1. Amount (acres) of Level 1 Land Cover Types Located within Existing BCFs by Region

	Total Acreage by LRR Region					
Land cover type	A	B	C	D	E	F
Transitional	637,977	376	1,848	5,743	477,991	820
Deciduous forest	1,637,113	20,134	428,945	112,206	1,514,806	457,768
Evergreen forest	11,577,847	646,764	1,196,731	5,127,101	17,002,078	4,833
Mixed forest	2,101,058	9,093	508,335	189,283	260,340	850
Shrubland	461,198	9,047,942	2,461,407	17,359,886	4,799,271	0
Orchards and vineyards	144,962	22,872	1,851,966	28,793	6,276	300,609
Grasslands/herbaceous	598,647	2,450,623	4,602,951	2,866,324	5,965,698	5,380,928
Pasture/hay	1,679,813	1,521,003	1,752,649	447,844	962,080	5,212,362
Row crops	205,137	921,644	2,119,789	580,490	31,353	15,093,999
Small grains	201,391	1,457,289	777,423	271,134	284,013	3,704,753
Fallow	11,080	794,671	4,567	3,558	91,726	1,188,765
Total	19,256,223	16,892,411	15,706,611	26,992,362	31,395,632	31,345,687
Land cover type	G	H	J	K	L	M
Transitional	415	1,028	1,354	219,499	13,047	31,550
Deciduous forest	304,394	622,172	264,907	15,537,563	5,439,146	17,747,466
Evergreen forest	2,164,001	54,166	26,065	2,540,125	521,116	381,639
Mixed forest	4,932	30,107	115,962	3,228,353	784,757	604,370
Shrubland	3,133,415	1,332,956	99	141,483	2,263	66,827
Orchards and vineyards	10	0	0	20	385	366
Grasslands/herbaceous	24,385,360	30,524,377	4,013	570,527	235,323	5,412,607
Pasture/hay	1,500,513	3,617,119	772,521	7,478,685	5,094,908	35,580,698
Row crops	2,130,217	18,408,434	24,117	9,678,160	11,236,842	91,190,514
Small grains	1,705,907	14,234,398	0	229,996	5,031	1,507,056

Fallow	1,006,796	1,335,941	0	0	0	1,453
Total	36,335,960	70,160,698	1,209,038	39,624,411	23,332,818	152,524,546

Land cover type	N	O	P	R	S	T
Transitional	325,784	27,705	2,685,403	333,711	39,181	402,060
Deciduous forest	41,318,100	315,830	16,747,193	18,076,215	5,319,151	563,371
Evergreen forest	4,908,472	422,204	17,465,983	6,254,001	505,222	2,635,023
Mixed forest	8,349,968	294,965	14,027,522	10,695,967	933,475	766,966
Shrubland	15,815	0	5,703	54,136	504	316
Orchards and vineyards	0	0	12,622	6,642	10	30
Grasslands/herbaceous	132,804	4,725	95,373	0	0	64,534
Pasture/hay	16,200,389	674,024	11,145,334	4,887,616	4,370,682	552,854
Row crops	5,692,221	5,615,520	11,990,276	2,528,511	1,055,061	1,176,024
Small grains	32,717	623,734	313,567	178	0	1,134,243
Fallow	0	0	0	0	0	0
Total	76,976,270	7,978,707	74,488,976	42,836,977	12,223,286	7,295,421

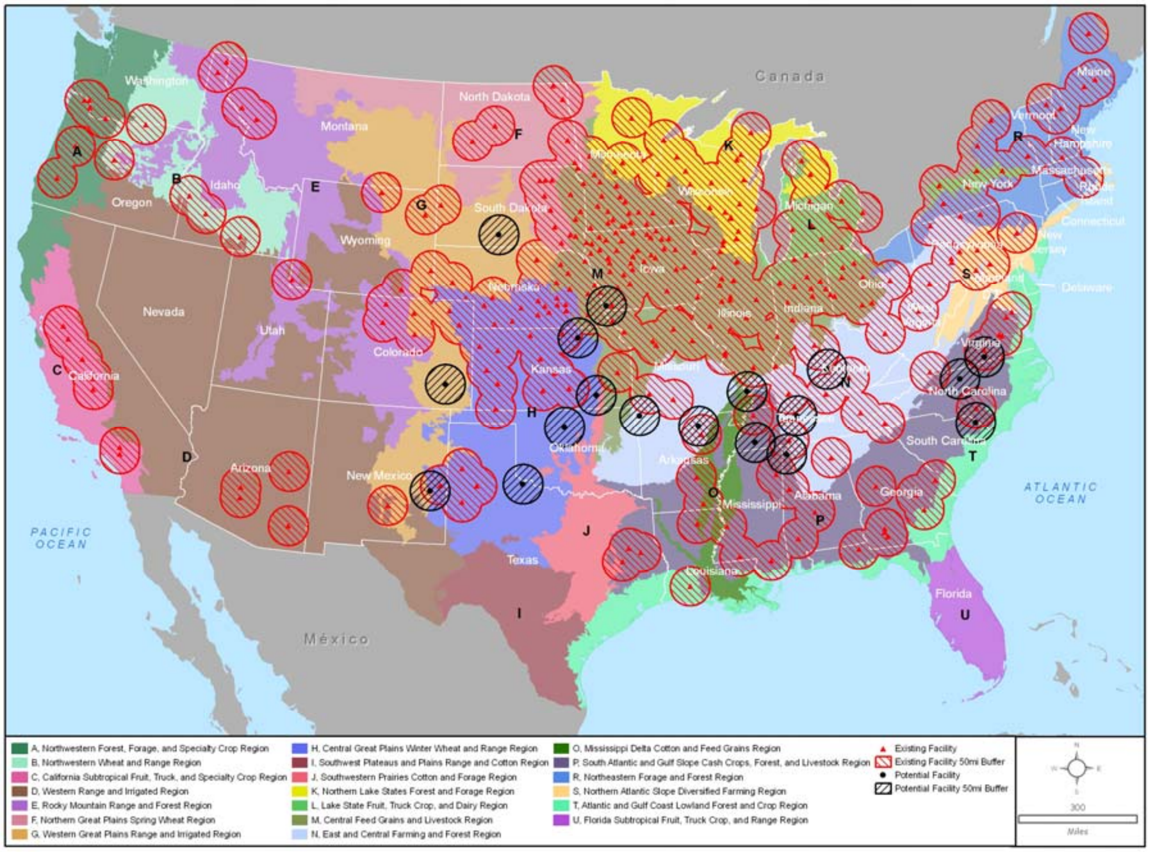


Figure 4.2-2. Map Showing Existing and Potential Location New BCFs with 50-mile Radius under Alternative 1

Region G contains a cumulative acreage of approximately 47.4 million acres that could be directly affected in Alternative 1 (Table 4.2-1). This includes mixed forest as well as a sizable pasture/hay and field crops that could potentially be harvested and converted to biomass energy with negligible effects on wildlife (Table 4.2-1). The demand for cellulosic feedstocks may require large losses in pasture-land—in some cases, more than 0.47 million acres. This degree of land-use change may amplify impacts to local and regional ecosystems. Typically, when feedstock are established they undergo agricultural intensification, fertilizer and pesticide applications increase, as does erosion due to increased cultivation. Also, the water requirements for pasture can be less than for many cellulosic energy crops; and planting new crops or installing irrigation systems on pastureland can alter local water cycling and land drainage patterns.

With most of the projected loss in pasture area occurring in the Corn Belt and Appalachian regions, irrigation will probably not increase with shifts out of pasture. However, if the energy crops that replace pasture in these regions are woody, such as hybrid poplar or other short-rotation crops, impacts to water, soil, and nutrient cycling could be larger than with perennial grasses due to differences in agronomic practices.

Under Alternative 1 an estimated 18.9 million acres of vegetative land cover in Region H is located within a 50-mile radius of a BCF, or potential new BCF, representing an increase of approximately 17 million acres when compared to the No Action. Conversion of various mixed forest or pasturelands land cover types to create new agricultural land could result in both local and regional impacts to vegetation cover and associated wildlife habitat (Table 4.2-2).

When the increases from the new BCAP project areas included with the existing BCF buffer, cumulative impacts for Region H can be determined. Sizeable increases in potential utilization of pastureland to support new BCAP project areas in Region H could have a negative effect on wildlife habitat at a local level via vegetation conversion. Pastureland vegetation generally provides a greater diversity of plant species and clear cutting entire tracts of pastureland will use as bio-fuel will reduce the amount of available habitat for some species. However, species preferring low groundcover will increase. Cutting of pastureland within a tract could increase the diversity of vegetation and alter the age and structure of the vegetation within a tract to the benefit of wildlife diversity and abundance. Roughly 74 percent and 57 percent of the total row crop and native and improved range lands in the region would be potentially available, respectively. However, cropland acres enrolled in the BCAP will be capped by 25 percent in qualifying counties, thus limiting potential deleterious effects upon wildlife that utilize these habitats.

Because no existing BCFs are located within Region J, Alternative 1 would result in the addition of approximately 0.7 million acres of vegetative land cover located within a 50-mile radius of a BCF. Though it represents a large increase in land area compared to the baseline, it is a relatively small proportion of the total land in Region J that is potentially suitable as a dedicated energy crop feedstock location. It is possible that the impacts on existing vegetation resources could be significant on a local level. However, the impact on the region would be minimal. Alternative 1 would result in nearly doubling the amount of land with the potential to be used for a dedicated energy crop feedstock for a BCF in Region J, with considerable in transitional and herbaceous grazing land located within the BCF buffers (Table 4.2-2). Such increases, though small in the overall landscape, could result in localized impacts to wildlife habitat since these land cover types in particular support a number of avian and mammal species.

Table 4.2-2. Projected Amount (acres) for Existing and Potential BCFs: Level 1 Land Cover Types by Region

Land Cover Type	Total (ac)	Currently in BCF (ac)	Projected new BCF (ac)	Total Projected BCF - Alt 1 (ac)		Total (ac)	Currently in BCF (ac)	Projected new BCF (ac)	Total Projected BCF - Alt 1 (ac)
	Region D					Region G			
Transitional	53,286	5,743	0	5,743		21,923	415	3,133	3,548
Deciduous forest	1,119,476	112,206	0	112,206		812,048	304,394	80,971	385,365
Evergreen forest	45,173,774	5,127,101	0	5,127,101		5,090,717	2,164,001	25,650	2,189,651
Mixed forest	1,203,443	189,283	0	189,283		52,574	4,932	17,031	21,963
Shrubland	229,339,250	17,359,886	82,761	17,442,647		13,743,261	3,133,415	530,476	3,663,891
Orchards and vineyards	112,453	28,793	0	28,793		10	10	0	10
Grasslands/herbaceous	38,522,853	2,866,324	285,249	3,151,573		95,192,693	24,385,360	9,512,214	33,897,574
Pasture/hay	5,472,594	447,844	79	447,923		3,323,953	1,500,513	478,228	1,978,741
Row crops	2,006,298	580,490	3,875	584,365		3,652,060	2,130,217	389,408	2,519,625
Small grains	1,132,524	271,134	0	271,134		6,211,755	1,705,907	551,707	2,257,614
Fallow	44,716	3,558	10	3,568		4,092,856	1,006,796	86,042	1,092,838
	Region H					Region J			
Transitional	11,051	1,028	1,384	2,412		51,615	1,354	4,319	5,673
Deciduous forest	1,910,955	622,172	322,374	944,546		6,920,582	264,907	221,792	486,699
Evergreen forest	824,344	54,166	77,374	131,540		1,633,910	26,065	6,099	32,164
Mixed forest	143,479	30,107	40,693	70,800		440,164	115,962	6,850	122,812
Shrubland	11,886,492	1,332,956	1,636,806	2,969,762		3,122,819	99	50,518	50,617
Orchards and vineyards	1,641	0	0	0		395	0	0	0
Grasslands/herbaceous	61,265,199	30,524,377	7,522,837	38,047,214		7,281,376	4,013	315,119	319,132

Pasture/hay	8,422,934	3,617,119	1,943,464	5,560,583		11,491,914	772,521	175,909	948,430
Row crops	27,820,748	18,408,434	3,077,718	21,486,152		2,864,199	24,117	51,210	75,327
Small grains	24,531,893	14,234,398	4,242,829	18,477,227		925,093	0	28,111	28,111
Fallow	1,464,920	1,335,941	5,664	1,341,605		830	0	0	0
	Region M					**Region N**			
Transitional	42,196	31,550	1,028	32,578		710,270	325,784	114,519	440,303
Deciduous forest	20,598,450	17,747,466	756,054	18,503,520		77,260,846	41,318,100	9,506,827	50,824,927
Evergreen forest	475,974	381,639	16,981	398,620		9,821,817	4,908,472	784,915	5,693,387
Mixed forest	784,886	604,370	86,843	691,213		16,905,025	8,349,968	1,913,308	10,263,276
Shrubland	131,579	66,827	29,415	96,242		113,095	15,815	35,425	51,240
Orchards and vineyards	1,641	366	237	603		0	0	0	0
Grasslands/herbaceous	7,167,955	5,412,607	1,102,970	6,515,577		819,757	132,804	63,654	196,458
Pasture/hay	41,779,594	35,580,698	2,511,649	38,092,347		29,304,299	16,200,389	6,055,249	22,255,638
Row crops	95,256,041	91,190,514	4,347,296	95,537,810		8,579,668	5,692,221	1,884,367	7,576,588
Small grains	1,774,879	1,507,056	207,035	1,714,091		115,171	32,717	69,021	101,738
Fallow	1,453	1,453	0	1,453		0	0	0	0
	Region O					**Region P**			
Transitional	35,969	27,705	751	28,456		4,693,649	2,685,403	326,110	3,011,513
Deciduous forest	759,569	315,830	65,868	381,698		37,007,040	16,747,193	6,713,814	23,461,007
Evergreen forest	477,050	422,204	3,232	425,436		35,232,497	17,465,983	2,911,781	20,377,764
Mixed forest	432,492	294,965	14,599	309,564		27,316,475	14,027,522	2,521,098	16,548,620
Shrubland	0	0	0	0		32,509	5,703	0	5,703
Orchards and	0	0	0	0		16,655	12,622	0	12,622

vineyards								
Grasslands/herbaceous	13,413	4,725	1,819	6,544	444,602	95,373	2,955	98,328
Pasture/hay	1,746,198	674,024	114,726	788,750	21,623,641	11,145,334	3,435,319	14,580,653
Row crops	13,042,625	5,615,520	1,714,230	7,329,750	21,739,899	11,990,276	3,560,690	15,550,966
Small grains	1,303,159	623,734	93,435	717,169	406,034	313,567	6,494	320,061
Fallow	0	0	0	0	0	0	0	0
	Region T							
Transitional	1,426,055	402,060	11,812	413,872				
Deciduous forest	3,441,832	563,371	91,597	654,968				
Evergreen forest	11,697,100	2,635,023	279,575	2,914,598				
Mixed forest	3,654,867	766,966	90,569	857,535				
Shrubland	910,603	316	0	316				
Orchards and vineyards	9,519	30	0	30				
Grasslands/herbaceous	1,162,720	64,534	0	64,534				
Pasture/hay	4,519,370	552,854	50,004	602,858				
Row crops	6,536,205	1,176,024	294,945	1,470,969				
Small grains	1,640,177	1,134,243	0	1,134,243				
Fallow	0	0	0	0				

Region M contains the greatest density of existing BCFs as indicated by the fact that approximately 91 percent of the land cover types with the potential to support dedicated energy crops and by-products that could be used by a BCF are located within a 50-mile radius of a BCF. Under Alternative 1 acreage for dedicated energy crops increases by approximately 3.9 million acres, and the cumulative footprint of potential acreage in Region M that could participate in BCAP is large, placing an emphasis on the remaining land cover types that support habitat such as deciduous forest, evergreen forest, and pasture/hay. Because cropland acres enrolled in the BCAP will be capped by 25 percent in qualifying counties, the potential deleterious effects upon wildlife on the region should be limited.

Table 4.2-3. Proportional Increase (%) in BCF Acreage under Alternative 1 from the Original Acreage under No Action Alternative

	Proportional change added as BCF by Region*								
Land Cover Types	**D**	**G**	**H**	**J**	**M**	**N**	**O**	**P**	**T**
Transitional	0.00	14.29	12.52	**8.37**	2.44	16.12	2.09	6.95	0.83
Deciduous forest	0.00	9.97	16.87	3.20	3.67	12.30	8.67	**18.14**	2.66
Evergreen forest	0.00	0.50	9.39	0.37	3.57	7.99	0.68	8.26	2.39
Mixed forest	0.00	**32.39**	**28.36**	1.56	11.06	11.32	3.38	9.23	2.48
Shrubland	0.04	3.86	13.77	1.62	**22.36**	31.32	0.00	0.00	0.00
Orchards and vineyards	0.00	0.00	0.00	0.00	14.44	0.00	0.00	0.00	0.00
Grasslands/herbaceous	**0.74**	9.99	12.28	4.33	15.39	7.76	**13.56**	0.66	0.00
Pasture/hay	0.00	14.39	**23.07**	1.53	6.01	20.66	6.57	**15.89**	1.11
Row crops	0.19	10.66	11.06	1.79	4.56	21.96	**13.14**	**16.38**	**4.51**
Small grains	0.00	8.88	17.30	3.04	11.66	**59.93**	7.17	1.60	0.00
Fallow	0.02	2.10	0.39	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.09	9.73	13.18	2.35	8.65	17.22	5.02	7.01	1.27
STD	0.22	9.11	8.47	2.42	6.85	16.99	5.15	7.17	1.53

*Bolded values represent those greater than the Mean + 1 STD, and which we consider to be a major change

Region N includes approximately 77.0 million acres of land within a 50-mile radius of a BCF with the potential to support a dedicated energy crop that could be used by a BCF. Under Alternative 1, the acreage potentially available increases this by approximately 4.4 million acres (Table 4.2-1). Similar to Region M, the contiguous acreage of crop land is less and tillable tracts fragmented by other native habitats. The cumulative footprint of potential acreage in Region N that could participate in BCAP is large. The mixture of land cover types that support wildlife such as deciduous forest, evergreen forest, and shrubland should result in sustainable vegetative communities (Table 4.2-1). In addition, the cropland acres cap (25 percent in qualifying counties) minimizes any potential deleterious effects upon wildlife populations within the region.

Under the Proposed Action the project locations of new BCFs in Region O and T may have a significant impact on the amount of acres of grasslands and row crops available (Table 4.2-2). As discussed earlier, while it is not expected that all of the available acreage of these land cover types would be affected by the establishment of these new BCFs, it is important to note that these amount of acreage available within the 50-miles region makes up a significant level of the available grasslands and row crops within these regions. If these BCFs were to become operational and more efficient, there is a concern that there would be more lands converted and competition between land resources for feedstocks and other agriculture commodities would be greater.

Region P contains a high density of existing BCFs as indicated by the fact that approximately 80 percent of the land cover types with the potential to support feedstocks and by-products that could be used by a BCF are located within a 50-mile radius. Under Alternative 1 acreage for dedicated energy crops increases, and the cumulative footprint of potential acreage in Region P that could participate in BCAP is large, placing an emphasis on the remaining land cover types that support habitat such as pastureland and cropland (Table 4.2-2). Because cropland acres enrolled in the BCAP will be capped by 25 percent in qualifying counties, the potential deleterious effects upon wildlife on the region should be limited.

Indirect Impacts

The measurement of the indirect effects the BCAP program would have on the wildlife resources of regions under consideration under Action Alternative 1 must be assessed in terms of sustainability. While available literature tends to indicate that production costs and maintenance of feedstocks may be less than row crops, it is understood that the establishment of feedstocks has the potential to be dependent on herbicides, insecticides, fungicides and fertilizers in the first couple of years of growth, and may have a direct impact on adjacent native vegetation through drift.

The potential effect of feedstock production on reduction or increase of nonpoint pollution of water quality depends greatly on the amount and type of land converted to energy crop production (Ranney and Mann 1994), and is discussed later in Section 4. However, it is important to note that there are potential positive benefits on water quality from feedstock plantings. At least some perennial energy crops, for example, could be established between waterways and annual row crop plantings to serve as filters for agricultural crop runoff. It is also anticipated that perennial energy crop plantings will require fewer fertilizers than most food crops (Ranney and Mann 1994). To the extent that land now dedicated to row crop production is converted energy crop plantings, some reduced water should be obtained. However, the potential net effect of energy crops on overall fertilizer use and nutrient runoff will be difficult to assess until commercial production begins.

The potential for nutrients entering groundwater is principally a function of the amount of fertilizer applied, the rate of plant uptake, the amount of nutrients bound to soil and organic matter, and weather conditions. Nitrogen is considered the most soluble of fertilizer macronutrients and is of most concern, particularly if applied during crop establishment phases when few roots are available to draw on it. Both phosphorus and nitrogen have contaminated water systems as a result of currently accepted agricultural practices (Carpenter *et al.* 1998; EPA 2008c). EPA has demonstrated through surveys of 1347 well water samples found nitrate levels above the 10 parts per million (ppm) human-health standards in 2.4 percent of the rural wells and 1.2 percent of the community wells (Ranney and Mann 1994). Animal wastes are the primary source of nitrate contamination of groundwater, but nitrogen fertilizers contribute to the problem. Actual nitrogen leaching rates have rarely been quantified for energy crops. Extremely heavy applications of fertilizers as municipal waste water to short-rotation hybrid poplar in central Pennsylvania resulted in groundwater nitrogen levels still within EPA standards (Sopper 1982) even with very heavy nitrogen loadings year after year. Nitrate-leaching studies of hybrid poplars in northern Wisconsin suggest that groundwater may be affected in the first year or two of crop establishment (Van Miegroet and Cole 1982).

Pesticides, including herbicides, insecticides, and fungicides, can potentially contaminate water supplies. As with fertilizers, ground and surface waters are most vulnerable to contamination from herbicides and pesticides during the crop establishment phase. However, it is estimated that insecticide and fungicide use will be very low for energy crops, and herbicide use will be much lower than that for row crops and similar to levels for pasture and hay land. During the establishment phase, perennial energy crops are expected to require more herbicides than wheat but significantly less than soybeans. Widespread use of insecticides and fungicides on energy crops is not anticipated.

The 2 year establishment phase of SRWC requires about the same herbicide application rate as that of corn, if total weed control is the desired result (Hansen and Netzer 1985). This means that average herbicide application rates for most energy crops are relatively low because of infrequent times of applications. But when they are applied, they approximate application fates for row crops. Furthermore, most herbicide use occurs during crop establishment precisely when maximum leaching and erosion also occur (Russelle and Hargrove 1989).

Herbicides can spread from their site of application in various ways. Four routes of particular concern are: drifting in the wind during application; leaching into groundwater; being carried off the land by water runoff and erosion into streams, wetlands, and areas of silt deposition; and spills during chemical transport, mixing and equipment cleaning. All of these problems can be controlled if not eliminated. Proper application methods can correct drift; alternative herbicides and modified weed control protocols under certain weather conditions can correct leaching into groundwater; and the development of safety measures, frequent training, regulations and clear labeling practices can address chemical spill.

Some of these same chemicals are slated to be used with energy crops. However, use will be much more infrequent for perennial herbaceous and woody crops, which will use herbicides and pesticides for about one to two years in a 10-20 year period. The establishment of perennial grass with the use of atrazine may present the greater concern. Any change from annual to perennial herbaceous or woody crops will reduce groundwater and surface-water contamination significantly, whereas conversions of hay land, pasture, or forage crop to energy crops are expected to generate little change in water quality.

Mitigation Measures

The conversion of agricultural land from row crops to biofuel crops under Action Alternative 1 has the potential for positive and negative effects upon the vegetation. The suggested appropriate manner in which to suggest effective mitigation approaches to the conservation of vegetation when dealing with these issues begins by understanding the processes that take place and how these actions either positively or negatively impact the resident wildlife. What is paramount is the development of a framework that has the flexibility to address positive and negative impacts on different taxa at different spatial and temporal scales, recognizing that there are trade-offs that will be determined by managers on a site specific basis that involve weighing short-term-localized effects with long-term-regional impacts on sustainability and species diversity (Firbank 2008). Further, Firbank (2008) suggests that it is useful to separate impacts at the local, regional, and national level spatially so that the offending or beneficial processes can be identified more readily.

One of the best strategies to achieve conservation goals for a wide range of species is to apply different management techniques to different fields in an area during the year instead of applying the same management schedule to all fields at the same time. Additionally, irregular management versus frequent will increase the biodiversity of the grassland via multiple stages of succession (Rahmig *et al.* 2009). Stone (2007) found that timing and scale of conversion were important in their impact on the small mammal community, and that by staggering disturbance over a period of years the negative impacts could be mitigated. Gill *et al.* (2006) determined that spatial and temporal rotation of prescribed fire and herbicide applications in CRP grasslands helped maintain and sustain vegetative structure where the species composition of an area was of less concern to management. Renfrew *et al.* (2005) observed an avoidance of edge areas by grassland birds, leading them to conclude that the complexity surrounding their strategies for minimizing predation must be more complex than first thought.

4.2.3.2 Wildlife

Under Alternative 1, the economic analyses indicated that given a limited funding supply under BCAP, BCAP would be able to support up to five project areas based on demonstration-scale BCF or two project areas for commercial-scale BCF through the new dedicated energy crop establishment. At the landscape and regional scale, the addition of perennial energy crops, especially woody crops, will add diversity to regions consisting of extensive monocultures of annual food and fiber crops. A landscape comprised of many small perennial monocultures, each with a different dominant species and of different ages, will have greater diversity than a landscape with one single-aged monoculture.

Direct Impacts

<u>Issues of Scale, Disturbance Intensity, and Regional Species Richness</u>

The BCAP program has potential impact wildlife on three distinct scales: local (site specific), regional (landscape), and national (ecoregions). The question of which scale is appropriate to assess the direct impacts of BCAP actions on the various species of wildlife is a component of the intensity of the action locally, the context of the local environment in the regional matrix of similar habitat types, and the distribution of the regional habitat components throughout the ecoregions that contains all similar types of habitat. The effects on the more robust measure of wildlife as biodiversity again may mean that while a reduction in local biodiversity occurs, there is little change at a regional level and no change at a national level.

Under Action Alternative 1, up to 25 percent (n = 44,000 acres) of an overall area of 5.1 million acres would be converted from existing agricultural use (which is less than sufficient at providing all of the needs for any wildlife species) to one that is more natural and thereby beneficial to a much broader diversity of wildlife (and would likely provide all of the resources required for many species). This means that in a region where the BCAP program was implemented within the existing agricultural landscape under Action Alternative 1, a small fraction (0.86%) of land would be converted. This makes it important for site specific assessments in case there are species that are locally isolated, but the effect at the regional and national levels would be minimal and likely measureless for the majority of wildlife.

The greatest potential impacts on wildlife resulting from implementation of the BCAP program would result from habitat fragmentation. Excessive fragmentation stresses many wildlife species, and in instances where an existing fragmented landscape is further degraded into poor quality habitat, wildlife species that were in a state of decline may be further isolated. The effects of fragmentation then cause a trickle down effect that could result in impacts to the species richness of an area, because local species extinctions would reduce the overall biodiversity for that area.

Protection of biodiversity is becoming increasingly important as naturally occurring habitat is increasingly diminished (Wilson 1988). Biodiversity is difficult to define and even more difficult to protect because of its complexity. The concept includes endangered species and critical habitats as well as regional species. It is defined by species distributions at large scales (regional or global), but is determined by species presence at the local scale (Ranney and Mann 1994). At the local scale, biodiversity includes the numbers of species in a given area, species composition, genetic variability and the habitat diversity and ecosystem function necessary for survival of those species. On a larger scale, landscape pattern is important to biodiversity.

Another aspect of biodiversity is the importance of individual species or groups of species at a small scale in relation to the regional or global scale. Introduced species may replace native species without lowering diversity at the local scale, and severe disturbances of natural ecosystems may increase diversity at the expense of the species initially present (McLaughlin *et al.* 1985). Thus, species displacements may increase biodiversity locally, but may lower diversity regionally and globally. For instance, species diversity can be high in young forests or edges of forests, but some species can survive only in interior forest habitat. As interior forest habitat becomes less abundant, the regional and global importance or rarity of the species living there increases.

Currently, no consensus exists on how best to assess and quantify the sustainability of renewable energy production at a local scale (Ogle 2008). However the general meaning of the term “sustainable” is “to endure”. Discussions of what is meant or intended by the term sustainable must be evaluated in terms of context, scale, space, and time. In broad terms environmental sustainability must incorporate the following principles: future generations must have equal or better environment, economic (or as in this study, farming) activities must not degrade the environment, ensuring that the environment is allowed to be adaptable and resilient to change, that irreversible damage and long term damage to the environment be avoided, and that practices that are sustainable at one scale are not damaging at a larger scale. For example a farmer should not be satisfied that he has achieved a sustainable system just because there is no environmental degradation on his property if his practices result in damages downstream. This concept would also apply on the regional and national scales.

Scientists have documented that there are both benefits and challenges to the environment through the conversion of existing or new crop land into biofuel feedstocks. Perennial herbaceous plants (such as switchgrass) in particular have been acknowledged to provide greater wildlife habitat, reduced soil erosion, and improved water quality by means of a reduction in pesticide and fertilizer usage compared to conventional commercial crop production. However, some of the benefits of grass feedstocks are only optimally realized when the grasses are not intensively managed for total dry matter yield. Monocultures consist of one dominant species, often have little structural diversity within an even-aged stand, and by definition comprise one vegetation type. Production of annual energy crops as monocultures would likely result in the same level of biodiversity as production of conventional annual crops, such as sorghum or corn. The intensification of production necessitates reductions in tolerable plant diversity within the stand, the use of fertilizers and pesticides, and greater plant densities, which curtail nesting, denning, and foraging activities. Therefore, in essence the perennial grass cover is comparable to a monoculture commercial crop.

One of the key difficulties in assessing the effects of biofuel crop production is the inability to quantitatively directly measure and assess the changes to biodiversity as a result of the action. The analysis of feedstock impacts on wildlife must take into account a number of factors. These factors include land resource scale, landscape patterns, landscape complexity, resource interspersion and juxtaposition, and temporal relationships. The impact of these variables also is conditioned by the needs and capabilities of the wildlife species themselves. These details are best analyzed on a project specific basis.

It is generally noted that suitability of agricultural lands for abundant and diverse wildlife populations varies considerably. Agricultural lands include intensively farmed row crops to extensively grazed native range lands. While efforts are often made to exclude wildlife from fields of row crops wildlife utilization may actually be encouraged on rangelands. Many farmers may actually manage their field crops to increase game animal and bird activities on their land. Crop rotation, strip cropping, grass and forested riparian buffers, seeded food plots, grassed waterways are common methods that agricultural producers can create habitat complexity, travel corridors, and foraging, and denning, and nesting habitat on their lands with little to no compromise in agriculture production. It must also be noted that managing vegetation like switchgrass for wildlife habitat is much different than managing switchgrass for biomass yield as a BCF feedstock. This said, native unfarmed lands typically provide more of the life history requirements for most vertebrates and many invertebrates, because of the more diverse and natural matrix of habitat types than managed commercial agricultural lands. The result is a net increase to biodiversity at the local scale.

Most wildlife species begin to decline when agriculture expands to the point of replacing extensive tracts of native habitat, and a study in Iowa showed that breeding bird species associated with the agricultural landscape were lowest under an intensively managed farmed row crop monoculture scheme and highest in a diverse mosaic of crop and non-crop habitats (Best *et al.* 1995). Native grasses, like switchgrass, may furnish greater long-term and seasonal benefits to wildlife than introduced grasses (Brady 2007). Theoretically there exists an optimum degree of fragmentation at the landscape scale (e.g. to maintain both interior and edge species) that will permit an integrative approach to sustainable agriculture, as well as to conserve biotic diversity at a greater spatial and temporal scale (Barrett and Peles 1994). Grassland bird species showed marked increases in diversity and richness in conversion areas where there was also suitable woody cover (Coppedge *et al.* 2001). As agricultural intensification declines, correlative increases in food web complexity can be observed (Culman *et al.* 2009).

Recently, USDA has sponsored, under the Conservation Effects Assessment Project (CEAP), a series of quantitative studies estimating wildlife response to USDA conservation programs (NRCS 2008), including specifically native and non-native CRP grassland conservation covers (Riffell *et al.* 2006; NRCS 2007a). A broader review of fish and wildlife response to Farm Bill conservation practices was recently undertaken in a series of papers published by the Wildlife Society in partnership with the CEAP, including several concerning grasslands (Haufler and Ganguli 2007; Jones-Farrand *et al*. 2007). The latter provides a useful summary of the issues concerning estimating the benefits of converting agricultural land into conservation areas for wildlife. Issues summarized include the potential impacts of particular conservation practices and vegetation management, how problems with existing datasets have structured analyses, and the complexity of addressing the habitat needs of many different types of wildlife that are often conflicting. The major conclusions are: (1) Conservation Plans should be designed for individual priority wildlife species for specific lands best suited to meet that particular species' need; (2) the benefits for a particular species would depend in part on the management of surrounding sites as well; and (3) the benefits of grassland establishment and management are location- and species-specific, hence, in order to benefit the most wildlife, the timing and frequency of management actions should be planned to create and maintain diversity of grassland successional stages over large areas.

No quantitative studies of the effects on wildlife from the conversion of cropland to biofuel crops have been completed to date. In the absence of specific quantitative studies, this analysis qualitatively assesses the impacts on biodiversity from converting cropland into switchgrass production for biofuel, using the best available data. The analysis focuses on wildlife most likely to inhabit the areas under consideration for enrollment into the BCAP program, and their predicted responses (negative/positive) to the alternative actions.

Potential direct effects include those associated with reproductive success and mortality of individuals and populations of wildlife. Changes in vegetation structure result in changes in cover for wildlife including cover associated with reproduction success (nesting and rearing young), and food sources (Klute 1994; Horn and Koford 2000; Hughes *et al.* 2000; Madden *et al*. 2000). Direct impacts to wildlife can also result from mortality sustained by conflicts with other animals during the establishment phase, and the direct impacts of establishment on nesting and rearing of young (Labisky 1957; Gates 1965; Calverley and Sankowski 1995; Renner *et al.* 1995; Reynolds 2000). Ground-nesting grassland birds are particularly susceptible to direct impacts associated with ground disturbance (NRCS 2006a).

In the absence of comprehensive data, this analysis of direct impacts on grassland birds assesses what the overall changes in sustainability of those species reliant upon the areas under consideration for conversion. A principal assumption of the analysis is that because the action areas are cropland prior to conversion to a biofuel crop, and because based on knowledge of harvest seasons these croplands do not provide a favorable environment for grassland nesting birds, no matter how fragmented or small a given area converted may be the net result is positive in favor of greater grassland bird nesting success. The caveat here is that the periods of disturbance in BCAP areas where grassland birds are resident must be limited to those calendar periods outside of their primary nesting seasons.

Large Mammals

The primary large mammal likely to be affected by the action alternative is the whitetail deer. The conversion of cropland into biofuel usage and its potential impacts on the activity of whitetail deer has begun to be studied. Preliminary results indicate whereas a reduction in deer home range size has been observed, there is no implication for a reduction in deer reproductive dynamics (Walter *et al.* 2009). Harper and Keyser (2009) suggest that switchgrass provides improved thermal cover and concealment from predators for does and fawns during the springtime, and that deer may utilize the rhizomes of the switchgrass as a valuable food source.

In general, the indirect effects of conversion to biofuel crops are expected to be negative to adults due to the loss of forage opportunities, but there is a benefit to be gained for fawns related to greater concealment cover from switchgrass areas. Additionally, deer are browsers, preferring broad-leaved vegetation to grasses; therefore, the benefits of maintaining extensive grassland areas do not extend to them.

It is not likely that there would be significant losses from direct impacts of biofuel crop conversion on whitetail deer. They are highly mobile and can move out of harm's way. Deer could possibly be birthing when haying or grazing is initiated since the birthing period for deer begins in May and can extend into August (Snyder 1991). However, deer are strongly associated with riparian areas and other densely shrub covered areas rather than open areas associated with fields in which managed crop conversion would take place. Individual young may experience conflicts with humans during the establishment phase, but it is not likely to occur at a level that would result in an impact to a population.

Small Mammals

Small mammals are an important component of the grassland ecosystem, primarily due to their intermediate trophic position and high dispersal abilities (Colorado State University 2008). Prairie rodents are omnivorous consuming significant numbers of arthropods, whereas rabbits and other small mammals are the most important prey of hawks, eagles, owls and coyotes. Small mammals alter the vegetative structure through consumption of vegetation, the disbursement of seeds, and the construction of mounds and colonies. Burrowing small mammals also enhance the soil by increasing water retention and providing refuges for other small animals, as well as aerating soil and moving soil nutrients. Christian *et al.* (1997) found that small mammal species richness and abundance levels were greater in *Populus* plantings for harvest compared to row crops.

Indirect effects of biofuel crop conversion on small mammals may include habitat changes, which in turn can result in a change in abundance, diversity, and composition of small mammal species. General composition of grassland small mammal communities is determined primarily by structural attributes of the habitat (Grant *et al.* 1982). Some species, such as voles, require more cover and litter, others require a mosaic landscape, and others prefer the more open structure provided by areas in the early stages of establishment (Clark *et al.* 1998; Yarnell *et al.* 2007). The establishment phase of biofuel conversion would involve a periodic, temporary change in the structure of the vegetation. Species that do not favor reduced cover would potentially find refuge in areas adjacent to the conversion area, at least temporarily. As long as weather patterns and other factors are favorable, switchgrass will establish itself within a year of planting, and research has shown that herbivorous litter-dwellers, such as voles, re-established themselves in tall grass prairie one year after disturbance (Grant *et al*. 1982). Movement of voles, and possibly other small mammal species, could be restricted by disturbance during establishment activities. Some species, such as deer mice and jackrabbits however, prefer reduced cover or mosaic landscapes and populations of these species may increase following disturbance events (Rickel 2005). Reduced cover could also increase the access of predators to small mammal prey species, but the overall effects are not knows (Torre *et al.* 2007).

Direct effects of conversion on small mammals are associated with reproductive success and mortality of individuals and populations. Generally, rabbits, hares and jackrabbits produce multiple litters in a year based on environmental conditions. Typically, the first litter is in the spring with a second litter later in the summer, with potential for four to five litters within a single year (Whitaker 2001). Chipmunks, ground squirrels, and pocket gophers potentially have multiple litters as well, with the first occurring in the spring. Most rodents are active year-round, but hibernation and inactivity during hot, dry seasons (aestivation) are also common. Direct impacts to small mammals from conversion would appear to be minimal. Small mammals are mobile and are able to escape from machinery, although some mortality is likely. Techniques recommended to minimize direct impacts to other wildlife would likely benefit small mammals as well (NRCS 2006a).

Birds

Conversion of cropland to switchgrass has many potential direct impacts to grassland bird species, including the presence of bird species (avoidance [Grandfors *et al.* 1996; Warner *et al.* 2000]); their reproductive success (destruction of nests, eggs, or young [Lokemoen and Beiser 1979; Wooley *et al.* 1982; Grandfors *et al.* 1996]); increase in predation (Lokemoen and Beiser 1979; Best *et al.* 1997; Horn and Koford 2000); increase in brood parasites (Grandfors *et al.* 1996), and individual collisions with farm equipment and vehicles (Wooley *et al.* 1982; NRCS 2006a). No potential direct impact is more important than the alteration or prevention of grassland birds from being able to nest and reproduce safely. It is vital that any activity that might negatively affect the primary nesting seasons (Table 4.2-4) of grassland birds (Table 4.2-5) be avoided and mitigated.

The bunchgrass nature of switchgrass can be very beneficial to species like bobwhite quail and wild turkey because it provides overhead cover but allows the broods to wander around freely searching for insects and other sources of nourishment (Harper and Keyser 2009). Higher densities and species richness values for birds have been shown to be greater in *Populus* plantings for harvest versus row crop/small grain fields and pasture/hayfield cover types (Hanowski *et al.* 1997; Chrisitian *et al.* 1998). However, grassland birds and area sensitive birds were shown to use these same areas less than the surrounding habitat. Of interest is a study by Sample *et al.* (1998) in Wisconsin, in which they observed that for 25 grassland bird species of concern, both species richness and density were noticeably higher in harvested areas of switchgrass versus unharvested areas. Their conclusion was that harvested switchgrass fields could support sensitive grassland bird species while providing an economically valuable biofuel crop annually. Switchgrass plantings as a native replacement for row crop agriculture in Iowa have shown an increase in grassland bird species (Hoffman 1998).

The widespread loss of the native grasslands throughout North America prompted the creation of the CRP under the USDA, a voluntary program under which private landowners voluntarily establish grass and other conservation vegetation on highly erodible or sensitive agricultural land. The CRP is a good example of how the reintroduction of grasslands into the agricultural matrix at the landscape level can benefit grassland birds. Benefits to date have been quantified locally (King and Savidge 1995; Best *et al.* 1997; Rodgers 1999; Reynolds *et al.* 2001), but they may be scalable given the relationship of the disturbance associated with the BCAP program at regional and national levels. The approach of the CRP program with the multi-agency CEAP shows that benefits to grassland birds and other wildlife can be designed and implemented within the context of an agricultural landscape, and that these efforts when properly managed can augment our knowledge of agricultural practices on wildlife locally and regionally. One concern is that as CRP contracts expire areas will be returned to row crop status, but if the BCAP program allowed for the continued development of these areas as a biofuel crop it would then continue to improve the richness and abundance of grassland birds shown to benefit from such habitat management actions. Areas that have been converted from

Table 4.2-4. Primary Nesting Season Dates by State

State	Date
Alabama	April 15 – July 15
Alaska	May 15 – June 25
Arizona	April 1 – July 1
Arkansas	April 1 – July 15
California	April 1 – July 1
Colorado	March 15 – July 15
Connecticut	April 15 – August 1
Delaware	April 15 – August 15
Florida	March 1 – July 15
Georgia	April 1 – August 31
Idaho	April 1 - August 1
Illinois	April 15 – August 1
Indiana	April 1 – August 1
Iowa	Jun 1 –August 1
Kansas	April 15 – July 15
Kentucky	May 15 – August 1
Louisiana	April 15 – July 15
Maine	May 1 – August 1

Maryland	April 15 – August 15
Massachusetts	April 1 – August 1
Michigan	April 1 – July 31
Minnesota	May 15 – August 1
Mississippi	April 1 – August 15
Missouri	May 15 – August 1
Montana	May 15 – August 1
Nebraska	May 1 – July 15
Nevada	May 1 – July 15
New Hampshire	April 15 – August 1
New Jersey	April 1 – July 15
New Mexico	March 1 – July 1
New York	April 1 – August 1
North Carolina	April 15 – September 15
North Dakota	April 15 – August 1
Ohio	March 15 – July 15
Oklahoma	May 1 – July 1
Oregon	March 1 – July 15
Pennsylvania	April 1 – August 1
Rhode Island	April 1 – August 1
South Carolina	April 1 – September 1
South Dakota	May 1 – August 1
Tennessee	April 15 – July 1
Texas	March 1 – July 1
Utah	April 1 – July 15
Vermont	April 15 – July 31
Virginia	April 15 – August 15
Washington	April 1 – August 1
West Virginia	March 15 – July 15
Wisconsin	May 15 – Aug 1
Wyoming	May 15 – July 15

row crop to grasslands have been shown to provide better arthropod diversity for grassland birds to forage upon versus more intensively managed agricultural areas (McIntyre and Thompson 2003).

Grassland bird species respond to habitat manipulations in a variety of ways (reviews by Saab *et al.* 1995; Ryan *et al.* 1998; Johnson *et al.* 2004) based on many factors, and the issues previously mentioned regarding questions of appropriate scale apply especially to this group of species. The vegetation analysis concluded that changes to the vegetation would be primarily to the structure. Changes in vegetation structure would have serious implications for local grassland bird populations, but regionally if enough habitats of varying types are available the impacts may again be minimized. As will be discussed in the mitigation section of this chapter, strategies that combine a varying array of harvest strategies will benefit grassland bird diversity.

Table 4.2-5. Representative Grassland Birds by State

State	Common Name	Scientific Name
Idaho	savannah sparrow	*Passerculus sandwichensis*
Kansas	northern bobwhite quail	*Colinus virginianus*
Montana	savannah sparrow	*Passerculus sandwichensis*
North Dakota	mourning dove	*Zenaida macroura*
Nebraska	savannah sparrow	*Passerculus sandwichensis*
New Mexico	savannah sparrow	*Passerculus sandwichensis*
Oklahoma	northern bobwhite quail	*Colinus virginianus*
Oregon	Grasslands - savannah sparrow	*Passerculus sandwichensis*
	Sagebrush - Blue-gray gnatcatcher	*Polioptila caerulea*
South Dakota	northern bobwhite quail	*Colinus virginianus*
Texas	northern bobwhite quail	*Colinus virginianus*
Utah	Grasslands - savannah sparrow	*Passerculus sandwichensis*
	Sagebrush – Brewer’s sparrow	*Spizella breweri*
Washington	northern bobwhite quail	*Colinus virginianus*
Wyoming	Grasslands - northern bobwhite quail	*Colinus virginianus*
	Sagebrush – Brewer’s sparrow	*Spizella breweri*

Amphibians and Reptiles

Reptiles and amphibians (collectively referred to as herpetiles or herpetofauna) would potentially have positive and negative responses to disturbance. Grasslands that have been disturbed may be used more frequently by herpetofauna because the variable habitat structure provides more micro sites (i.e., sunning and shading spots) (Partners in Amphibian and Reptile Conservation [PARC] 2008). Additionally, some reptiles and amphibians, especially members of the genus Phrynosoma (horned lizard), may benefit from disturbance due to the reduction of dense vegetation, increasing the open areas for foraging (Pianka 1966; Fair and Henke 1997). By increasing native vegetation, the invertebrate population may increase, indirectly increasing the herpetofauna that may forage upon them (PARC 2008). Herpetofauna need various stages of vegetative succession within their habitat, which historically was achieved through natural disturbance regimes (NRCS 2005).

Populations may experience permanent short-term reductions in population sizes locally the year that conversion occurs as a result of crushing, and fatalities from agricultural equipment, and increased predation due to increased exposure. Many herpetofauna are not fast enough to move out of the way of potential danger. However, these potential impacts would not significantly impact breeding and reproduction of amphibians because most amphibians breed in early spring, laying eggs in wetlands and other aquatic habitats, and then move into terrestrial areas to winter. Reptiles breed in a variety of habitats, including upland pastures and grasslands, thus it is anticipated that there would be some loss to resident reptiles.

Techniques that may be implemented to reduce negative impacts to herpetofauna include initiate disturbance at the center of a treatment area, progressively moving out from the center to allow wildlife to flee in all directions and not become trapped to one side. The highest potential for mortality due to site management occurs during spring and fall migrations to and from breeding or wintering habitats (NRCS 2006a).

Invertebrates

Invertebrate community studies have indicated that the diversity of invertebrates is often related to plant species diversity, structural diversity, patch size, and density (Jonas *et al.* 2002; McIntyre and Thompson 2003). Species richness in invertebrate communities appears to be greatest in mid to late June in temperate regions of the United States (Burke and Goulet 1998; Jonas *et al*. 2002). Total biomass of invertebrates has been documented to be significantly greater in areas with greater forb coverage (Klute 1994).

Invertebrate species responses to conversion correlate to the life-style and habitat preferences for a species. Managed monoculture would create a uniform plant height and remove smaller topographical features, such as grass tussocks (Morris 2000). This would result in a decrease in plant structural diversity within a field and thus a potential decrease in invertebrate diversity based on a species preference for structure. However, long-term abandonment of management in formerly farmed fields can also lead to insect declines, primarily resulting from floristic changes (Swengel 2001). Properly managed commercial switchgrass for biofuel production would result in a dense, uniform plant stand that would have minimal structural diversity, thereby minimizing niches for invertebrates. The relative merit of switchgrass habitat for invertebrates (or any wildlife category) is dependent on what other agricultural systems it is compared with. Commercial switchgrass production will result in a net improvement in habitat when compared to traditional row crop agriculture but it may equal or lower than the habitat value provided by properly managed improved hay or native grass hay lands.

Direct mortality to invertebrates from conversion would be dependent upon the degree to which a species is exposed, specifically if the species is a below ground insect, and to mobility of the species or life stage (Swengel 2001). Arthropod populations have been documented to decline immediately after mid-summer disturbances related to mowing, but only for a two week period (Bulan and Barrett 1971). Impacts to invertebrates from the establishment phase include destruction of potential nest sites, existing nests, and contents; direct trampling of invertebrates; and removal of food resources (Sugden 1985).

These direct impacts to invertebrates could be reduced if the establishment process occurred when flowers are not in bloom, planting is conducted in a manner that would produce a mosaic of vegetation patches, and a single area is not disturbed more than once a year (DiGiulio *et al*. 2001). Pollinator invertebrate species include butterflies, moths, bees and wasps, beetles and flies and are a critical component of the grassland ecosystem as well as crop production. Pollinators include generalists that forage from a range of plants and specialists that are limited in their sources for nectar and pollen. Two primary habitat needs for all pollinators include a diverse native plant community and egg laying or nesting sites. Management techniques, such as grazing, mowing, prescribed fire and insecticides can be both beneficial and detrimental to pollinators and no single management plan benefits all pollinators (Black *et al.* 2007). It is suggested by the Xerces Society for Invertebrate Conservation (Xerces) that prior to any implementation of management techniques a biological inventory be conducted to identify important plant resources and pollinator habitat for generalist and specialized pollinator species (Black *et al.* 2007). Xerces emphasizes that some areas remain untreated when implementing management techniques to promote recolonization of the treated areas. Furthermore, disturbance of a site in multi-year cycles provides a source from which pollinators can spread

(Black *et al.* 2007). Specific recommendations by Xerces relating to harvesting include delaying management practices until most flowering plants have died back and a majority of the pollinators are in diapause (a state of dormancy) or have successfully laid eggs, which typically occurs in late summer or early fall.

Aquatic Resources

The two direct impacts from BCAP program implementation that can be expected to affect on aquatic resources are the dangers associated with toxins and increased sediment load in the waterways. It has been suggested that the impacts from herbicides and pesticides will be greatly reduced compared to their threat and usage levels when the environment is developed in row crop agriculture (Ranney and Mann 1994). Many of the potential negative effects associated with toxins and sediment runoff could be mitigated for by using proper designed management schemes. A major management goal in agricultural areas that are also concerned with conservation of native wildlife is sustainable management of watersheds. The hydrological component of the landscape is inextricably linked to the soil, air, plants animals, and humans that live there in those types of environments. Land clearing, leveling, draining, tilling, fertilizing, and harvesting together create prolonged perturbations manifested in the ecological and physical conditions of streams and rivers. Regardless of the cause of a problem in a watershed, its effect on aquatic habitats and their biological communities is dramatic. Physical damage due to channelization, erosion, sedimentation, and altered hydrological regimes coupled with ecological damage due to excessive nutrients, pesticide contamination, and riparian clearing cumulatively diminish the quality of aquatic habitats and threaten their biological communities (Knight and Boyer 2007). Kort *et al.* (1998) observed that perennial herbaceous and woody biomass crops stabilized soil better than row crops, which would result in a reduced sediment load in waterways adjacent to those areas. Another recent survey of the available scientific literature on biofuel crop conversion has suggested a similar improvement to water quality as a result of the transference of row crop agricultural areas into switchgrass or other woody biofuel crops (Simpson *et al.* 2008). Snagging and clearing is generally considered detrimental to aquatic fauna because of the important role large wood plays in providing habitat and carbon. However, removal of some material may prevent bank erosion and failure, thus reducing suspended sediment loads (Knight and Boyer 2007). Field borders are often too far removed to have a significant impact on aquatic fauna; however, additional research may be necessary to explore off-site impacts of these practices. Stream crossing, bank protection, and exclusions improve water quality and intuitively should have a positive impact on aquatic fauna; however, documentation remains a significant gap. Cumulative effects of multiple practices, and the time scale at which effects of practices on aquatic communities can be demonstrated, have not been reported. Determining key indicators relevant to the appropriate time scale in the continuum of conversion actions is needed and would easily coincide with the examination of site specific assessments in the future.

Indirect Impacts

The measurement of the indirect effects the BCAP program would have on the wildlife resources of regions under consideration under Action Alternative 1 must be assessed in terms of sustainability and temporal fluctuations. The indirect effects that would potentially occur from the conversion to biofuel crops would not be immediate, but rather they would slowly emerge over time.

The indirect impacts associated with the alternatives analyzed on all wildlife species would result principally from changes in the vegetation structure, in the soil structure, and hydrological cycle. These indirect effects can also include changes resulting from the conversion process that subsequently alter food abundance (seeds, insects) and cover for protection (thermal), escape, or breeding (courtship, nests) (NRCS 1999).

Indirect effects of Action Alternative 1 that affect wildlife may include changes in quantity and quality of food, availability of nest sites, predation pressure, parasitism and disease, and competitive and social interactions (Kaufman *et al.*1990). The measurement of the indirect effects require study and observation over temporal scales measured in years, and dynamics like species population trajectories and regional biodiversity sustainability require assessments over large spatial scales over long periods of time.

Another potential indirect impact involves the loss of biodiversity on surrounding lands if the wildlife finds the conversion areas more favorable and thereby vacates the substandard land adjacent. Indirect impacts can also result from changes in plant community composition, structure, and productivity which together largely determine wildlife habitat suitability. Possibly one of the most pervasive indirect impacts is the effect of edge and patch dynamics on the wildlife. It is also possible that genetic heterogeneity may become reduced for certain species that require a more connected environment at a landscape scale. A large percentage of the indirect impacts to wildlife will stem from the direct impacts to vegetation. Compared to direct effects from these types of conversion actions there exists little examination of the broader ecological and associated indirect effects on wildlife.

An indirect effect on birds in particular may include increased exposure (thermal) and predation due to vegetation removal and composition shifts (Brady 2007). Any practice that improves runoff water quality and/or reduces sediment delivery will have beneficial effects to aquatic ecosystems (Brady 2007). Generally, as soil conserving measures increase, upland wildlife habitat quality also improves (Lines and Perry 1978; Miranowski and Bender 1982). Direct changes in land use can have greater effects on habitat quality than changes in management practices can (Miranowksi and Bender 1982). Riparian herbaceous buffers tend to have indirect effects on aquatic organisms by affecting channel morphology and erosion control, and as a source of organic materials (Knight and Boyer 2007).

4.2.4 Mitigation Measures

The conversion of agricultural land from row crops to feedstocks under Action Alternative 1 has the potential for positive and negative effects upon wildlife. In a broad context, the conversion into feedstocks is suggested to help mitigate the negative effects of greenhouse gas emissions, which in turn may help benefit biodiversity that has been continuously under siege as a result of the implications greenhouse gasses have on the regional climate regime (Firbank 2008). The suggested appropriate manner in which to suggest effective mitigation approaches to conservation of wildlife when dealing with these issues begins by understanding the processes that take place and how these actions either positively or negatively impact the resident wildlife.

What is paramount is the development of a framework that has the flexibility to address positive and negative impacts on different taxa at different spatial and temporal scales, recognizing that there are trade-offs that will be determined by managers on a site specific basis that involve weighing short-term-localized effects with long-term-regional impacts on sustainability and biodiversity (Firbank 2008). Further, Firbank (2008) suggests that it is useful to separate impacts at the local, regional, and national level spatially so that the detrimental or beneficial processes can be identified more readily.

At the local scale, the pressure applied to the existing biodiversity under Action Alternative 1 is the replacement of one form of vegetation with another. This may lead to substantial changes in the growth form, phenology, and disturbance regimes of that area, resulting in a change in the area's biodiversity. At the regional scale, the pressure applied to the existing biodiversity under Action Alternative 1 is on the spatial structure (from fragmentation and edge effects) of the various habitat components in the ecological matrix. The biodiversity of a landscape is closely related to the quality of individual habitats, their successional stages, and the way in which they are relating to each other at the regional level in a dynamic-fluid environment (Firbank 2008). For example, areas that have been less disturbed over time will tend to exhibit a greater stability in the face of a transitional environment or stochastic event. The highest quality habitats (read biodiversity here) tend to be those that have remained unperturbed over time. The greater the diversity of habitats at the landscape level, the greater the biodiversity of wildlife species (Benton *et al.* 2003; Firbank *et al.* 2008). At the National scale under Action Alternative 1, the potential exists to further fragment ecosystems that may be isolated or already degraded within the agricultural context of existing land use practices. This corresponds to a change in the intensity of how the land is used, and it must be weighed with the potential local impacts to biodiversity. The easiest way for this danger to be avoided would be to focus on implementing biofuel conversion on lands of marginal quality.

The conversion of land to biofuel production is a broad initiative that requires a thorough assessment that balances the goals of all stakeholders involved with the desire to not harm the existing regional biodiversity while allowing for an economic increase in the potential of the existing lands under agricultural use. There is a good reason why the specifics of many aspects of this plan have been referred to as requiring or needing site specific assessments, and it is largely because every situation is going to be unique enough in biodiversity composition and abiotic characteristics associated with the landscape that there would be no way to programmatically account for them all. However, what can be offered is a set of guidelines (following Firbank 2008) that are designed to provide an initial baseline idea of what the interaction between the land-use and biodiversity will be, thereby resulting in an educated and scientifically informed suggestion of whether or not it is worthwhile to proceed to the site specific analysis stage. The project areas that should be likely candidates should be those that (1) Avoid management actions that have the potential to allow the transference of non-wild genetic material to wild stock. (2) Do not create a situation where the biofuel crop becomes an invasive. (3) Are biodiverse on their own merit, meaning taking advantage of local strains to maintain genetic diversity and minimize the potential of having an effectively genetic monoculture across the region. (4) Enhance local biodiversity by management actions such as rotation of harvest sectors, alternating planting densities, and trying to create niches for grassland birds and small mammals. (5) Increase landscape diversity, which will be achievable via a good understanding of the habitat matrix. (6) Do not threaten high value habitats and species at the local scale. In other words if there already exists sensitive, rare or threatened species in an area then it should no longer be considered. (7) Promote sustainability of biodiversity. (8) Do not increase the risk to primary habitats. The easiest way to prevent future conflicts and negative impacts to biodiversity, regarding the implementation of Action Alternative 1, would be to take full advantage of existing agricultural lands, preferably those which are marginal, and offer the minimal amount of conflict between land use goals. By taking full advantage of these lands, which are likely depauperate in biodiversity already, there can be little question about a positive effect both on biodiversity locally and regionally.

The conservation of regional biodiversity in agricultural landscapes is vital to maintain proper ecosystem functioning, and to protect and buffer global biodiversity (Fischer *et al.* 2006). To ensure the long-term economic success of the BCAP program and to provide for a transparent integration of agricultural and conservation associated management goals, it is important that management choices on where to implement BCAP be scientifically defensible (Fischer *et al.* 2006). Therefore, strategies that bolster biodiversity resilience in these areas will focus upon landscape or regional patterns (guidelines 1-5) while supplementing these strategies to focus special conservation attention on more sensitive species and at risk areas (guidelines 6-10). These specific guidelines are steeped in scientific evidence, and are: (1) Design and maintain structurally complex natural complexes. Structural complexity supports species complexity. Attempts should be made to identify "keystone habitat features" that can act as a foundation upon which to base biodiversity. (2) Avoid monoculture based landscapes. Three key benefits of a structurally complex habitat matrix are the existence of native habitat for native species, reduced landscape contrast between conversion and native habitat areas, and a mitigation of the negative effects on species from edge and fragmentation effects. (3) Buffer sensitive areas. This serves to augment and support the suggestions made in number (2). (4) Connect areas of native habitat with corridors and islands of refuge for migratory species. It is not only important to manage the habitat matrix on a regional scale, but it is important to connect all of the various elements within the matrix so that they can function as a cohesive unit. This helps to mitigate the effects of any localized disturbance by allowing the replenishment of an areas biodiversity from other areas within the matrix. (5) Maintain landscape heterogeneity and maximize the existing range of environmental gradients. Heterogeneous landscapes can be designed to mimic natural patterns, and this helps to maximize associated biodiversity by expanding the range of environmental conditions and habitats over which the gradient is found (Fischer *et al.* 2006). Or to put it another way there is more benefit to having something other than a vast monoculture from a biodiversity standpoint. Guidelines 6-10 address specifics related to processes at work within the landscape, and are designed to augment the pattern-oriented guidelines 1-5 offered. (6) Enhance keystone species and functional diversity. In the case of grassland birds, it may be possible to treat grassland nesting birds as a functional guild that for management purposes is used as a keystone group. By creating an environment within the BCAP areas suitable and beneficial for grassland nesting birds the amount of surrogate benefit to be gained by the other areas of the regions biodiversity also improve. When many species occur within a single functional group, the potential negative effects on the ecosystem and the chances of a disturbance causing a large scale decline in biodiversity associated with that system are minimized (Walker 1995; Elmqvist *et al.* 2003). In order to achieve this it is necessary to identify the key processes that will affect in this example grassland birds nesting success. The easily identifiable way to ensure that management activities related to Action Alternative 1 do not negatively affect grassland birds while nesting is to prohibit all management related disturbance to these areas during the entire primary nesting season for the species known or expected to be present in a given area. (7) Apply the proper disturbance regimes to maintain a semblance of natural processes. The prairies and grasslands that are primarily the affected areas under the BCAP program evolved under a natural regime of fire. It would be wise to consider the use of prescribed burning in maintaining and improving these areas. Disturbance regimes that attempt to mimic natural historical ones are a good starting point (Lindenmayer and Franklin 2002; Bowman *et al*. 2004; Fischer *et al.* 2006). (8) Control invasive species. (9) Minimize any ecosystem processes that have the potential to infect the entire system (i.e. chemical toxins). (10) Be sure to catch species that may “fall” through the cracks, because they tend to be the rarer species.

One important way to ensure the minimization of impacts to grassland birds would be to avoid any management activities during the primary nesting seasons of all grassland birds associated with an area under consideration for development based upon an expected species assemblage and the calendar for the primary nesting season for that area under site specific analyses (Table 4.2-4; Bowen and Kruse 1993; Knopf *et al.* 1988; NRCS 2006a). Research examining the effects of SRWC on nesting birds revealed that to ensure successful nesting it is best to establish and locate plantings on a rotational basis (Tolbert *et al.* 1997). Switchgrass that is only harvested in the fall helps prevent mortality in wildlife that nest in these areas or uses them for cover during spring and summer. This especially provides benefits for grassland birds and whitetail deer that raise their young in these environments (Harper and Keyser 2008). If the decision is made to wait even further into the winter season additional there would be a benefit to wildlife in the form of continued cover (Harper and Keyser 2008). Exposure and predation rates are highest on adults in the wintertime, and leaving this cover can help increase adult survival rates which in turn can result in increased population densities. If switchgrass is harvested in the fall, some should be left unharvested whenever possible to continue to provide cover (Murray and Best 2003). Harper and Keyser (2008) suggest a minimum of 5 percent left unharvested around edges or some other form of cover to provide continuity in protection. This combined with an approach that either leaves whole fields unharvested or only 50% harvested can dramatically benefit resident wildlife (Roth *et al.* 2004).

Findings based upon CRP fields shows that there is no difference in production value of a fallow switchgrass field versus a previously harvested switchgrass field, and that when retaining cover the strips of unharvested switchgrass should be 50 feet wide and/or at least 0.5 acre in size (Harper and Keyser 2008) thereby reducing negative impacts on wildlife associated with fragmentation effects, smaller patches have more edge and less interior and thereby result in a greater chance of predation related mortality for small mammals and grassland birds. As has been discussed before, monoculture switchgrass fields offer little food in the form of seed and soft-mast producing forbs. Harper and Keyser (2008) suggest that incorporating various forbs into the switchgrass mixture would enhance its value as forage to wildlife tremendously while minimizing the production value minimally. In instances where the advent of a monoculture is unavoidable, hedgerows that are wide and diverse should be used to border and break up the monoculture. The addition of field borders planted with forbs and other native shrubs could provide a softer transition between fields and increase food availability and winter cover for many small mammals and grassland and upland game birds.

The conclusion is that switchgrass as a crop grown for use in the biofuel production process holds promise as being “better wildlife habitat than non-native grasses” if managed with consideration for wildlife” (Lindberg *et al.* 1998; Harper and Keyser 2008). Farrand *et al.* (2007) suggest that field size, shape, and context within the greater landscape, were all critical factors in the establishment of an effective grassland for the conservation of birds. Riffell *et al.* (2006) observed that grassland bird abundance (n = 15 species) was greater in relation to the amount of CRP grasslands in the regional landscape. Veech (2006) found a similar finding in 36 species of grassland birds in the Midwest and Great Plains, including the popular bobwhite quail. Again, any “immediate effects” on nesting grassland birds resulting from the conversion of cropland into biofuel converted lands can be negated completely by avoiding any and all regular management activities during the set “nesting seasons”.

One of the best strategies to achieve conservation goals for a wide range of species would be to apply different management techniques to different fields in an area during the year instead of applying the same management schedule to all fields at the same time. Additionally, irregular management versus frequent will increase the biodiversity of the grassland via multiple stages of succession (Rahmig *et al.* 2009). Stone (2007) found that timing and scale of conversion were important in their impact on the small mammal community, and that by staggering disturbance over a period of years the negative impacts could be mitigated. Gill *et al.* (2006) determined that spatial and temporal rotation of prescribed fire and herbicide applications in CRP grasslands helped maintain and sustain vegetative structure where the species composition of an area was of less concern to management. Renfrew *et al.* (2005) observed an avoidance of edge areas by grassland birds, leading them to conclude that the complexity surrounding their strategies for minimizing predation must be more complex than first thought.

Originally the CRP program was aimed at areas where soil was highly erodible, and the same tenets can and should be used in applying the BCAP to benefit not only terrestrial wildlife but aquatic biodiversity as well. By stabilizing the soils of these steeper sloped areas and reducing the sediment load in the riparian areas of these agricultural systems, the water clarity improves and subsequent aquatic ecosystems are capable of improving as well. There are many overlaps in the desired management objectives between the CRP and BCAP program. Another CRP initiative, which BCAP may consider in designing ways to mitigate impacts on wildlife resources and maximize the selection of the best areas for the combined goal of improved wildlife biodiversity and sustainability and biofuel production, is some form of the CRP’s own Environmental Benefits Index (EBI). The EBI is applied to potential CRP enrollments and is geared towards maximizing erosion control, water quality, and benefits to wildlife and their habitat. It could certainly be modified to add in the economic incentives at the root of the BCAP program.

4.2.5 Action Alternative 2

Alternative 2 includes the establishment of BCFs in accordance with the implementation of a broad BCAP. For the analysis no detailed location analysis is presented, as is currently impractical to perform, however geographic distribution of the feedstock would drive potential BCAP project locations.

4.2.5.1 Vegetation

Alternative 2 addresses the impacts of an expanded BCAP, in which the basic assumption would be that BCAP would play a key role in the achieving the goals established by the EISA legislation of advanced biofuels. To assess this, the methodology used for Alternative 1 was employed to look at the potential of all LRR to support BCFs and how these potential changes might impact natural vegetative communities.

Direct Impacts

Under Alternative 2, the potential impacts of the expansion of BCAP are not premised based on feedstock species composition, scale, and intensity analyzed in Alternative 1. A variety of crops may be considered. They include:

<u>Perennial Grasses</u>

Providing higher yields of biomass with lower input than corn, several genera of perennial "bunch" (clump forming) grasses, native and nonnative, are being considered for biofuel feedstock (Sargent and Carter 1999, Cornell University 2005, Tilman 2006). Perennial grasses replenish soil nutrients, help reduce soil erosion, provide wildlife habitat, and are tolerant of a wide range of environmental conditions such as poor soil, humidity, and drought. Additionally, they can be used to buffer runoff from wetland areas (Sargent and Carter 1999). Harvesting can be done with the same equipment used for traditional crops such as grass hay and alfalfa (Cornell University 2005), and once established, perennial grasses require fewer inputs of chemicals and mechanization than food crops and feedstock corn. Perennial grasses are either "warm" season or "cool" season. Warm season grasses are generally native to the United States and are usually referred to as "prairie" grasses; developing in the summer months they are tall (up to ten feet or more) with stiff structure and deep root systems. Examples include switchgrass, Miscanthus, reed canary grass, and sweet sorghum (Sargent and Carter 1999).

Although initially more costly to plant than cool season grasses and requiring three to five years to establish, warm season grasses are long-lived (up to 20 years). Cool season grasses are often nonnative species, and develop during the early spring and summer months, and again in late summer and early fall. Cool season grasses only require a year to become established, however are not as long-lived as warm season grasses (Sargent and Carter 1999).

The various grass species have advantages in over each depending on the region planted; new cultivar are being bred for enhanced rates of growth, size, and hardiness (Sargent and Carter 1999, Cornell University 2005, Tilman 2006).

Short-Rotation Woody Crops

Short-rotation woody crops (SRWC) are fast growing trees grown at relatively close spacing and harvested under shorter rotation periods than in conventional timber productions. Species being considered include willow, poplar, cottonwood, sycamore, and southern pine (BRDB 2008).

SRWC provide high yield and require minimal input. SRWC help reduce soil erosion, act as buffers for runoff, improve soil organic matter, provide habitat for a wide range of birds and can enhance landscape diversity, in contrast to agricultural crops (BRDB 2008).

Areas of the US most conducive to SRWC plantations would be river bottoms along the Pacific Coast, in the areas of high rainfall between the Cascade and Rocky Mountain ranges, throughout the Northeast and North-Central States, and in the South, on sandbanks along river systems. The largest cost component in SRWC production is harvest costs (BRDB 2008).

Sugar Crops

Crops high in sugar content are easier to process into ethanol than starch crops since the sugar required by fermentation is already present. Fast growing, high yielding biomass crops with high sugar content are being considered for feedstock and include sweet sorghum, sugarcane varieties with high fiber content known as "energycane", and sugarcane cross bred with Miscanthus, known as "miscane" (Richard 2007). The seasonal diversity of biomass production that these species afford may play an important role in ensuring year-round production of feedstock supplies. (McCutchen *et al.* 2008). A key to sustaining and enhancing growth of the biofuels industry is the development of feedstock that produce high tonnage at prices that give growers and the BCF's acceptable profit margins.

Even though ethanol production is not competitive with sugar production at current prices (for sugar destined for human consumption), production of ethanol from industrial-use sugarcane is being pursued in Florida, and Louisiana (Christiansen 2008). One ton of sugarcane produces about 19.3 gallons of ethanol, a greater ethanol output per acre than for corn. In 2007, around 880,000 acres of U.S. sugarcane were harvested (NASS 2008a), which is less than 1 percent of total acres devoted to corn. According to USDA data for 2006, 27 counties in Florida, Louisiana, Hawaii, and Texas produced sugarcane, with 1 Florida county accounting for 40 percent of total production.

However, under Alternative 2, an expanded BCAP, significant changes in how these crops are preferred will be tied to changes in net revenues as the values of the total revenues increase more than the cost of producing the feedstock, and as the increase of feedstock production reduces the supply of other crops and consequently increases their prices. Under the implementation of Alternative 2, changes in farm prices become a very important impact. Crop prices would be expected to increase due to the increase demand for cropland to plant energy corps. Hence, any future prediction of how BCAP may evolve nationally will be influenced by a number of variables including: ownership of lands that can grow energy crops, existing land cover types that can grow energy crops, the distribution of lands that can grow energy crops, and the competition between energy crops and typical agricultural crops on that are suitable for either.

Graham (1994) reported that over 99 percent of lands that can grow energy crops are in private ownership and exist as croplands (78 percent). However, the distribution of these lands is not uniform across the nation. Regions M, H, P, and N have the greatest amount of lands that can grow energy crops (Table 4.2-6) (*ibid.*).

Table 4.2-6. Distribution of lands that can grow energy crops by NRCS LRR

Region Code	Land Resource Region Descriptive	Percent
A	Northwestern forest, forage, and specialty crop region	0.7
F	Northern Great Plains spring wheat region	9.2
H	Central Great Plains winter wheat and range region	20.2
J	Southwestern prairies cotton and forage region	4.9
K	Northern lakes states forest and forage region	5.3
L	Lake states fruit, truck crop, and dairy region	8.7
M	Central feed grains and livestock region	52.2
N	East and Central farming and forest region	12.8
O	Mississippi Delta cotton and feed grains region	7.6
P	South Atlantic and Gulf slope cash crops, forest, and livestock region	16.4
R	Northeastern forage and forest region	4.5
S	Northern Atlantic slope diversified farming region	2.8
T	Atlantic and Gulf coast lowland forest and crop region	5.8
U	Florida subtropical fruit, truck crop, and range region	1.6

These findings would tend to indicate that further pressure will be placed on regions that currently support the majority of BCF facilities and requiring the utilization of more lands within the 50-mile radius to support each BCF. As discussed earlier under Alternative 1, while it is not expected that all of the available acreage of these land cover types would be affected by the establishment of these new BCFs, it is important to note that these amount of acreage available within the 50-miles region makes up a significant level of the available grasslands and row crops within these regions. If these BCFs were to become operational and more efficient, there is a concern that there would be more lands converted and competition between land resources for feedstocks and other agriculture commodities would be greater. Under Alternative 2, these concerns are amplified.

Indirect Impacts

When discussing the indirect impacts of the BCAP program, of importance is the description of the relationship between the disturbance or conversion process (i.e., the area(s) which are being turned into energy crops, the vegetation that are present within that local area, the species richness for the landscape within which the BCAP area resides, and the context of that particular landscape within the broadest context spatially of the ecoregions itself. The direct impacts to vegetation are not limited to site-specific events, and because the different degree to a particular species is impacted will vary by some degree of the interaction of that species impact of the local scale it is difficult to assess impacts without performing a site specific analysis. While the dynamics of a plant species may be directly impacted at the local site scale, if the composition of the species throughout the broader landscape is one that can absorb short-term local disturbances so long as there remains unimpacted population centers than the direct impact can be said to be measurable locally (i.e., site-specific), but inconsequential at the landscape level. Furthermore, if at an ecoregion scale the species has several landscapes over which it is distributed or several ecoregions throughout the national geographic level then there is no cause for concern. It is only in situations where a species does not have the buffers of these larger spatial scales in the context of the overall species population dynamics that it should be paramount that extraordinary measures be considered to negate or at least minimize any and all impacts local in scale.

The key issue that confronts conservation managers in regards to the potential indirect impacts on vegetation by the BCAP program deal with the consequences of fragmentation. Excessive fragmentation stresses many species (e.g., genetic drift), and the concern should be in cases where an already fragmented landscape is further parceled up into poor quality habitat that further serves to isolate those plant species that were in a state of decline originally. The effects of fragmentation then cause a trickle down effect that results in impacts to the species richness of an area, because local species extinctions do reduce the overall biodiversity for that area. Of equal importance may very well be the spatial arrangement of the habitat patches in the landscape, and these again are questions that must be dealt with in a site specific examination of the proposed BCAP developmental area (Morrison *et al.* 1992).

4.2.5.2 Wildlife

Direct Impacts

Issues of Scale, Disturbance Intensity and Regional Species Richness

The same conclusions discussed under Action Alternative 1 apply in the case of Action Alternative 2. The only difference is that Action Alternative 2 has a much larger pool of potential BCAP locations to select from, both in geographical scope and in the types of land that may be considered.

<u>Large Mammals</u>

Action Alternative 2 enlarges the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and the small/pilot BCFs and crops would qualify for BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on large mammals, especially white-tailed deer, large mammals are not expected to be impacted from the conversion of croplands and areas of marginal habitat quality into BCAP.

<u>Small Mammals</u>

Action Alternative 2 changes the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and small/pilot BCFs and crops would qualify for BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on small mammals are not expected to be reduce their population densities or richness at the regional scale from the conversion of croplands and areas of marginal habitat quality into BCAP.

<u>Birds</u>

Action Alternative 2 changes the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and small/pilot BCFs and crops would qualify for

BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on birds, grassland birds in particular, BCAP is not expected to impact population densities or species richness at the regional scale from the conversion of croplands and areas of marginal habitat quality into BCAP. However, as previously noted the science examining the impacts of row crop conversion to biofuel energy crops is only beginning to lend insight into the long-term implications of such large scale landscape alteration activities. The potential magnitude of the impact on grassland bird habitat therefore is a proximate measurement. As discussed in the mitigation section under Alternative 1, the largest potential suite of negative impacts to grassland bird persistence and sustainability within the BCAP regions is the avoidance of management activity on BCAP sites during the PNS of all birds likely to be utilizing that specific BCAP site. Combine this with the fact that a small portion of the total grasslands in a BCAP region would be managed actively for BCAP production and the potential negative impacts on grassland nesting birds appears further diminished under Alternative 2.

<u>Amphibians and Reptiles</u>

Action Alternative 2 changes the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and small/pilot BCFs and crops would qualify for BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on the herpetofauna are not expected to reduce their population densities or richness at the regional scale from the conversion of croplands and areas of marginal habitat quality into BCAP.

<u>Invertebrates</u>

Action Alternative 2 changes the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and small/pilot BCFs and crops would qualify for BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on the invertebrates are not expected to reduce their population densities or richness at the regional scale from the conversion of croplands and areas of marginal habitat quality into BCAP.

<u>Fish</u>

Action Alternative 2 changes the category of lands eligible for consideration of conversion into BCAP to include new non agricultural land, an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and small/pilot BCFs and crops would qualify for BCAP consideration. As stated in the discussion of the direct effects of Action Alternative 1 on the fish are not expected to reduce their population densities or richness at the regional scale from the conversion of croplands and areas of marginal habitat quality into BCAP.

Indirect Impacts

As was the case under Alternative 1, the majority of indirect effects remain unknown because of differences in temporal scale and issues pertaining to stability. The results of the vegetation analysis impact section 4.2 are relied upon to assess indirect impacts to wildlife. The indirect impacts associated with vegetation can include changes in abundance, diversity, and composition of communities

Mitigation Measures

No significant negative impacts to any wildlife are expected from implementation of Alternative 2 if established conservation practices, procedures, and guidelines are followed, and the BCAP management plan for the specific site is adapted to resource conditions on the area just prior to engaging in active establishment of the biofuel crop.

4.2.6 No Action Alternative

4.2.6.1 Vegetation

The No Action Alternative provides a baseline for quantifying and comparing environmental consequences associated with each BCAP action alternative. Under the No Action Alternative, the BCAP would not be implemented; therefore, there would not be financial assistance available for the establishment of new dedicated energy crops in the U.S. Thus, the impacts associated with existing facilities in each region are considered in order to provide a basis for analysis of the alternatives.

Direct Impacts

<u>Current Crop Trends</u>

Agricultural production in the U.S. is distributed throughout five regions: the Corn Belt, the Great Plains, the West Coast, Delta, and Sugarcane (Figure 4.2-3). Corn and soybeans are primarily farmed in the Corn Belt. Wheat is the dominant crop in the Great Plains and West Coast regions with corn and sorghum serving as alternative crops. Rice is a major crop in the Mississippi

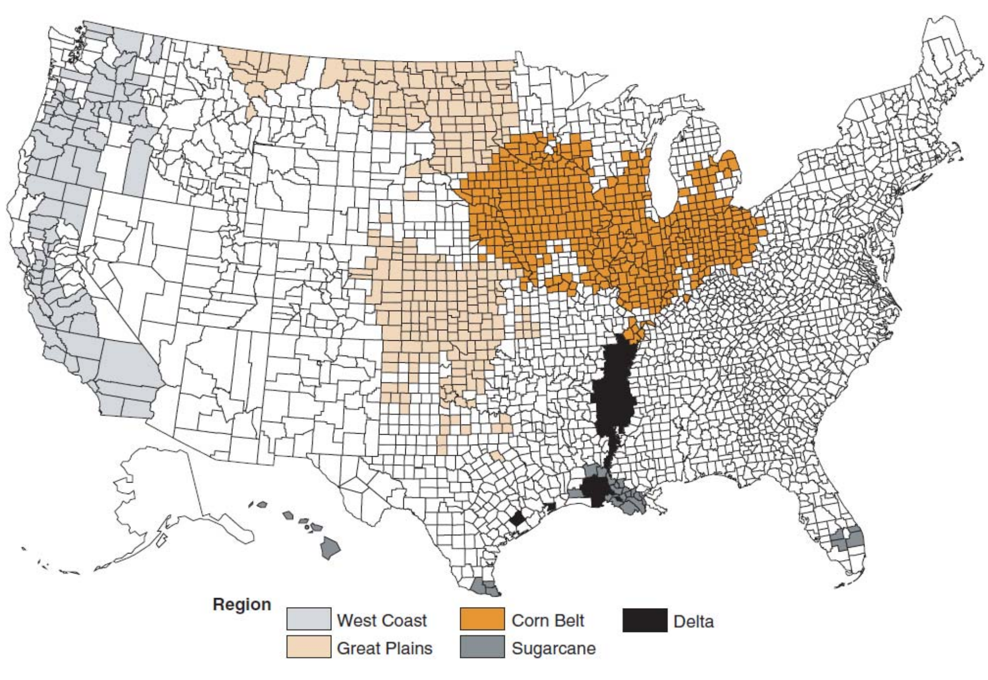


Figure 4.2-3. Crop residue regions (Gallagher *et al.* 2003)

Delta; about half of rice production in the region occurs in Arkansas and a large proportion takes place in southwest Louisiana. Sugarcane bagasse is important in southern Louisiana and southern Florida (Gallagher *et al.* 2003).

Vegetation and wildlife diversity can be described in the five agricultural regions by comparison with the LRRs defined in the Agriculture Handbook 296. The Corn Belt is located within LRR M, N, and P. Wheat crops are primarily grown in the Great Plains and West Coast agricultural regions which fall within F and G. Rice crops are dominant in the Southern agricultural region, which covers LRR O, P and T. The majority of rice is found in LRR O and P.

Corn Trends

From providing just one percent U.S. of the nation’s transportation fuel supply in 2000, ethanol production roughly quadrupled by 2007 to an expected 7 million tons, about 3 percent of the nation’s vehicle fuels. Ethanol production is likely to soar in the next several years as refineries now under construction or expanding will nearly double current capacity. The Department of Energy expects ethanol to greatly exceed the goal of 7.5 billion gallons of annual domestic renewable fuel production by 2012 set by the 2005 Energy Policy Act. Nearly all of this will be from corn ethanol, which now uses about 18 percent of U.S. corn production.

Corn grain yield across the nation in 2008 was approximately 153.9 bushels per acre making it the second highest year on record, behind 2004. Production in 2008 was 12.1 billion bushels making it the second highest year for corn behind 2007. Eighty-six million acres were planted in 2008 and 78.6 million acres were harvested. Both figures have decreased since 2007 by 8 and 9 percent, respectively (NASS 2008a). Fewer acres of corn are expected to be planted in

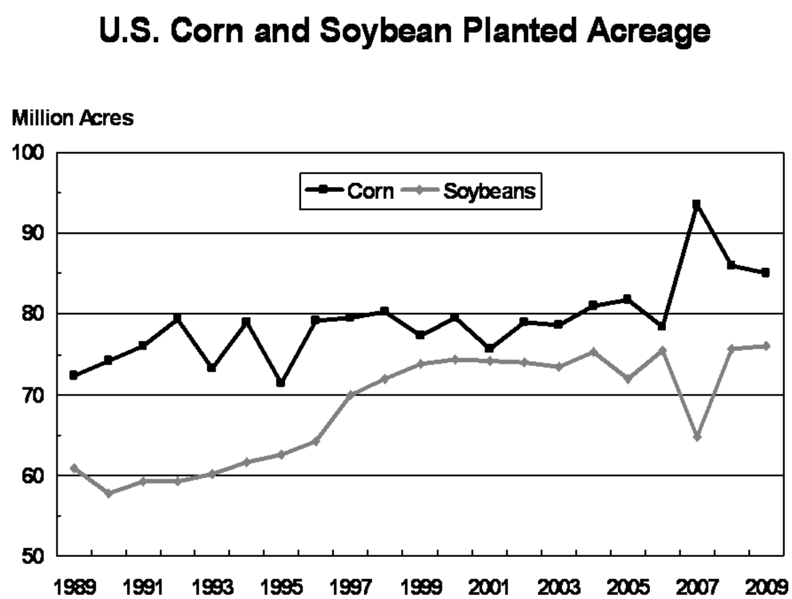


Figure 4.2-4. Historical Trends of Planted Acres of Corn (NASS 2009b)

2009 (85 million acres) compared to 2007 and 2008 (NASS 2009c). The slight decrease is attributed to a trend of lower corn prices and unstable input costs. However, planted acreage of corn expected in 2009 remains at the third highest level since 1989 (Figure 4.2-4).

Wheat Trends

In 2008, production of wheat totaled 2.50 billion bushels, grain area was 55.7 million acres, and yield was 44.9 bushels per acre in the U.S. All values have increased since 2007 with winter wheat leading the largest change in production at 25 percent, followed by Durum wheat at 18 percent, and spring wheat at 14 percent (NASS 2008b). Planted wheat is expected to cover 58.6 million acres in 2009, which is 7 percent less than 2008 figures.

Rice Trends

Rice production across the U.S. was 204 million cwt (i.e., hundredweight), planted area was 3.00 million acres, and area for harvest was 2.98 million acres in 2008. Production, planted acres, and area for harvest all slightly increased from 2007. Average rice yield was 6,846 pounds per acre, which was down from 2007 largely due to the effects of Hurricane Gustav and Ike in the country's most productive states for rice (NASS 2008a). The projected area planted in rice in 2009 is 3.18 million acres, which is approximately 6 percent higher than acreage planted in 2008 (NASS 2009d).

Without government funding available to absorb the potential economic risks and initial start up for producers of new dedicated energy crops, research ends would be driven to optimize first-generation energy crops already in place, such as corn. Modifying existing feedstock through genetic engineering to gain with higher yields, higher percentage of usable biomass, tolerance to environmental pararmeters, resistance to insects and herbicides could fuel the distribution of potentially invasive and/or harmful GE organisms.

<u>Genetically Engineered Organisms</u>

Genetically engineered (GE) organisms are those whose genetic material has been inserted with the genetic material from one or more organism(s); the receiving organism is then capable of producing new substances or performing new functions (NRCS 2001).

This technology has been used extensively in creating improved agricultural crops; the most widely adopted bioengineered crops have been those with herbicide-tolerant traits and/or insect resistant traits such as in bioengineered soybeans and corn (Fernandez-Cornejo, J. *et al.* 2002).

This improved technology and gene analysis allows geneticists to achieve desirable plant characteristics much faster than conventional breeding methods (Heaton *et al.* 2008) and many farmers have adopted this technology's progeny: in 2006, the USDA anticipated 85 percent of the corn, 91 percent of the soybeans, and 81 percent of the cotton grown in the United States would be genetically engineered by 2009 (ERS 2009).

These modified, traditional agricultural crops have been grown with extensive oversight, regulation and review by USDA, APHIS, and EPA. When compared to conventional counterparts, Goklnay (2001) found GE oilseed rape, potato, corn, and sugar beets no more invasive or persistent than non GE crops. Many of these crops have been deregulated by APHIS and have also completed the required reviews from the EPA and the Food and Drug

Administration (FDA) (APHIS 2006). However, a variety of plants currently being evaluated and grown for feedstock are undergoing modification via genetic engineering for enhanced environmental tolerance (e.g., tolerance to drought, salt, deleterious soil), high biomass yields, resistance to insect pests, and tolerance to herbicide (diTomaso *et al*. 2007) . This enhancement in environmental tolerance likely will increase the potential risk of escape from cultivation and invasion into surrounding environments (diTomaso *et al.* 2007). The effects of genetic engineering technology can be highly variable, and risks and benefits must be considered on a case-by-case basis (Chapman and Burke 2006).

Potential impact upon the lands comprising the eligible BCF project areas during establishment of feedstock, in the form of harm to agricultural and natural vegetation could occur upon introduction and establishment of GE feedstock species and their attendant propagules. This impact could take effect in the form of new plant diseases being introduced and/or the alteration of existing plant diseases; the prevention of native and agricultural species from reproducing or thriving by out-competing native species for nutrients, light, moisture or other vital resources; adverse impacts to erosion rates, hydrologic regimes and soil chemistry such as pH and nutrient availability (National Invasive Species Council, Invasive Species Management Plan 2008-12); risks to biodiversity by gene transfer from a genetically modified feedstock to wild relatives within an area of genetic diversity, and toxicity to non-target organisms (Firbank 2008).

Under BCAP, excluded crops include those plants that have the potential to be invasive or noxious, or as determined further by the Secretary of Agriculture in consultation with other federal or state departments. The Plant Protection Act (PPA), which became law in June 2000 as part of the agricultural risk protection act, consolidates all or part of ten USDA existing laws into one comprehensive law, including the authority to regulate plants, plant products, certain biological control organisms, noxious weeds, and plant pests (APHIS 2002). It gives the Secretary of Agriculture and USDA APHIS the ability to prohibit or restrict the importation, exportation, and interstate movement of plants, plant products, noxious weeds, plant pests, and certain biological control organisms (APHIS 2002).

Consistent with the Coordinated Framework, 51 FR 233302, June 26, 1986, (APHIS 2006), USDA works with the EPA and the FDA to ensure the safe development of GE products (APHIS 2006). Under the Plant Quarantine Act and the Federal Plant Pest Act, regulations were first implemented for biotechnology as Title 7 Code of Federal Regulations, Part 340 (APHIS 2006). Under the authority of the PPA, APHIS' BRS regulates the introduction of GE organisms in the United States. BRS refers to these organisms as 'regulated articles', which are organisms that have been altered by or produced through GE and have the potential to be plant pests. Introduction includes any movement into or through the United States, or release into the environment that is outside an area of physical confinement (APHIS 2006). USDA biotechnology regulations require any GE organism, with potential to be a plant pest, be regulated until it has undergone extensive review to demonstrate that it does not pose a risk

The safe use of pesticidal substances is regulated by the EPA. Thus, a bioengineered food that is the subject of a consultation with FDA may contain an introduced pesticidal substance also known as a plant-incorporated protectant (PIP) that is subject to review by EPA (2009).

The resulting GE organisms are not necessarily plant pests, however, the review process for demonstrating they are not plant pests has not been completed (APHIS 2006). Because of the high degree of variability of risks, crops site environment, crop species, and local plant communities, each GE plant must be considered on a case-by-case and site specific basis (Chapman *et al.* 2006)

In order to minimize the chance of GE plants hybridizing with wild populations and preventing the spread of potentially invasive GE species, plant geneticists are emphasizing the practice of creating sterile GE plants that are unable to reproduce sexually. Sterile cultivars can decrease the likelihood of feedstock escaping from production fields and becoming established, however continued sterility is not guaranteed (Raghu *et al.* 2006). Additionally, sterile cultivars are capable of vegetative reproduction; many invasive species including giant reed (*Arundo donax*), common reed (*Phragmites australis*), and Johnson grass (*Sorghum halepense*), reproduce primarily through vegetative means, regardless if viable seed is produced or not. These species are able to colonize vast regions and inflict economic and ecological damage (Swearingen *et al.* 2002; diTomaso *et al.* 2007)

Farmers are reducing the risks posed by GE plants by utilizing research tested ‘Best Management Practices’. These practices include crop rotation, strategic pesticide usage, and the use of bait crops to attract and control pests. In particular, crop rotation and strategic pesticide use are key elements in minimizing and/or avoiding the creation of resistant pests (weeds, insects, fungi, bacteria, and viruses)

Because the specific locations of the BCAP project areas and the numbers of participants are not known, and the choice of specific measures cannot be determined at this time, conditions under which particular component actions of the BCAP would have the potential for significant environmental impact will require site-specific environmental reviews and compliance with applicable environmental laws in accordance with 7 CFR 799 and procedures established in the FSA Handbook on Environmental Quality Programs for State and County Offices (1-EQ) (FSA 2008) and those actions that may require an individual Environmental Assessment (EIS).

<u>Invasive Species</u>

Executive Order (EO)13112 defines “native species’’ as a species that, with respect to a particular ecosystem, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

An “alien” or “nonnative” species is any species, with respect to a particular ecosystem, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; an “invasive” species is a nonnative species whose introduction does or is likely to cause economic or environmental harm or harm to human health (EO 13112). The PPA defines a “noxious weed” as any plant or plant product that can directly or indirectly bring harm to agriculture, the public health, navigation, irrigation, natural resources, or the environment; this Act expands the definition of noxious weed from the definition in the 1974 Federal Noxious Weed Act, which included only weeds that were of foreign origin, new to, or not widely prevalent in the United States (APHIS 2002).

Plants that are nonnative to the United States are not solely culpable as to being categorized as “invasive” or as to invasive impact; the terms ‘invasive’ and ‘noxious’ may be applied to plant species native to the United States as well as those nonnative to the United States (USFWS 2009; NISC 2008). The majority of nonnative plant species do not exhibit invasive tendencies (NISC 2008) and many, such as wheat and corn, have become indispensible to our economy and way of life USFWS 2009; NISC 2008). Less than 9 percent of nonnative plant species introduced into the U.S. may be invasive (USFWS 2009). Conversely, many native species exhibit aggressive growth habits and are noxious weeds outside their native range. For example, Virginia copperleaf (*Acalypha virginica*), a native herb, is variously ranked ‘state endangered’, ‘state threatened’, and ‘species of concern’ in several states; however it is also included on the list of noxious and invasive weeds of the northeast (NRCS 2009). A biogeographical context must therefore be included when assessing whether a non-native species should be considered an invasive species (NISC 2008).

Many purportedly beneficial introduced species have had long-term economic and environmental costs owing to their invasiveness (Raghu *et al.* 2006). Kudzu (*Pueraria montana*), Johnson grass, multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*) are examples of nonnative, invasive species that were at one time promoted and distributed by the U.S. government for such uses as erosion control, livestock “living fences”, forage, wildlife habitat, and highway medians

These species were later recognized as invasive and causing harm, invading and impacting natural systems across the United States; and have since caused unforeseen ecological damage; incurring long-term economic and environmental costs that are ongoing still (Swearingen *et al.* 2002). A variety of plants currently being evaluated and grown for feedstock include genera and species nonnative to the areas where production is proposed; several are known invasive pests in other regions where they have been introduced (diTomaso *et al.* 2007). These include graminoids (plants that are grasses, rushes, or sedges), woody species, and forbs (plants that are non woody and non graminoid, such as herbs).

To obtain feedstock that will produce maximum biomass for a minimum investment of resources, these species have been selected for and/or genetically enhanced as to traits that support this goal, including: perennial root and/or rhizome system; rapid, dense growth; C4 photosynthesis; nutrient re-allocation to belowground structures in the fall; adaptability to a wide range of environmental conditions including flooding and saline soils; highly competitive (reducing herbicide use); erosion control; low nutrient, pesticide, and water requirements; long foliage/canopy duration; no known pests or diseases; low lignin content, and (except as needed for stock) sterility (Heaton *et al.* 2008; Raghu *et al.* 2006; diTomaso *et al.* 2007). However, with the exception of sterility and perennial growth, these traits are also known to contribute to invasiveness (Raghu *et al.* 2006). This could potentially result in the creation and cultivation of native and nonnative feedstock that is more competitive with native vegetation and other cultivated crops. Potential important adverse impacts upon adjacent natural and agricultural lands could result if invasive feedstock were to establish outside the production areas. (Heaton *et al.* 2008; diTomaso *et al.* 2007).

Potential impact upon the lands comprising the eligible BCF project areas during establishment of feedstock, in the form of harm to agricultural and natural vegetation, could occur upon introduction and establishment of invasive and/or allelopathic nonnative, native, hybrid and/or bioengineered feedstock species and their attendant propagules. This impact could take effect in the form of biologically important decreases in native species populations, alterations to plant communities or to ecological processes native plant species and other desirable plants depend on for survival (including impact upon native pollinators) (NISC 2008).

Invasive plant species could potentially cause or vector plant diseases, prevent native and agricultural species from reproducing or thriving via allelopathic effect or by out-competing native species for nutrients, light, moisture or other vital resources; adversely impact erosion rates, hydrologic regimes and soil chemistry such as pH and nutrient availability. Natural wildfire cycles could also be altered; invasions by fire promoting grasses could alter entire plant communities eliminating or sharply reduce populations of many native plant species (NISC 2008). Potential risk to biodiversity includes gene transfer from a genetically modified feedstock to wild relatives within an area of genetic diversity (Firbank 2008).

Under BCAP, excluded crops include those plants that have the potential to be invasive or noxious, or as determined further by the Secretary of Agriculture in consultation with other federal or state departments. Presidential directive, Executive Order 13112, protects the United States from invasive species, unless benefits clearly outweigh potential harms. In addition, the PPA, which became law in June 2000 as part of the agricultural risk protection act, consolidates all or part of ten USDA existing laws into one comprehensive law, including the authority to regulate plants, plant products, certain biological control organisms, noxious weeds, and plant pests (APHIS 2002). It gives the Secretary of Agriculture and USDA's animal and plant health inspection service the ability to prohibit or restrict the importation, exportation, and interstate movement of plants, plant products, noxious weeds, plant pests, and certain biological control organisms (APHIS 2002).

However, currently the introduction of nonnative species for horticultural or agronomic purposes is not regulated unless the taxa are on state or federal lists of noxious weeds (diTomaso *et al.* 2007). Sterile cultivars can decrease the likelihood of feedstock escaping from production fields and becoming established, however continued sterility is not guaranteed (Raghu *et al.* 2006). Additionally, sterile cultivars are capable of vegetative reproduction; many invasive species including giant reed, common reed, and Johnson grass, reproduce primarily through vegetative means, regardless if viable seed is produced or not. These species are able to colonize vast regions and inflict economic and ecological damage (diTomaso *et al.* 2007).

For some feedstock candidates, the use of sterile cultivars may not be an option as viable seeds are needed to create a stock source. As new traits and transgenic technologies are applied to perennial out-crossing species, ecological risks must be assessed and safety established by rigorous research/field tests (agronomic and ecological analyses) such as those already mandatory for biological control agents and transgenic plants (Raghu *et al.* 2006). Mechanisms for responsible introductions could be modeled on the horticulture industry in which local and regional organizations cooperate with the nursery industry to restrict sale and distribution of species and cultivars that pose quantifiable threats to native species and ecosystems. Pre-introduction, science-based risk assessment tools to estimate quantitatively the risk of a nonnative species becoming invasive should be adopted, including:

- The Weed Risk Assessment performed for each potential genotype targeted for cultivation within a particular region;
- Climate matching analysis;
- Evaluation of the cross-hybridization potential of the feedstock with related species and other closely related taxa to assess the risk of genetic invasion;
- Determination of the susceptibility of native and managed ecosystems to introduction of seeds or vegetative fragments of feedstock; and
- Multi-year studies of competitive interactions between feedstock and native or agronomic species within susceptible ecosystems (diTomaso *et al.* 2007).

Other alternatives may be photoperiod regulation and target use of specific varieties to appropriate latitudes that lack the day length cues necessary to trigger reproductive growth (Heaton *et al.* 2008)

4.2.6.2 Wildlife

Direct Impacts

The No Action Alternative would maintain the status quo. Therefore no direct impacts of any kind are expected.

Indirect Impacts

The No Action Alternative would maintain the status quo. Therefore no indirect impacts of any kind are expected

Mitigation Measures

The No Action Alternative would maintain the status quo. Therefore no impacts of any kind are expected and thus there is nothing to mitigate.

4.3 AIR QUALITY

4.3.1 Significance Thresholds

An impact would be considered significant if BCAP practices produce greenhouse gas (GHG) emissions greater than traditional crop production GHG emissions.

4.3.2 Methodology

For this analysis, the aspect of air quality with the most potential for impact from BCAP is GHG emissions that contribute to global warming. Energy use and associated CO_2 emissions can increase or decrease in response to changes in cropland management, by the type of crop planted, and associated production inputs influenced by responses to market demands or incentives for land management practices directly influencing emissions (e.g. increase carbon sequestration).

The analysis method for assessing the impact of BCAP on air quality is based on comparing estimated BCAP emissions against a baseline of traditional crop emissions by constructing Net Ecosystem Carbon Budgets (NECB) for multiple scenarios. This provides information on whether crop management practices under BCAP increase or decrease net GHG emissions. In constructing NECB, the analysis includes soil carbon, fossil-fuel emissions, other carbon emissions (CO_2 from agricultural lime), upstream energy and emissions from production inputs, and nitrous oxide (N_2O) emissions from fertilizer application. The analysis uses the Intergovernmental Panel on Climate Change (IPCC) methodology for estimating N_2O emissions. The IPCC analysis estimates on-site energy use and emissions from fossil-fuel consumption occurring on the farm directly related to crop production and off-site energy and emissions resulting from fossil-fuel combustion. The fossil fuel combustion component includes activities associated with the transport of crop production inputs such as fertilizer, pesticides, and seeds and includes emissions from power plants producing electricity used on-site. Thus, potential air quality impacts from establishment, growth, harvest, collection (processing), storage, and transport of biomass from the field to a bioconversion facility (BCF) are examined.

The FCA model is a statistical-based model that estimates changes in soil carbon and GHG emissions as a function of soil attributes, cropping practices, and production inputs, which was used to provide the NECB. Calculations of soil carbon flux and stock changes are driven by statistical relationships between the aforementioned variables, and these relationships are derived from hundreds of paired field experiments (West and Post 2002; West *et al.* 2004). Energy, CO_2 emissions, and N_20 emissions are derived from energy and emissions analyses conducted on regional cropping practices and production inputs (West *et al.* 2008; Nelson *et al.* 2009). Results from these analyses have been used by the DOE Carbon Sequestration in

Terrestrial Ecosystems (CSiTE) program and in the EPA Inventory of US GHG Emissions and Sinks.

4.3.3 Action Alternative 1

Selecting Alternative 1 would result in positive change in air emissions generated from the conversion of traditional cropping systems to dedicated energy crops; however, given the limited acreage to be converted under this alternative, the effect would not be significant.

4.3.3.1 Direct Impacts

Tables 4.3-1 and 4.3-2 include estimates for changes in each potential project location from implementation of Alternative 1 from the baseline. These changes are for energy consumption (direct, indirect, total), carbon equivalent emissions (direct, indirect, total) and for Soil Carbon.

The concept of direct refers to the energy and/or emissions related to the activities directly involved in agricultural production (machinery use, gasoline, tillage, application of nutrients, cropping).

The concept of indirect refers to the activity related to the production of the inputs, machinery that is used later in agricultural production activities. Finally, Soil Carbon refers to the Carbon stored in the soil by the tillage and growing of the plant.

Table 4.3-1. Table Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative)

Top 5	Top State	Location	Direct Energy	Indirect Energy	Total Energy	Direct Carbon	Indirect Carbon	Total Carbon	Soil Carbon
			(GJ)			Metric Tons			
	X	Mellette, SC	(1,759)	13,683	11,924	(50)	855	805	2,258
X		Osage, KS	(442)	(2,072)	(2,514)	(12)	43	32	1,213
	X	Fremont, IA	1,685	(2,901)	(1,217)	34	30	64	1,074
	X	Pawnee, NE	1,203	(881)	322	26	102	129	1,163
	X	Roosevelt, NM	(1,997)	3,714	1,717	(42)	325	283	1,324
	X	Bent, CO	3,318	8,355	11,672	72	487	559	1,587
	X	Chautauqua, KS	768	1,037	1,805	18	125	143	1,190
X	X	Garfield, OK	1,028	(1,317)	(289)	21	(48)	(27)	1,257
X		Callahan, TX	(6,335)	(6,062)	(12,397)	(137)	(182)	(319)	1,742
	X	Hardeman, TX	320	1,086	1,406	5	96	101	1,316
X		Harmon, OK	680	1,616	2,296	13	113	126	1,283
	X	Tishomingo, MS	(10,809)	(33)	(10,842)	(239)	422	183	1,902
	X	Izard, AR	(15,779)	(3,711)	(19,490)	(340)	635	295	3,317
	X	McDonald, MO	(3,662)	1,579	(2,083)	(86)	294	208	1,651
X		Lawrence, MO	(2,781)	1,606	(1,175)	(67)	291	224	1,538
	X	Alexander, IL	550	(1,270)	(720)	10	122	131	1,192
	X	Marion, KY	(20,572)	4,527	(16,044)	(477)	620	142	2,424
	X	Lawrence, TN	(11,394)	(2,286)	(13,681)	(258)	224	(33)	1,517
	X	Colbert, AL	22,970	52,047	75,017	470	2,450	2,920	2,725
	X	Dillon, SC	1,271	(3,100)	(1,829)	30	92	121	1,117
	X	Mecklenburg, VA	(2,603)	(4,433)	(7,037)	(65)	179	114	1,719
	X	Person, NC	(1,637)	930	(707)	(41)	288	247	906

Table 4.3-2. Table Percent Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative)

Top 5	Top State	Location	Direct Energy	Indirect Energy	Total Energy	Direct Carbon	Indirect Carbon	Total Carbon	Soil Carbon
	X	Mellette, SC	-0.03%	0.22%	0.10%	-0.04%	0.33%	0.21%	1.29%
X		Osage, KS	-0.01%	-0.02%	-0.02%	-0.01%	0.01%	0.01%	0.77%
	X	Fremont, IA	0.02%	-0.01%	0.00%	0.02%	0.00%	0.01%	0.18%
	X	Pawnee, NE	0.02%	-0.01%	0.00%	0.02%	0.02%	0.02%	0.27%
	X	Roosevelt, NM	-0.04%	0.05%	0.01%	-0.04%	0.11%	0.07%	4.73%
	X	Bent, CO	0.11%	0.14%	0.13%	0.11%	0.19%	0.17%	2.52%
	X	Chautauqua, KS	0.01%	0.01%	0.01%	0.01%	0.04%	0.03%	1.15%
X	X	Garfield, OK	0.01%	-0.01%	0.00%	0.01%	-0.01%	0.00%	1.25%
X		Callahan, TX	-0.16%	-0.11%	-0.13%	-0.16%	-0.07%	-0.10%	10.14%
	X	Hardeman, TX	0.01%	0.01%	0.01%	0.00%	0.03%	0.02%	2.05%
X		Harmon, OK	0.01%	0.02%	0.02%	0.01%	0.03%	0.03%	2.17%
	X	Tishomingo, MS	-0.42%	0.00%	-0.17%	-0.44%	0.31%	0.10%	4.08%
	X	Izard, AR	-0.25%	-0.05%	-0.14%	-0.25%	0.22%	0.07%	6.02%
	X	McDonald, MO	-0.06%	0.03%	-0.02%	-0.07%	0.14%	0.06%	1.88%
X		Lawrence, MO	-0.05%	0.03%	-0.01%	-0.05%	0.13%	0.06%	1.43%
	X	Alexander, IL	0.01%	-0.01%	0.00%	0.01%	0.02%	0.02%	0.53%
	X	Marion, KY	-0.40%	0.09%	-0.16%	-0.42%	0.31%	0.05%	1.76%
	X	Lawrence, TN	-0.32%	-0.05%	-0.16%	-0.34%	0.12%	-0.01%	1.90%
	X	Colbert, AL	0.74%	1.30%	1.06%	0.72%	1.66%	1.37%	4.91%
	X	Dillon, SC	0.06%	-0.07%	-0.03%	0.07%	0.05%	0.05%	1.36%
	X	Mecklenburg, VA	-0.11%	-0.14%	-0.13%	-0.13%	0.15%	0.07%	2.87%
	X	Person, NC	-0.07%	0.03%	-0.01%	-0.09%	0.30%	0.17%	1.70%

Under Alternative 1, using the BCAP potential project locations in the top five regions would reduce direct energy consumed by 3,664 Giga Joules (GJ) through the conversion of switchgrass when compared to the previous cropping system. The top location in each of the states varies greatly in total energy consumed, sometimes showing an increase and sometimes a decrease reflecting the different energy potentials from the differing land conversion systems. The total energy change under Alternative 1 is minor, in most cases less than 0.1 percent, except for the Alabama site, which was 1.06 percent. This particular location had some hayland converted but most land converted was not in one of the previous crops analyzed meaning no calculated energy savings during conversion. Changes in total carbon were usually positive, although the percent changes from the No Action Alternative compared to Alternative 1 were small, usually less than 0.1 percent.

Additional direct effect associated with the implementation of Alternative 1, would be the fugitive dust emissions associated with establishment activities both within the field and with associated transportation over rural, non-paved roads. Given the limited scale of conversion associated with Alternative 1, it would be anticipated that these effects would be minor, temporary, local, and approximately equal to current fugitive dust emissions associated with on-going agricultural traditional crop production, during the establishment phase. If the conversion to perennial dedicated energy crops alters cropping systems toward limited or no tillage, there would be a reduction in fugitive dust emissions from cropping activities, due to the longer life span of these species. Overall, in the longer term, these effects would be positive, but minor.

4.3.3.2 Indirect Impacts

Implementing Alternative 1 would create only limited indirect effects to air quality through establishment and growth of the dedicated energy crops. These indirect emissions could be derived from equipment exhaust or additional mobile sources required for unique techniques developed for the establishment of dedicated energy crops. However, since under existing conditions machinery would be utilized on these fields, these impacts would be similar to the No Action Alternative.

4.3.3.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the conservation or FSP or through local or state regulations concerning air emissions of criteria pollutants. Some best management practices (BMP) to reduce mobile sources would be proper maintenance of equipment and dust suppression activities, as required for site specific conditions.

4.3.4 Action Alternative 2

Implementing Alternative 2 would result in a decline in soil carbon ranging from 3.4 percent to as high as 22.6 percent based on a national broad-scale adoption of BCAP. These changes would be locally significant and could create significant national effects as well. This is primarily due to utilization of acreage for crop residue removal and conversion of previous hayland and pasture to bioenergy crops.

4.3.4.1 Direct Impacts

The direct carbon equivalent emissions during the period of switchgrass growth are reduced (Table 4.3-3). These include the N_2O emissions using a conversion factor of 286 for conversion of CO_2 to N_2O. The indirect emissions, reflecting the activity related to previous equipment manufacturing, etc. is difficult to interpret since numerous assumptions had to be made concerning prior ownership of switchgrass planting, and harvesting equipment. The carbon equivalent emissions for N, P, and K were usually positive, but for chemicals, seed, and lime they were or usually became negative. As mentioned earlier, the total of these are small compared to soil carbon, except for the Alabama location, the site with considerable idle land brought into production.

Table 4.3-3. Percent Change in Net Carbon Flux, Carbon Equivalent Emissions, and Energy Consumed from No Action Alternative to Alternative 2

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
NET CARBON FLUX	2.18	2.75	2.88	3.65	6.05	9.79	13.51	12.79	11.64	10.80	11.10	11.73	12.05	10.30	10.98
SOIL CARBON	-4.8	-4.2	-3.4	-5.8	-9.9	-15.8	-22.6	-20.4	-17.5	-14.7	-13.9	-14.4	-12.1	-7.4	-9.0
Carbon Equivalent Emissions															
TOTAL CARBON	0.00	0.54	0.87	0.61	0.87	1.46	1.61	1.81	1.91	2.25	2.62	2.90	3.80	4.18	4.07
DIRECT CARBON	0.00	-0.20	-0.20	-0.30	-0.30	-0.31	-0.31	-0.41	-0.31	-0.41	-0.31	-0.30	-0.61	-0.92	-0.92
INDIRECT CARBON	0.00	0.83	1.31	0.96	1.34	2.14	2.35	2.58	2.75	3.20	3.66	3.96	5.41	5.99	5.89
Fertilizers	0.00	0.72	1.07	0.83	1.19	1.90	2.15	2.49	2.73	3.21	3.58	3.98	5.29	5.92	5.92
Chemicals	0.00	0.65	1.29	0.64	0.64	1.28	0.64	0.00	0.00	-0.63	-0.64	-1.25	-0.63	-1.26	-1.26
Seed	0.00	0.00	0.58	0.58	0.00	0.59	0.00	-1.17	-1.75	-2.34	-2.94	-4.05	-4.65	-5.85	-5.85
Nitrogen	0.00	1.19	1.79	1.38	1.93	3.04	3.46	3.93	4.20	5.02	5.82	6.48	8.71	9.80	9.51
Lime	0.00	0.00	0.00	-0.35	0.00	-0.35	-0.35	-0.35	-0.35	-0.70	-0.70	-1.39	-1.74	-2.10	-1.75
Total Energy															
TOTAL ENERGY	0.00	0.00	0.00	0.00	0.89	0.89	0.89	1.79	1.79	1.79	0.89	0.88	1.77	1.77	1.77
DIRECT ENERGY	0.00	0.00	0.00	0.00	0.00	-2.27	0.00	-2.27	-2.27	-2.27	0.00	0.00	-2.27	-2.27	0.00
INDIRECT ENERGY	0.00	0.00	1.47	1.47	1.47	1.47	1.47	2.94	2.94	2.94	2.94	1.43	2.86	1.43	1.43
Fertilizers	0.00	0.00	2.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00	3.92	5.88	5.88	5.88
Chemicals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.00	-10.00	-10.00	-10.00
Seed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-11.11	-11.11

Total energy over time was about 1 to 2 percent higher in most years, mostly reflected in indirect energy from prior equipment manufacturing, etc. Direct energy was always neutral or decreased over time. Fertilizer energy was positive, but chemical and seed energy was strongly negative.

It appears that the overall gaseous emissions would be increased due to the large percentage in decrease in the large soil carbon pool. The net flux changes are positive.

Additional direct effects associated with the implementation of Alternative 2 would be the fugitive dust emissions associated with establishment activities, both within the field and with associated transportation over rural, non-paved roads. Given the potential scale of conversion associated with Alternative 2, it would be anticipated that these effects would be similar to Alternative 1 during the establishment phase, i.e., minor, temporary, local, and approximately equal to current fugitive dust emissions associated with on-going agricultural crop production. If the conversion to perennial dedicated energy crops alters cropping systems toward limited or no tillage, there would be a reduction in fugitive dust emissions from cropping activities due to the longer life span of these species. Overall, in the longer term, these effects would be positive and have the potential for regional effects.

4.3.4.2 Indirect Impacts

Implementing Alternative 2 would create only limited indirect effects to air quality through establishment and growth of the dedicated energy crops. These indirect emissions could be derived from equipment exhaust or additional mobile sources required for unique techniques developed for the establishment of dedicated energy crops. However, since under existing conditions machinery would be utilized on these fields, these impacts would be similar to the No Action Alternative.

4.3.4.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the conservation or FSP or through local or state regulations concerning air emissions of criteria pollutants. Some BMPs to reduce mobile sources would be proper maintenance of equipment and dust suppression activities, as required for site specific conditions.

4.3.5 No Action Alternative

Selecting the No Action Alternative would be unlikely to change either existing GHG emissions from agricultural activities or emissions of criteria pollutants within the U.S., which when compared to the Proposed Action would be a negative effect. Under this alternative, crops currently used to produce bioenergy would be primarily Title I crops, Title I crop residues, and woody biomass residues. There could be increased mobile source emissions and fugitive dust emissions from increased transportation for the movement of crop residues from the field to a qualified BCF; however, given the limited number of BCF throughout the country and the limited economically viable distance to transport materials via conventional means, these emissions would be limited to a local scale.

4.4 SOIL QUALITY

4.4.1 Significance Thresholds

4.4.2 Methodology

POLYSYS has an environmental module to estimate for each county changes in fertilizer and chemical expenditures, erosion and sedimentation/deposition, fossil-based carbon emissions, and soil carbon sequestration resulting from changes in cropping patterns with increased ethanol production. Changes in environmental indicators are reported in aggregate for each BCF.

Changes in fertilizer and chemical expenditures (expressed in 2007 dollars) were estimated using crop supply module budgets and by multiplying either the fertilizer (N, P, and K) or chemical expenditures by the land area for a given crop and region. The expenditures used in the analysis are a weighted average of the tillage system employed in the analysis for each county in each BCF and are determined by multiplying the change in crop acres from the baseline times the associated input cost.

Changes in water erosion (sheet and rill) incorporate computed levels of erosion for cropland, pastureland, and CRP land using the Universal Soil Loss Equation (USLE) (Wischmeier and Smith 1965; Wischmeier and Smith 1978). The 1997 and 2003 National Resource Inventory (NRI) data sets (NRCS 2007b) and the county-level tillage data base from the Conservation Technology Information Center (CTIC 2007) were used to develop the USLE estimates for POLYSYS. Sheet and rill erosion (Mg ha^{-1}) for each county were estimated using the following equation:

$$USLE_i = R_{i,j} \times K_{i,j} \times L_{i,j} \times S_{i,j} \times P_{i,j} \times C_{i,k,m} \times A_{i,j,k,m}, \qquad (1)$$

where *i* is CRD, *j* is land type (1= cropland, 2= pastureland, and 3 = CRP land), *k* is crop grown, *m* is tillage method (1 = conventional tillage, 2 = reduced tillage, and 3 = no tillage), *R* is a rainfall and runoff factor, *K* is a soil erodibility factor, *L* is a slope length factor, *S* is a slope steepness factor, C is the crop management factor, *P* is a crop support practice factor (based on proportion of land under terrace, strip crop, and no additional conservation practice for example) , and A is total available land area.[1]

Estimated average *R*, *K*, *L*, *S,* and *P* factors for each CRD based on the 2003 NRI data were from the USDA National Resource Conservation Service (Goebel 2007). The C factor was derived from the 1997 NRI and reflects the cropland tillage practice factor by crop and tillage system. The proportions of crop area in conventional tillage, reduced tillage, and no tillage practices in each County was fixed at 2009 county levels as used in the POLYSYS Baseline. Estimated changes in planted area crop for each county from the POLYSYS crop supply solutions were multiplied by the tillage proportions for that region to determine the land area planted using conventional, reduced, and no tillage practices by crop. These estimates were then multiplied times *KLSR*, *P*, and C factors to estimate changes in gross sheet and rill erosion levels. The changes in sheet and rill erosion estimated for each County using Equation (1) and aggregated to the 105 U.S. Geological Survey 4-digit sub-regional hydrological units (NRCS 2007c) adjusted to county boundaries.

The soil erosion data were then used in the Micro Oriented Sediment Simulator (MOSS) to estimate aggregate soil deposited and suspended for each location (Alexander and English 1988).

4.4.3 Action Alternative 1

Implementing Alternative 1 would result in positive reduction in the soil erosion from all sources. Based on the average soil erosion rates, the effects from the conversion of Title I croplands to switchgrass has been estimated to conserve approximately 0.4 inch of soil per acre per year, which over a 10 year period would save approximately four inches of topsoil. This effect would be locally significant and would benefit multiple characteristics associated with topsoil retention. In addition to topsoil retention, it was estimated that Alternative 1 would increase soil carbon from 900 to 3,300 metric tons and ranged in percent to less than one percent to greater than 10 percent increase, depending upon the location. Depending upon the location, this additional soil carbon could be locally significant in some areas.

4.4.3.1 Direct Impacts

Soil Erosion

The selection of the top five plant locations and implementation of BCAP resulted in an average of approximately 39,486 acres surrounding each BCF being converted to a perennial dedicated energy crop. Switchgrass was chosen in the overall analysis as the model perennial dedicated energy crop due to the available data on this species. This land conversion from various crops resulted in an average of 30,450 acres of switchgrass. This resulted in reductions in erosion across the locations of 11 to 120 tons per acre per year as determined by dividing the total soil reduction by the acres converted to a perennial dedicated energy crop compared to the previous cropping system. The average erosion reduction was 66 tons per acre per year. This is very approximately the equivalent to the loss of 0.4 inch of soil over each acre each year. A 10 year switchgrass production period would result in the average total saving of as much as four inches of topsoil on some of the acres previously planted to other crops. The reduction in soil loss will result in maintenance of soil carbon and reduce the potential for sediment to move from fields carrying pesticides, and nutrients to surface water bodies. This is reflected in the reduced sediment being deposited off-site and the reduced suspended sediment that could move with runoff water directly into water bodies. Table 4.4-1 shows the estimated levels of reduced erosion from the implementation of BCAP.

Soil Carbon Sequestration

Soil carbon in all cases increased and ranged from about 900 to 3,300 total metric tons from the implementation of Alternative 1. The percent changes were usually large and ranged from about 0.2 to 10.1 percent. The Callahan, Texas, site had a 10.1 percent change, which was partly the result of changing the most acres on this site from cotton, a low surface cover crop, to switchgrass.

Table 4.4-1. Estimated Reduced Levels of Erosion as a Result of Land Conversion to Dedicated Energy Crops (tons/year)

State	Location	Rank	Reduced Erosion	Reduced Sediment Deposited	Reduced Sediment Suspended
			Tons		
Oklahoma	Garfield	1	2,750,331	667,039	550,066
South Carolina	Dillon	2	559,620	167,886	167,886
Tennessee	Lawrence	3	950,101	505,810	365,969
Texas	Hardeman	4	1,365,321	410,907	279,616
South Dakota	Mellette	5	508,506	159,324	146,174
Iowa	Fremont	6	4,528,640	2,899,531	1,585,024
Kentucky	Marion	7	1,114,820	667,912	445,946
Colorado	Bent	8	236,767	75,845	47,353
Missouri	McDonald	9	1,253,788	411,246	269,816
New Mexico	Roosevelt	10	579,043	71,581	69,773
Kansas	Chautauqua	11	1,823,858	490,822	364,772
Illinois	Alexander	12	3,511,271	1,737,216	1,261,032
Mississippi	Tishomingo	13	998,494	472,547	367,303
Alabama	Colbert	14	950,819	405,450	332,787
Nebraska	Pawnee	15	3,913,795	2,481,035	1,340,147
Virginia	Mecklenburg	16	887,347	270,998	270,998
Arkansas	Izard	17	756,739	336,211	243,720
North Carolina	Person	18	820,743	248,060	248,060
Top Plant 1	Garfield, OK	19	2,750,331	667,039	550,066
Top Plant 2	Lawrence, MO	20	1,381,868	556,977	358,779
Top Plant 3	Callahan, TX	21	497,337	147,685	124,334
Top Plant 4	Harmon, OK	22	1,292,778	387,783	258,556
Top Plant 5	Osage, KS	23	2,820,940	1,433,279	857,635

Table 4.4-2 shows the percentage changes in the use of fertilizers and chemicals from implementing the BCAP projects in Alternative 1.

Table 4.4-2. Percent Changes in Use of Fertilizers and Chemicals after Implementation of Alternative 1

Top 5	Top State	Location	FertN	FertP	FertK	FertLime	Herbicides	Insecticides	OtherChem
	X	Mellette, SC	5.2%	0.2%	-2.5%	0.0%	-2.9%	-0.8%	na
X		Osage, KS	0.4%	-1.6%	-7.3%	-8.1%	-6.5%	-20.5%	0.0%
	X	Fremont, IA	-0.3%	-1.1%	-1.1%	-1.5%	-1.5%	-0.8%	na
	X	Pawnee, NE	-0.1%	-0.7%	-2.8%	-3.3%	-2.1%	-2.1%	0.0%
	X	Roosevelt, NM	-10.7%	-8.8%	-0.1%	-0.1%	-10.4%	-9.3%	-12.2%
	X	Bent, CO	2.6%	10.0%	-2.3%	-2.1%	-5.6%	-4.4%	0.0%
	X	Chautauqua, KS	4.6%	2.3%	-6.2%	-7.1%	-6.3%	-5.1%	-0.5%
X	X	Garfield, OK	3.2%	15.5%	-2.4%	-5.3%	-2.5%	-7.9%	0.0%
X		Callahan, TX	1.4%	-2.6%	-2.0%	-2.0%	-11.7%	-18.6%	-12.0%
	X	Hardeman, TX	-1.2%	2.3%	-1.3%	-1.3%	-4.6%	-8.3%	-5.2%
X		Harmon, OK	-1.2%	3.8%	-1.6%	-1.6%	-2.8%	-6.8%	-3.7%
	X	Tishomingo, MS	-1.0%	-0.7%	-2.9%	-6.0%	-4.3%	-3.5%	-5.1%
	X	Izard, AR	-0.3%	9.4%	-3.5%	-2.0%	-7.6%	-9.7%	-5.5%
	X	McDonald, MO	8.0%	-0.7%	-3.2%	-3.7%	-4.9%	-3.1%	-2.3%
X		Lawrence, MO	6.7%	-0.7%	-2.4%	-3.2%	-3.9%	-2.2%	-2.1%
	X	Alexander, IL	0.1%	-2.0%	-2.8%	-3.6%	-3.5%	-1.7%	-3.5%
	X	Marion, KY	3.2%	-0.1%	-2.1%	-2.7%	-2.4%	-2.9%	-4.7%
	X	Lawrence, TN	-0.5%	-1.7%	-2.8%	-4.0%	-4.2%	-4.0%	-6.0%
	X	Colbert, AL	8.2%	5.8%	2.5%	-0.4%	2.0%	2.3%	8.1%
	X	Dillon, SC	1.5%	-1.0%	-4.8%	-8.3%	-8.9%	-15.6%	-13.3%
	X	Mecklenburg, VA	0.4%	-1.7%	-3.2%	-7.2%	-6.5%	-9.1%	-7.7%
	X	Person, NC	3.1%	-1.3%	-3.3%	-7.1%	-7.1%	-9.2%	-8.2%

4.4.3.2 Indirect Impacts

Indirect effects associated with implementing Alternative 1, would be increased biological diversity associated with soil living organisms, which benefit from a reduction of soil organic matter loss, and the increase of perennial vegetation. The increased biodiversity within the soil would generate additional benefits to the vegetation and wildlife, given the biological resources dependence on this resource. Additionally, the capture and retention of topsoil within these areas would provide for overall biodiversity at the local area.

4.4.3.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional needs, as prescribed in the conservation or FSP, or through local or state regulations concerning soil erosion. Some BMPs to reduce soil erosion would be buffer areas and limited or no tillage cropping systems. Additionally, these BMPs provide avenues for greater soil carbon retention.

4.4.4 Action Alternative 2

Implementing Alternative 2 would result in a significant reduction at the local and regional level in soil erosion from traditional cropping practices, due to the conversion to perennial dedicated energy crops.

4.4.4.1 Direct Impacts

Soil Erosion

As a result of increased demand for cellulose, both land use and a movement occurs toward reduced and no tillage production practices. These changes bring about a reduction in erosion as cellulosic ethanol increases. Increased demand for corn stover and wheat straw resulted in a shift from conventional tillage to no tillage in some regions of the country. As indicated previously, corn acreage decreases nearly 0.5 million acres by 2022, with a shift from conventional tillage toward no tillage. Two million acres of wheat is projected to shift from conventional to no tillage practices. Sorghum acreage decreases by 1.3 million acres and soybeans by 4.67 million acres (Table 4.4-3). Dedicated energy crop acreage increases from 0 acres in the baseline to 33 million in Alternative 2. This increase does result in a positive change in erosion from switchgrass (Table 4.4-4). However, the per-acre erosion is less than 0.5 tons per acre. Nearly 40 million tons of gross soil erosion are saved annually. If there 160 tons of soil in an inch of top soil, then an estimated 243,000 inches of topsoil are saved each year.

Table 4.4-3. Change in Acreage Planted under Alternative 2 from the Baseline, 2022

Crop	Conventional Tillage	Reduced Tillage	No Tillage	Total Change in Acres from the Baseline
Corn	-651,107	-440,819	620,327	-471,599
Sorghum	-845,738	-398,731	-90,647	-1,335,116
Oats	-73,663	-233,016	-10,509	-317,187
Barley	233,954	-438,686	-12,227	-216,959
Wheat	-2,145,637	-10,060,209	2,219,983	-9,985,863
Soybeans	-321,443	-704,494	-3,645,631	-4,671,568
Cotton	-2,067,534	-235,923	-621,155	-2,924,612
Rice	-442,235	53,189	14,529	-374,518
Dedicated Energy Crop	26,441,947	7,035,655		33,477,602
Hay	-6,301,127	4,064,088	156,606	-2,080,433

Table 4.4-4. Changes in Erosion Compared to the Baseline (Scenario 1), 2022

CROP	Change in acres	Change in Gross Soil Erosion
Corn	-471,599	-3,406,947
Sorghum	-1,335,116	-3,061,977
Oats	-317,187	-919,290
Barley	-216,959	-135,640
Wheat	-9,985,863	-17,899,055
Soybeans	-4,671,568	-10,469,936
Cotton	-2,924,612	-8,868,687
Rice	-374,518	-1,492,768
Dedicated Energy Crop	33,477,602	7,339,343
Hay	-2,080,433	-569,601
Total	11,099,747	-39,484,559

4.4.4.2 Indirect Impacts

Indirect effects associated with implementing Alternative 2, would be increased biological diversity associated with soil living organisms, which benefit from a reduction of soil organic matter loss and the increase of perennial vegetation. The increased biodiversity within the soil would generate additional benefits to the vegetation and wildlife, given the biological resources dependence on this resource. Additionally, the capture and retention of topsoil within these areas would provide for overall biodiversity at the local area.

4.4.4.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional needs, as prescribed in the conservation or FSP, or through local or state regulations concerning soil erosion. Some BMPs to reduce soil erosion would be buffer areas and limited or no tillage cropping systems. Additionally, these BMPs provide avenues for greater soil carbon retention.

4.4.5 No Action Alternative

Selecting the No Action Alternative would be unlikely to change current cropping practices or crop species mix, which when compared to the Proposed Action would be a negative, potentially significant effect. Under this alternative, crops currently used to produce bioenergy would be primarily Title I crops, Title I crop residues, and woody biomass residues. It would be plausible that an increase in the use of crop residues to supply BCFs would result in some alteration of cropping practices, to minimize loss of residues; however, too great a loss of residue from being incorporated back into the soil could require greater use of agricultural chemicals. The need for BMPs, associated by region, would be necessary to ensure that an appropriate crop residue level remain to ensure minimized soil loss, as applicable.

4.5 WATER QUALITY AND QUANTITY

4.5.1 Significance Thresholds

An accounting of increases or reductions in input use such as fertilizer, herbicides, and pesticides is performed to evaluate potential changes in water quality. Water quantity changes could result in positive or negative effects on total water use compared to other cropping systems depending on the regional climate. Land use and water use changes will affect hydrology relative to runoff and stream flow.

4.5.2 Methodology

A combined approach was used to determine the potential affect to both water quality and water quantity. An analysis of the potential change in agricultural chemicals using POLYSYS was generated. Additionally, the analysis to determine the changes in soil erosion was considered under the potential for water quality changes. The land use changes as determined by the POLYSYS model were utilized in combination with estimated water use as determined by the USGS for county-level data associated with both groundwater and surface water irrigation sources.

4.5.3 Action Alternative 1

Implementing Alterative 1 would result in a very small positive change in nitrogen use, a variable change in phosphates, but in many cases a reduction and a substantial reduction in potassium use. Since switchgrass is expected to be an excellent nutrient scavenger and recycler to the switchgrass root system, and results in excellent soil surface cover to prevent erosion losses, off-site movement of nitrogen and phosphorus would be expected to be low even with slight increases in use. Lime, herbicides, insecticides, fungicides, etc. were usually greatly reduced from land conversion to switchgrass.

4.5.3.1 Direct Impacts

Water Quality

Table 4.4-2 indicates the percentage changes to be expected in agricultural chemical inputs for the establishment and growth of switchgrass within the top five potential BCAP project locations and across the states. For the top five potential BCAP project locations the conversion to the dedicated perennial energy crop would on average create a reduction in the use of potassium (3.1 percent), lime (4.0 percent), herbicides (5.5 percent), insecticides (11.2 percent), and other agricultural chemicals (3.6 percent). The conversion to a perennial dedicated energy crop would require an average increase across these regions in the use of nitrogen (2.1 percent) and phosphorus (2.9 percent) fertilizers. Across the states, similar declines and increases would be anticipated.

Under this alternative with the limited number of acres to be converted the reduction in agricultural chemical use may not be as great as the average across all regions or it may be greater, though it will be limited to the local area of effect from the conversion activities. The reduction in agricultural chemicals, as well as the reduction in erosion, Total Suspended Solids (TSS), and sedimentation from the conversion to perennial dedicated energy crops would produce a positive effect on water quality, though this effect would be most significant at the local scale. At a regional scale, given the limited amount of acreage expected to be converted under this alternative, the effect would be positive, but minor.

Water Quantity

Water use relative to total quantity will probably only be affected by BCAP if land not previously irrigated is brought into production. The highest states for use of either for irrigation are California, Colorado, Idaho, Montana, Oregon, and Wyoming (Hutson *et al.* 2004). These areas are not thought to be areas generally suitable for a land base for herbaceous or woody energy crops (Graham 1994). Residue removal after harvest of wheat might be feasible, but will still be likely limited compared to corn stover (Graham *et al.* 2007). The temperate humid land areas of the country will not like be changed from non-irrigated to irrigated for residue or biomass crop production.

Using a GIS-based analysis, agricultural irrigation-based water use was determined from the USGS water use estimates (Hutson *et al.* 2004). Table 4.5-1 and Figure 4.5-1 illustrate the estimated water use for irrigation purposes, both groundwater and surface water sources, within the top five Potential BCAP project locations. Table 4.5-2 and Figure 4.5-2 illustrate the estimated irrigation water use for the top regions within each state. According to Kiniry *et al.* (2008) switchgrass has a water use efficiency (WUE) approximately 1.8 to 5.0 percent greater than corn for grain per unit of water transpired (or plant dry weight increase per unit water used). For example a 150 bushel per acre grain (15.5 percent moisture) corn crop for grain produces approximately four tons of biomass, whereas switchgrass could have a biomass yield of eight tons per acre, with greater water use efficiency in the switchgrass biomass production. The total amount of water used in the corn or switchgrass crop cannot be evaluated on the basis of

WUE, but it has been documented that switchgrass is highly adaptable to various water regimes and is more drought tolerant than traditional Title I crops. If it is assumed that all acreage currently defined as cropland in Tables 4.1-2 through 4.1-4 was irrigated acreage, then by converting approximately 133,000 acres to switchgrass and not irrigating that acreage then across the combined top five potential BCAP project locations it would save an estimated 1.2 million gallons per day of irrigation water. Across these five regions, the effect would be minimal, saving only approximately 0.2 percent of irrigated water use; however, depending upon the level of irrigation at the local level, conversion could create greater savings. When compared across all states, the savings could generate 23.6 million gallons per day, which would also be a minimal

Table 4.5-1. Agricultural Water Irrigation Withdrawals Top Five Potential BCAP Potential Project Locations

Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions gallons per day)		
1	84.98	10.26	95.24
2	17.03	15.65	32.68
3	106.89	44.84	151.73
4	236.90	135.32	372.22
5	23.75	16.88	40.63

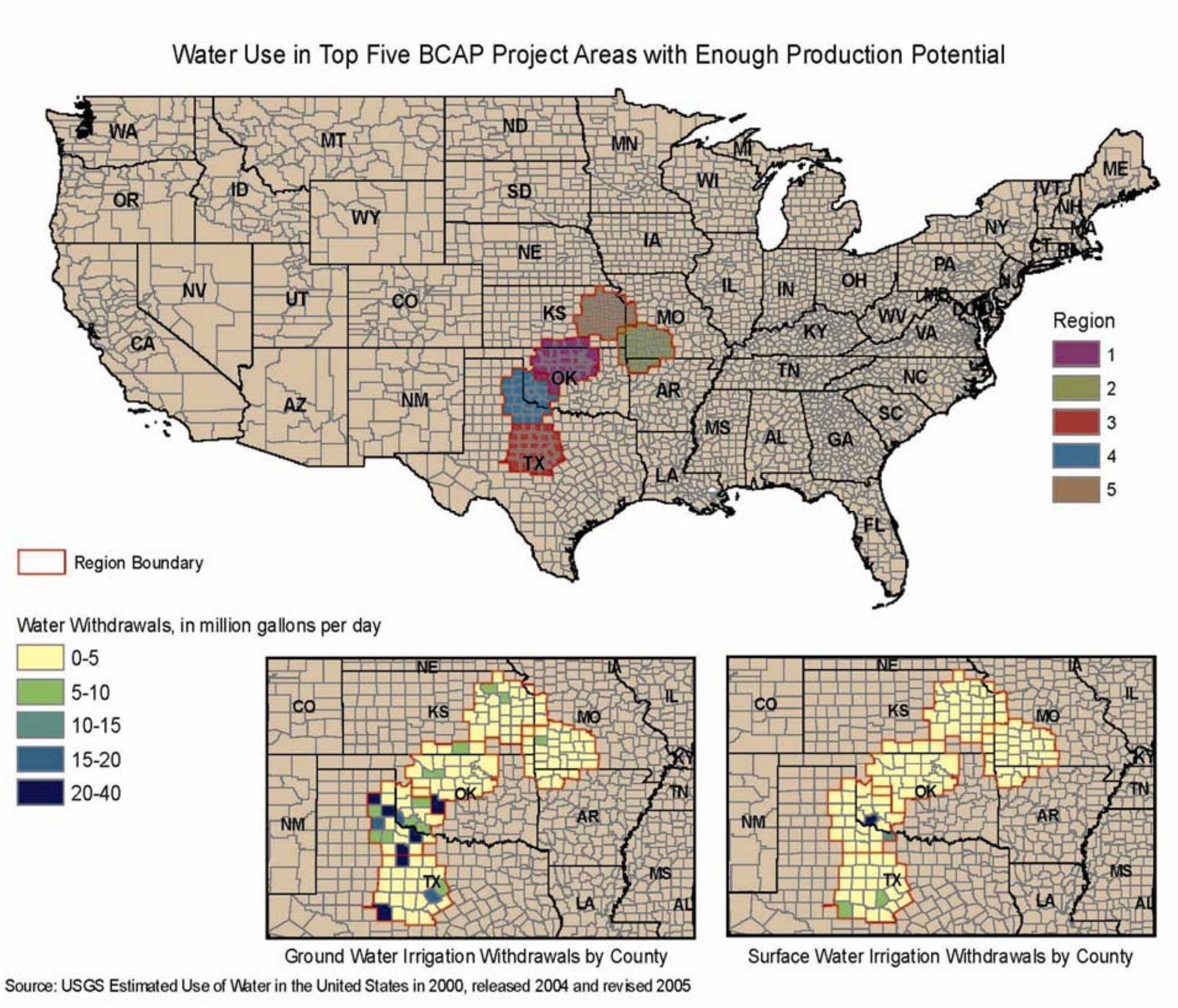


Figure 4.5-1. Estimated Water Use for Irrigation in Top Five BCAP Project Locations

Table 4.5-2. Agricultural Water Irrigation Withdrawals Potential BCAP Potential Project Locations within Each State

Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions of gallons per day)		
1	84.98	10.26	95.24
2	46.21	83.79	130.00
3	2.85	10.09	12.94
4	249.45	134.15	383.60
5	93.71	88.92	182.63
6	284.08	44.58	328.66
7	0.45	14.47	14.92
8	792.49	1,292.09	2,084.58
9	15.29	14.14	29.43
10	2,915.55	300.94	3,216.49
11	46.58	7.51	54.09
12	1,276.59	11.41	1,288.00
13	1.46	6.39	7.85
14	2.17	8.31	10.48
15	705.66	93.94	799.60
16	14.19	77.56	91.75
17	2,535.16	318.83	2,853.99
18	15.47	85.64	101.11

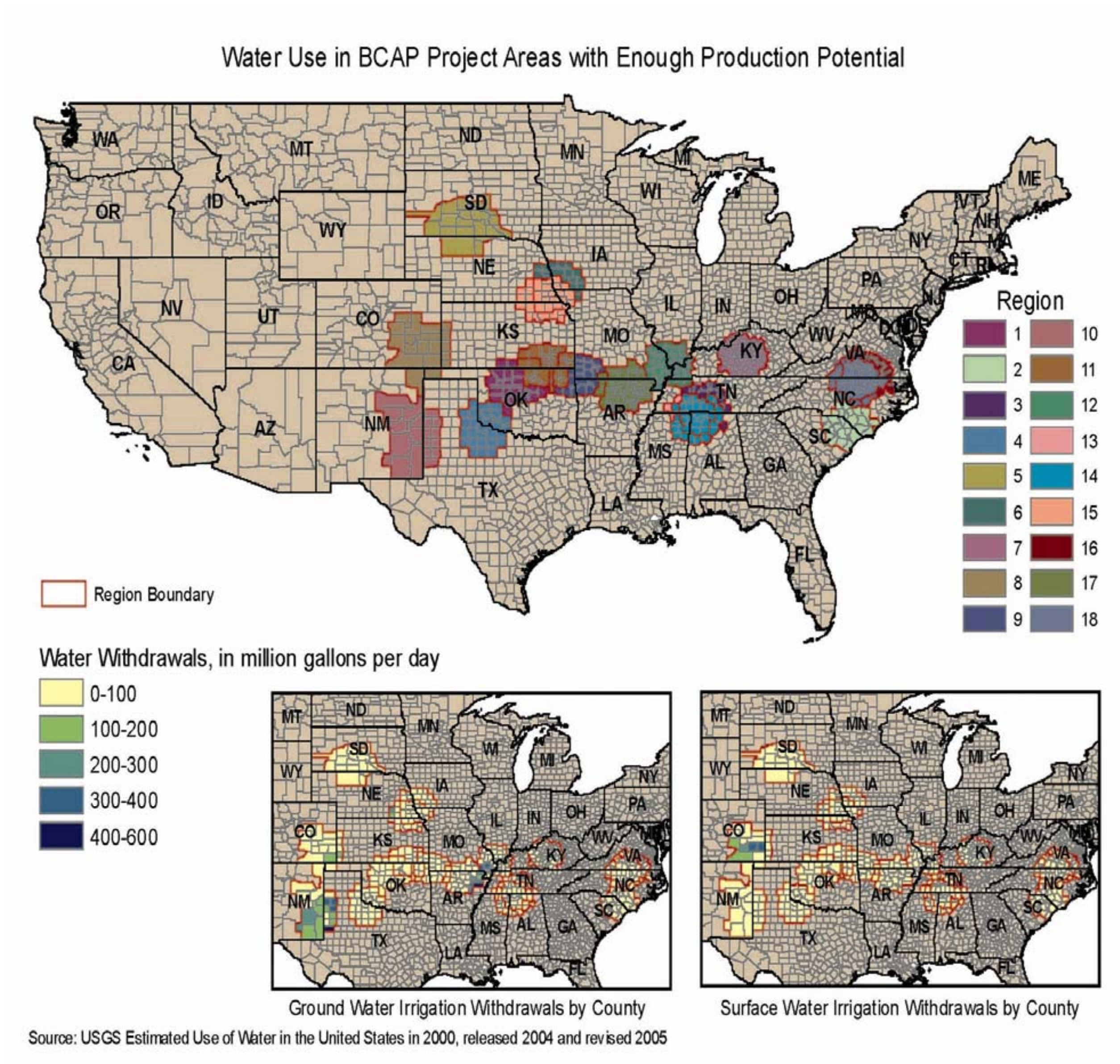


Figure 4.5-2. Estimated Water Use for Irrigation in Top BCAP Project Locations in States with Sufficient Feedstock Potential

4.5.3.2 Indirect Impacts

Indirect impacts associated with implementing Alternative 1 would be the general downstream effects within the larger water courses. Implementing Alternative 1 would create significant local benefits through the reduction in most agricultural chemicals, which would in turn, indirectly benefit larger stream courses and regional water quality aspects.

4.5.3.3 Mitigation Measures

To further reduce impacts to water quality, buffer strips of mixed native species should be utilized prior to any agricultural stormwater flows from monoculture fields reaching stream courses. The mixed native species would provide additional mechanism for sediment and nutrient retention prior to reaching ephemeral or intermittent streams in rural areas. The use of buffer strips as part of the site specific conservation planning, along with other mechanisms as prescribed by the NRCS would create additional water quality benefits associated with the conversion of Title I croplands to perennial herbaceous dedicated energy crops.

4.5.4 Action Alternative 2

4.5.4.1 Direct Impacts

Implementing Alternative 2, would produce similar benefits to water quantity as Alternative 1;; however as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.5.4.2 Indirect Impacts

Implementing Alternative 2 would produce similar benefits to water quantity as Alternative 1; however as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.5.4.3 Mitigation Measures

Implementing Alternative 2 would produce similar benefits to water quantity as Alternative 1; however as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.5.5 No Action Alternative

Implementing the No Action Alternative, with the primary reliance on Title I crops and crop residues would not produce a significant change in water quality or water quantity used for irrigation purposes, unless there was a substantial increase in land use toward Title I crops. Based on agricultural crop production projections, planted corn acreage is anticipated to increase by approximately 5.4 percent between 2008 to 2017; however, all other primary field crop planted acreage is anticipated to decline. Overall the change in land use through the selection of the No Action Alternative would not indicate increased acreage with a need for increased agricultural chemicals or agricultural irrigation.

4.6 RECREATION

4.6.1 Significance Thresholds

The significance of impacts on biological resources, particularly changes in wildlife habitat and viability, are directly related to impacts on outdoor recreation. Significant negative impacts to wildlife habitat would result in reduced opportunities for hunting and wildlife watching.

4.6.2 Methodology

This section will use the changes in wildlife caused by changes in land use and vegetative cover that are identified in Section 4.2, Biological Resources, to estimate changes in recreational spending and non-market impacts. The impact analysis will use, as applicable, the data presented in Section 3.7 from the *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USDOI and USDC 2008) and the Sullivan *et al.* (2004) report.

4.6.3 Action Alternative 1

4.6.3.1 Direct Impacts

As discussed in Section 4.2.3.2, the addition of perennial energy crops will add diversity to regions consisting of monocultures of annual crops. Within regions, the relatively small amount of conversion to cropland will be small, although impacts to wildlife habitat could be large on a very local scale if biodiversity is lessened. Site specific analyses will be required to assess impacts of a BCAP project area on wildlife and subsequent impacts on hunting or other wildlife activities.

In general, impacts to ground-nesting grassland birds will be greatest during establishment of crops, but this will be a short, transitory impact, minimized if the disturbances are outside the primary nesting season.

Impacts to white-tailed deer, the large mammal most likely to be affected under this Alternative and the target of hunters and those involved in wildlife watching, are expected to be minimal.

Impacts to small mammals, including rabbits and other small mammals that are prey to predatory birds and coyotes, are expected to be limited to the establishment period and as such are expected to be transitory and short-lived.

Impacts to birds can be expected to vary as some species, such as bobwhite quail and wild turkey are well-suited to switchgrass plantings, while some grassland birds are less likely to use such areas, although switchgrass plantings in Iowa, as a replacement for row crops, have shown an increase in grassland bird species.

Depending on the overall diversity of vegetative cover and wildlife, the impacts to recreation could be positive or negative at the local area, but based on the small amount of acreage that might be converted, impacts to recreation are expected to be minimal at the regional or national level.

4.6.3.2 Indirect Impacts

Changes in habitat for wildlife can result in a reduction (or increase) in the amount of hunting and wildlife viewing, causing a reduction *(*or increase*)* in national and regional spending for dedicated trips for these activities. Because the changes in habitat acreage will be limited, the impacts on hunting and wildlife viewing are expected to be small, although there could be local impacts.

4.6.3.3 Mitigation Measures

None needed.

4.6.4 Action Alternative 2

4.6.4.1 Direct Impacts

Nationally, the amount of land shifted to biomass crops is expected to be small and the impacts are expected to be small on a national level. Locally, the impacts could include a substantial number of acres, remove habitat suitable for wildlife, and increase monocultures of vegetation. This could have a negative effect on recreation by reducing wildlife populations suitable for hunting and potentially limiting the areas for wildlife viewing. Site specific analyses will need to be performed.

4.6.4.2 Indirect Impacts

Changes in habitat for wildlife can result in a reduction *(*or increase*)* in the amount of hunting and wildlife viewing, causing a reduction *(or increase)* in national and regional spending for dedicated trips for these activities. Because the *national* changes in habitat acreage will be limited, the impacts on hunting and wildlife viewing are expected to be small*, although there could be local impacts*.

4.6.4.3 Mitigation Measures

None needed.

4.6.5 No Action Alternative

4.6.5.1 Direct Impacts

Section 4.2.5.2 discussed the impacts of the BCAP program under the No Action Alternative. Under this alternative, no additional BCFs would be constructed as a result of the BCAP program. Section 4.2.5.2 concluded that the effects of the No Action Alternative upon biological resource are likely to be minimal. If there are no impacts on wildlife habitat or wildlife, then the impacts on recreation involving wildlife are likely to be minimal.

Under the No Action Alternative, the BCAP program will not be implemented and there will be no change in croplands or forest lands from current usage. There will be no impacts to recreation under the No Action Alternative.

5.0 CUMULATIVE IMPACTS ASSESSMENT

5.1 DEFINITION

The EPA (1999) offers the following statement to their NEPA reviewers concerning cumulative impacts, “The combined, incremental effects of human activity, referred to as cumulative impacts, pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources.” This underscores the importance placed on determining the past, present, reasonably foreseeable future activities that interact with the No Action Alternative and the Proposed Action potentially providing synergistic effects that contribute to change (both positive and negative) to the human and natural environments.

According to CEQ guidance, the first steps in assessing cumulative effects involve defining the scope of the other actions and their interrelationship with the Proposed Action. The scope must consider geographic and temporal overlaps affected by the Proposed Action and other programs or projects. It must also evaluate the nature of interactions among these actions.

Cumulative effects most likely arise when a relationship exists between a Proposed Action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in proximity to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, actions that coincide, even partially, in time tend to have the potential for cumulative effects.

5.2 RECENT LEGISLATION AND LEGISLATIVE PROGRAMS

Alternative energy sources to petroleum and other carbon-based energy sources began to migrate into mainstream conscience during the energy crisis of the 1970s. Until recently, the primary alternative energy sources have been solar, geo-thermal, wind, and corn-based ethanol. On the horizon had been energy crops; non-food crops grown specifically for the production of energy to reduce dependence on traditional carbon-based energy sources (i.e., oil, gasoline, natural gas, and coal). The Congressional Research Service (CRS) in RL33831 analyzed the number of energy efficiency and renewable energy bills that were introduced in 110th Congress (Sissine *et al.* 2008). As of 13 November 2008, more than 460 bills associated with energy efficiency and renewable energy were introduced; of those approximately one-third were for renewable fuels and one-third were for tax incentives for investment, energy productions, fuel use, or fuel reduction. Numerous other measures have been introduced in Congress, including the establishment of a Green Bank to provide alternative financing for clean energy projects and energy efficiency projects, as an example.

5.2.1 Energy Independence and Security Act of 2007 and Renewable Fuel Standards

The EISA of 2007 established guidelines for developing 25 percent of our energy needs from renewable sources by the year 2025. This initiative is followed closely by non-governmental agencies, special interest groups, and congressional endorsements for the 25x’25 organization. EISA also called for renewable fuel standards that (1) compare the greenhouse gas (GHG) emissions of renewable based fuels to standard petroleum fuels with a goal of a 60 percent reduction in GHG emissions and (2) set a time table for inclusion of renewable fuel components in standard automobile fuels to reach 36 billion gallons by 2022; for 2009 that level has been set at 10.21 percent or approximately 11.1 billion gallons of renewable fuel components to be blended into automobile fuels.

The EPA has recently issued (May 2009) a notice of proposed rulemaking for the second version of the National Renewable Fuel Standards (RFS2) for 2010 and beyond under EISA. The EPA has included calculations for life-cycle analysis (LCA) of renewable fuels to determine their direct and indirect effects to GHG emissions. The direct effects include the integrated production cycle from farm level (biomass production) to facility (fuel production) to vehicle (fuel consumption), while the indirect effects include indirect land use changes at a global scale to account to changes in exports/imports of agricultural commodities (e.g., corn and soybeans). When finalized, the RFS2 will set the baseline for what will be considered renewable fuel, advanced biofuel, biomass-based diesel, and cellulosic biofuel. Currently, all LCA models are under peer-review and comment, EPA is expecting to issue the final rule for 2010 by 30 November 2009.

5.2.2 American Recovery and Reinvestment Act of 2009 Funding

The *American Recovery and Reinvestment Act of 2009* (ARRA) included numerous renewable energy and energy efficiency provisions. These included extension of production tax credits for wind derived energy (facilities built and functional by 31 December 2012) and for geothermal, biomass, hydropower, landfill gas, waste-to-energy, and marine facilities (facilities built and functional by 31 December 2013) or the conversion of those tax credits to (1) investment tax credits or (2) grant program in lieu of tax credits; advanced energy manufacturing credits; state energy programs; DOE demonstration project funding through the Office of Energy Efficiency and Renewable Energy (EERE); DOE energy efficiency and conservation block grants; Clean Energy Renewable Bonds; and Renewable Energy Loan Guarantee Program. The DOE has partitioned their ARRA funds into $480 million for integrated pilot- and demonstration scale biorefineries (10 to 20 awards ranging from $25 million to $50 million); $176.5 million for commercial-scale biorefinery projects (2 or more projects); $110 million for fundamental research in biomass program; and $20 million for ethanol research.

5.2.3 Food, Conservation, and Energy Act of 2008 Titles

The 2008 Farm Bill authorized numerous programs benefiting energy efficiency and renewable energy production. The following (short) Titles have some components that relate to renewable energy production or use of biomass for the production of energy.

- Biorefinery Assistance (Title IX – Section 9003) - to assist in the development of new and emerging technologies for the development of advanced biofuels.
- Repowering Assistance (Title IX – Section 9004) - to encourage biorefineries in existence on the date of enactment… to replace fossil fuels used to produce heat or power to operate the biorefineries.

- Bioenergy Program for Advanced Biofuels (Title IX – Section 9005) - the Secretary shall make payments to eligible producers to support and ensure an expanding production of advanced biofuels.
- Biomass Research & Development (Title IX – Section 9008) - Secretary of Agriculture and the Secretary of Energy shall coordinate policies and procedures that promote research and development regarding the production of biofuels and biobased products.
- Forest Biomass for Energy (Title IX – Section 9012) - the Secretary, acting through the Forest Service, shall conduct a competitive research and development program to encourage use of forest biomass for energy.
- Community Wood Energy Program (Title IX – Section 9013) - the Secretary, acting through the Chief of the Forest Service, shall establish a program… to provide grants to State and local governments to develop community wood energy plans and competitive grants to State and local governments to acquire or upgrade community wood energy systems.
- Tax Credit for Production of Cellulosic Biofuel (Title XV – Section 15321) – a cellulosic biofuel producer credit of any taxpayer is an amount equal to the applicable amount for each gallon of qualified cellulosic biofuel production.

5.2.4 Oregon Biomass Producer or Collector Tax Credits

In 2007, the Oregon Legislature passed the Oregon Biomass Producer or Collector Tax Credits (House Bill 2210) for applicable businesses, such as agricultural producers. The tax credits are for the in-state production and collection of biomass or energy crops used for the production of bioenergy within the State of Oregon. The detailed tax credits include:

- oil seed crops, $0.05 per pound;
- grain crops, including but not limited to wheat, barley and triticale, $0.90 per bushel; grains do not include corn, and wheat is eligible only after 1 January 2009;
- virgin oil or alcohol from Oregon-based feedstock, $0.10 per gallon;
- used cooking oil or waste grease, $0.10 per gallon;
- wastewater biosolids, $10.00 per wet ton;
- woody biomass collected from nursery, orchard, agricultural, forest or rangeland property in Oregon, including but not limited to prunings, thinning, plantation rotations, log landing or slash resulting from harvest or forest health stewardship, $10.00 per green ton;
- grass, wheat, straw or other vegetative biomass from agricultural crops, $10.00 per green ton;
- yard debris and municipally generated food waste, $5.00 per wet ton; and
- animal manure or rendering offal, $5.00 per wet ton.

5.3 CUMULATIVE IMPACTS ANALYSIS

Hoekman (2009) indicated that a mature bioenergy industry would generate both positive and negative effects, both short-term and long-term. Table 5.4-1 illustrates Hoekman's idea of potential benefits and challenges from the biofuels industry. This PEIS has focused on the potential environmental effects from the implementation of the BCAP and from the No Action Alternative, no implementation of the BCAP. Overall, it has been indicated that in general the BCAP would generate many positive effects at the local, regional, and national scale depending upon the size of the program. Table 5.4-2 summarizes the overall anticipated cumulative effects from the BCAP by alternative.

Table 5.3-1. Potential Benefits and Challenges of Biofuels

Improved Energy Security	Economic Productivity	Environmental Impacts
• Domestic Supply • Distributed Resources • Supply Reliability • Petroleum Reduction	• Price Stability • Increased Rural Development • Reduced Trade Deficit • Improved Global Competitiveness	• Land and Water Use • Criteria Air Pollutants • GHG • Wildlife Habitat • Biodiversity • Carbon Sequestration

Source: Hoekman 2009

Table 5.3-2. Estimated Cumulative Effects by Alternative for BCAP

Resource Area	No Action	Alternative 1	Alternative 2
Socioeconomics and Land Use	I -	I/S +	S +
Vegetation	I	I +	S -/+
Wildlife	I	I +	S -/+
Air Quality	I -	I/S +	I/S -/+
Soil Quality	I/S -	I +	I/S +
Water Quality and quantity	S -	I/S +	S +
Recreation	I	I	I
Transportation	I -	I -	I/S -

Note:
S = Significant
I = Insignificant
N = No Effect
+ = Positive
- = Negative

5.3.1 Socioeconomics and Land Use

Depending upon the level of funding available to meet the desired goals associated with BCAP, the cumulative socioeconomic and land use effects of BCAP when taken into consideration with all of the other Title IX 2008 Farm Bill Programs and state programs that assist with both establishment and CHST would range from insignificant and negative to significant and positive.

With a limited level of BCAP funding that would only provide for two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the location of the facilities. However, land use changes to dedicated energy crops as feedstock for a new BCF, potentially funded through RD, would not be nationally significant, but could create local or regional effects. Under Alternative 1, the limitation of no more than 25 percent of cropland within a county would further limit the potential effects from land use changes. Under Alternative 1, the limited funding would not induce national changes in agricultural related prices, given the limited land use changes to dedicated energy crops.

Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level price changes in Title I commodities specifically related to BCAP implementation. These price changes would induce downstream economic effects, which would generate additional employment positions and increased earnings. Additionally, implementing Alternative 2 would provide greater regionalization potential to take advantage of regionally significant feedstocks (i.e., SRWC, woody biomass, energycane, energy sorghum). Having the ability to take advantage of regionally competitive species could induce land use changes toward dedicated energy crops in those areas that currently would not support Title I crops or are only marginally productive for Title I crops.

The combination of the USFS provisions for the utilization of woody biomass for bioenergy and the CHST Matching Payment provisions of BCAP would likely contribute to a greater use of forestry residues in BCFs. This would be the most likely path for short term increases in the utilization of biomass for bioenergy due to the availability of this feedstock and the proximity and wide definition of qualified BCF under the CHST. USFS NEPA requirements for materials taken from National Forest System Lands would limit the cumulative effects from the use of forestry residues, as each removal application would be required to follow all applicable Federal, State, and local environmental regulations and mitigation measures.

5.3.2 Biological Resources

Both the direct and indirect impacts to vegetation and wildlife from the implementation of Alternative 1 vary greatly depending on the region in which BCAP Project Areas may be established. Cumulative impacts to vegetation would occur from the conversion of large amounts of agricultural land from traditional crops to dedicated energy crops. The amount of land within the 50-mile radius of potential qualified BCFs ranges from 0.7 million to 77 million acres. The cap on the amount of acreage that may be used for dedicated energy crop of 25 percent in any county within the 50-mile radius reduces this impact. Similarly, because of the limited funding that would only provide for two to five qualified BCFs, the amount of agricultural land that potentially would be converted is negligible.

As stated previously, there are no quantitative studies of the impacts to wildlife directly related to biofuel crops. Direct effects on wildlife occur from conflicts with haying machinery or trampling by grazing livestock that may result in mortality. Under Alternative 1, direct impacts are expected to occur during the establishment and harvest of crops; yet, these impacts are expected to be short-term and localized. Indirect impacts would be the result of habitat change, as cropland use is shifted from traditional crops to dedicated energy crops. These habitat changes would impact such aspects as food availability, type and quantity of cover for escape and breeding, and the availability of adequate nesting sites. Wildlife in lands adjacent to the dedicated energy cropland may either be positively or negatively impacted depending on the habitat quality provided by the biofuel crops. Studies have shown that switchgrass can be more beneficial to certain species of birds that row crops and small grain crops, with density and richness being higher in harvested switchgrass areas. Yet, because of the limited implementation under Alternative 1, benefits would only be locally beneficial for wildlife abundance and diversity.

The broad implementation of Alternative 2 could lead to both direct and indirect impacts to vegetation and wildlife at a national scale. The overall direct impacts to vegetation and wildlife may be either positive or negative as lands are converted dedicated energy crops. Positive impacts would result from a conversion of traditional crops to perennial or short-rotation woody crops. This vegetation type generally provides a higher quality habitat than row crops or small grain crops. As with Alternative 1, direct impacts are not expected to impact wildlife at a population level. However, the significance of indirect impacts are dependent on potential land use changes; the quantity and habitat quality of any land converted from native grasses, forestland or pastureland for dedicated energy crops will determine the level of cumulative impacts. Under Alternative 2, depending upon the level of land use changes, the cumulative impacts to vegetation and wildlife could be either insignificant or significant.

Under the No Action Alternative, the BCAP Project Areas Program would not be implemented and financial assistance would not be provided for the conversion of cropland and potentially non-agricultural land to dedicated energy crops. Both the positive and negative impacts to vegetation and wildlife as described above would not occur.

5.3.3 Air Quality

In general, the maturation of the biofuels and bioenergy industries should result in significantly positive energy balance in relation to first generation biofuels and bioenergy supported by grain feedstocks and fossil fuels. Substantial effort has been made on determining the potential value of biofuels and bioenergy at localized, regional or state, national, and global levels.

Depending upon the level of funding available to meet the desired goals associated with BCAP, the cumulative air quality effects of BCAP when taken into consideration with all other Title IX of the 2008 Farm Bill Programs and state programs that assist with both establishment and CHST would range from insignificant and negative to significant and positive with some potential for significant and negative.

With a limited level of BCAP funding that would only provide for two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the location of the facilities. However, it was estimated that the BCAP program would generate net energy savings and greater soil carbon sequestration as lands are converted to dedicated energy crops. The effects were estimated to only be locally or regionally significant and not nationally significant.

Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level effects, such as a decline in soils carbon sequestration, due to an increased use of crop residues to meet the EISA volume requirements. It was estimated that there would be benefits from the conversion of lands associated with total carbon flux and overall energy use, but there would also be negative effects from the greater use of residues, which would generate additional GHG emissions and reduce soil carbon sequestration. In the longer term, as more acreage is planted to dedicated energy crops and regionally competitive crops (i.e., SRWC), there would be some off-set from the anticipated soil carbon losses associated with residue removal and use.

5.3.4 Soil Quality

The implementation of BCAP would generate positive effects from a reduction in soil erosion and increased soil carbon sequestration from the conversion of Title I crops to perennial dedicated energy crops. The conversion to a perennial dedicated energy crop provided greater soil retention due to anticipated cropping practices and the plant structure holding soil in place. Under Alternative 1, with the limited BCAP funding, the benefits associated with reduced soil erosion would be only locally significant and would provide for positive changes to water quality, soil organisms biodiversity and overall biological diversity. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively. When combined with the USFS measures to increase woody biomass utilization for bioenergy, there may be short term increases in soil erosion from forest lands in some regions, while in other regions, those effects would be insignificant due to the species and understory cover provided. The increased use of crop residues is anticipated to lead to changes in cropping practices, which should provide greater soil cover by standing crop residues and reduced tillage practices to promote residues use.

5.3.5 Water Quality and Quantity

The implementation of BCAP would generate positive effects from (1) a potential reduction of irrigated acres, (2) greater water use efficiency on non-irrigated and irrigated acreage, and (3) a general reduction in agricultural chemical use from the conversion of Title I crops to perennial dedicated energy crops. The conversion to a perennial dedicated energy crop provides greater WUE, which would limit runoff from agricultural fields and potential need for irrigation past the initial establishment period. Under Alternative 1, with the limited BCAP funding, the benefits associated with increased water quality and decreased water quantity would be only locally significant and would provide for positive changes. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively.

5.3.6 Recreation

Impacts to recreation could be positive or negative based on the locality for BCAP project regions. However, they would be small regionally and nationally under either alternative and would not substantively or cumulatively change the recreational aspects of participation in wildlife activities.

5.3.7 Transportation

The transportation system's capacity to move biomass, and co-location products derived from processing biomass/biofuel production would increase proportionately as production increases. However, biomass use for fuel is likely to have a mixed impact on rail, truck, and barge transportation. For example, trucks are used to ship most of the biomass used by BCF today.

The cost of transporting biomass goods is highly dependent on the scale of the project. A recent study by Brechbill and Tyner (2008) showed that the total per ton costs for producing and transporting biomass within 30 miles area range between $39 and $46 for corn stover and $57 and $63 for switchgrass. The difference in transportation costs between per ton owned for corn stover and switchgrass is due to the capital transportation costs being spread over more tons in the case of switchgrass. It is reported that this difference also exists between corn stover and switchgrass due to differences in yields of these crops per acreage (Brechbill and Tyner 2008).

When considered cumulatively, BCAP has the potential to provide positive benefits associated with the transportation sector and negative effects associated with increased use of primarily truck transportation during the short term. Under Alternative 1, provided the limited funding of BCAP for only the support of two commercial-scale facilities, transportation efforts would be centered on the available modes to move dedicated energy crops to the BCF and move equipment to the field to establish the dedicated energy crop. Primarily, the transportation mode would be heavy trucks with the ability to transport bales of biomass. For establishment, the transportation network would use heavy trucks to move machinery very similar to machinery currently in use or readily available from commercial producers. Related transportation effects would be through noise, fugitive dust, and level of service aspects on rural roadways. Under Alternative 1, with the limitation of new dedicated energy crops, conversion of existing cropland, which is currently in production, would be the key factor to determine the overall level of effects. Site specific traffic analysis would be required by RD, if the new BCF were to receive funding under its Title IX program, which would address and mitigate potential effects directly related to the BCF and the transportation of feedstock to the facility.

Under Alternative 2, to meet the EISA volume requirements, in the short term, there would be a heavy reliance on the use of crop residues and woody biomass. These feedstocks would be transported over existing road networks using existing equipment, but potentially at a higher volume. If, under Alternative 2, there is larger scale expansion of BCFs, then there would be the potential for greater investment in the transportation system, which would have the potential to bring new jobs to the rural areas through construction and maintenance. The development of infrastructure can bring increased traffic to existing business and industries, all which in turn would potentially create utility surplus in rural economies.

Because of heavy reliance on trucking systems the interstate and highway systems (including bridge systems, etc.) would experience greater levels of use as the need for feedstocks increase over the longer term. Semi-trailers and other forms of heavy traffic accelerate the rate of deterioration on the road networks and bridge systems, thereby increasing the expenses for state and local governments. Overall, transportation effects from the implementation of BCAP would generate both positive benefits and negative effects at local and regional areas associated with a BCF.

5.3.8 Energy Balance

Koh and Ghazoul (2008) indicate a range of potential net energy balance (NEB) ratios from a high of 8.33 for sugarcane-based ethanol to a low average of 0.66 for wood-based ethanol. From the analysis, all studies that included biodiesel had NEB ratios for each species greater than 1.0, indicating that the biomass material created more energy output than was required to convert the crop into energy. In the reverse the analysis of studies indicated that all materials used for cellulosic ethanol had NEB ratios of less than 1.0. Table 5.3-3 provides synopsis of NEB ratios as derived from the entire well-to-wheels cycle of energy output to energy input, based on recent literature; while Table 5.3-4 provides an overview of production to farm gate efficiency identified in recent literature. Overall, these studies indicate that bioenergy can be produced to provide a significant NEB ratio, especially later generation feedstocks.

Table 5.3-3. NEB Ratio (Output/Input) by Product Type

Authors	Date	Corn Grain Ethanol	Soybean/Oilseed Diesel	Biomass Electricity	Biomass Ethanol	Biomass Synfuel
Tilman *et al.*	2006	1.25	1.93	5.51	5.44	8.09
Staley and Bradley	2008	1.3 – 1.5				
Giampietro *et al.*	1997	0.5 – 1.7	0.6 – 1.3		3.0 – 2.5	
Escobar *et al.*	2009	1.3	1.7 – 5.95		5.2 – 7.9	

Table 5.3-4. Energy Efficiency Cradle to Farm–Gate by Plant Species

Authors	Date	Giant Reed	Miscanthus	Switchgrass	Cynara
Monti *et al.* [GJ/ha/yr]	2009	349	283	200	75
Smeets *et al.* [Renewable Output/Fossil Fuel Input]	2009		23-56	25-49	

5.4 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effect that the use of these resources has on future generations. Irreversible effects primarily result from the use or destruction o a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action. For the proposed action, the use of gasoline for operating heavy equipment would be the only irreversible or irretrievable resource commitment expected from the implementation of the proposed action.

6.0 MITIGATION

6.1 INTRODUCTION

The purpose of mitigation is to avoid, minimize, or eliminate negative impacts on affected resources to some degree. CEQ Regulations (40 CFR 1508.20) state that mitigation includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- Compensating for the impact by replacing or providing substitute resources or environments.

6.2 ROLES AND RESPONSIBILITIES

CEQ Regulations state that all relevant reasonable mitigation measures that could improve a project should be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies. This serves to alert agencies or officials who can implement these extra measures, and would encourage them to do so. The lead agency for the alternatives analyzed is FSA.

6.3 MITIGATION RECOMMENDATIONS

The long-term negative impacts associated with implementation of the action alternatives analyzed are expected to be minor. Short-term impacts would occur primarily during establishment and management of biomass eligible crops and thus are localized in nature. Prior to BCAP approval, a site-specific environmental evaluation would have to be completed that would reveal any protected resources on or adjacent to the land proposed for eligible biomass crop production. When sensitive resources such as protected species or cultural resources are present or in the vicinity of the proposed biomass crop production site, consultation with the appropriate regulatory agency would occur. Specific mitigation measures necessary to reduce or eliminate the potential localized negative impacts to those sensitive resources would be identified. If the environmental evaluation identifies species or critical habitat protected under ESA are potentially present, and the proposed agricultural activity on the land is determined to have negative impacts, it is not likely the site would be approved for production of eligible biomass crops.

In addition to a site specific evaluation, BCAP approval is also contingent upon, the development of a Conservation or Forest Stewardship Plan that is in compliance with NEPA and all other applicable Federal and State laws and regulations. The conservation plan must be completed by qualified individuals either employed at NRCS or an NRCS-certified Technical Service Provider. The qualified conservationist would use information from ecological site descriptions, trend determinations, similarity index determinations, assessments of the health of the conservation lands and other information (climatic conditions, appropriate stocking rate) to assist the CRP program participant to design a plan for biomass crop management activities on authorized conservation practices that would not defeat the purposes of the CRP contract. The Forest Stewardship Plan would identify and describe actions to protect, manage, maintain and enhance relevant resources listed in the law (soil, range, aesthetic quality, recreation, timber, water, and fish and wildlife) consistent with the objectives of BCAP and the plan must be approved by the State forester or a designated representative of the State forester.

Potential negative impacts to the affected resources identified in the analysis for implementing the proposed action alternatives and the proposed mitigation that would reduce or eliminate these impacts are described below.

Biological Resources:

The establishment of dedicated energy crops may result in impacts to vegetation and wildlife under both action alternatives. These impacts may be reduced by the development and implementation of a Conservation Plan and adherence to established NRCS Conservation Practice Standards. Conservation Plans require habitat evaluation and appraisal to identify habitat-limiting factors, and have developed habitat evaluation tools to achieve habitat conditions for particular species such as northern bobwhite or greater prairie chickens. Measures to benefit native pollinators and other wildlife and provide insect food sources for grassland nesting birds, spraying or other control of noxious weeds would be done on a “spot treatment” basis in accordance with NRCS Practice Standard 595 Pest Control. All methods of plant and insect pest management must comply with Federal, State, and local regulations. Likewise, procedures for harvesting at a stage of maturity or harvest interval range that provides adequate food reserves and/or basal or auxiliary tillers or buds for regrowth and/or reproduction to occur without loss of plant vigor are outlined in Conservation Practice Standard 511 Forage Harvest Management. Other mitigation methods include maintaining vegetative structure diversity, avoiding monocultures, provide buffers for sensitive areas, connect areas of native habitat with corridors, maintain landscape heterogeneity, apply disturbance regimes that mimic the natural regime, and control invasive species,

The establishment, management, and transport activities of biomass eligible crops may result in impacts to Air Quality by increasing GHG emissions under both Alternatives 1 and 2. However these impacts may be minimized and mitigated through the implementation of site specific mitigation measures based on the local or regional Air Quality Control Region, as prescribed in the conservation or forest stewardship plan or through local or state regulations concerning air emissions of criteria pollutants. Best management practices (BMPs) such as proper maintenance of equipment and dust suppression activities would help to minimize mobile source emissions as required for site specific conditions.

Biomass eligible crop establishment and management activities may result in increased soil erosion and decreases in soil carbon sequestration under both Alternatives 1 and 2. Site specific mitigation measures determined by the local or regional needs, as prescribed in the conservation or forest stewardship plan, or through local or state regulations concerning soil erosion would help to minimize or mitigate these impacts. Utilizing BMPs such as buffer areas and limited or no tillage cropping systems are designed to reduce soil erosion and provide for greater soil carbon retention.

The establishment and management of biomass eligible crops may negatively impact water quality and quantity under both Alternatives 1 and 2 due to increases in agricultural chemical use, soil erosion, and irrigated lands. Buffer strips of mixed native species should be utilized prior to any agricultural stormwater flows from monoculture fields reaching stream courses to help minimize or mitigate these impacts. The use of mixed native species would provide additional mechanism for sediment and nutrient retention prior to any runoff reaching ephemeral or intermittent streams in rural areas. The use of buffer strips as part of the site specific conservation planning, along with other mechanisms as prescribed by the NRCS would create additional water quality benefits associated with the conversion of Title I croplands to perennial herbaceous dedicated energy crops.

The impacts on recreation are expected to be small, therefore no mitigation is needed. However, site specific analyses may determine that mitigation could be needed to address local concerns.

This page inbtentionally left blank

7.0 REFERENCES

Adler, P.R., del Grosso, S.J., and Parton, W.J., 2007, Life-cycle assessment of net greenhouse-gas flux for bioenergy cropping systems: Ecological Applications, v. 17, p. 675-691.

Alexander, R.R., and English, B.C., 1998, The micro-oriented sediment simulator, version 2.1 user's manual, Research Report 88-21, University of Tennessee, Department of Agricultural Economics and Rural Sociology.

APHIS (Animal and Plant Health Inspection Service), 2002, Factsheet: The plant protection act, http://www.aphis.usda.gov/publications/plant_health/content/printable_version/fs_phproact.pdf, U.S. Department of Agriculture, APHIS. Accessed July 2009.

APHIS (Animal and Plant Health Inspection Service), 2006, APHIS biotechnology: Permitting progress into tomorrow, Biotechnology regulatory services factsheet. http://www.aphis.usda.gov/publications/biotechnology/content/printable_version/BRS_FS_permitprogress_02-06.pdf, U.S. Department of Agriculture, APHIS. Accessed July 2009.

Barrett, G.W., and Peeles, J.D., 1994, Optimizing habitat fragmentation: An agrolandscape perspective: Landscape and Urban Planning, v. 28, p. 99-105.

Benton, T.G., Vickery, J.A., and Wilson, J.D., 2003, Farmland biodiversity: is habitat heterogeneity the key?: Trends in Ecology and Evolution, v. 18, p. 182-188.

Best, L.B., Freemark, K.E., Dinsmore, J.J., and Camp, M., 1995, A review and synthesis of habitat use by breeding birds in agricultural landscapes of Iowa: American Midland Naturalist, v. 134, p. 1-29.

Best, L.B., H. Campa, I., Kemp, K.E., Robel, R.J., Ryan, M.R., Savidge, J.A., Weeks, J., H.P.,, and Winterstein, S.R., 1997, Bird abundance and nesting in CRP fields and cropland in the midwest: A regional approach: Wildlife Society Bulletin, v. 25, p. 864-877.

Black, S.H., Hodges, N., Vaughn, M., and Shepard, M., 2007, Invertebrate conservation fact sheet: Pollinators in natural areas, a primer on habitat management, *in* The Xercies Society for Invertebrate Conservation, ed.

Bowen, B.S., and Kruse, A.D., 1993, Effects of grazing on nesting by upland sandpipers in southcentral North Dakota: Journal of Wildlife Management, v. 57, p. 291-301.

Bowman, D., Walsh, A., and Prior, L.D., 2004, Landscape analysis of aboriginal fire management in Central Arnhem Land, north Australia: Journal of Biogeography, v. 31, p. 207-23.

Brady, N.C., 1990, The nature and property of soils and soil taxonomy, 9th edition: NY, MacMillan Publishing.

Brady, S.J., 2007, Effects of cropland conservation practices on fish and wildlife habitat, *in* Society, T.W., ed., Fish and wildlife response to Farm Bill conservation practice, p. 9-23.

BRDB (Biomass Research and Development Board), 2008, Economics of biomass feedstocks in the United States: A review of the literature.

Brechbill, S.C., and Tyner, W.E., 2008, The economics of biomass collection, transportation, and supply to Indiana cellulosic and electric utility facilities: West Lafayette, IN, Department of Agricultural Economics, Purdue University.

Bulan, C.A., and Barrett, G.W., 1971, The effects of two acute stresses on the arthropod component of an experimental grassland ecosystem: Ecology, v. 52, p. 597-605.

Burke, D., and Goulet, H., 1998, Landscape and area effects on beetle assemblages in Ontario: Ecography v. 21, p. 472-479.

Calverley, B.K., and Sankowski, T., 1995, Effectiveness of tractor-mounted flushing devices in reducing accidental mortality of upland-nesting ducks in central Alberta hayfields. Alberta North American Waterfowl Management Plan Centre, Edmonton, Alberta, Canada.

Carpenter, S., Caraco, N.F., Correll, D.L., Howarth, R.W., Sharpley, A.N., and Smith, V.H., 1998, Nonpoint Pollution of Surface Waters with Phosphorus and Nitrogen: Ecological Applications, v. 8, p. 559-568.

Chapman, M.A., and Burke, J.M., 2006, Letting the gene out of the bottle: the population genetics of genetically modified crops: New Phytologist, v. 170, p. 429-443.

Christian, D.P., Hoffman, W., Hanowski, J.M., Niemi, G.J., and Beyea, J., 1998, Bird and mammal diversity on woody biomass plantations in North America: Biomass and Bioenergy, v. 14, p. 395-402.

Christiansen, R.C., 2008, U.S. sugarcane-to-ethanol projects underway: Ethanol Producer Magazine.

Clark, B.K., Clark, B.S., Homerding, T.R., and Munsterman, W.E., 1998, Communities of small mammals in six grass-dominated habitats of southeastern Oklahoma: American Midland Naturalist, v. 139, p. 262-268.

Colorado State University, 2008, Research: Monitoring Studies of Small Mammals. http://sgs.cnr.colostate.edu/Research/SmallMammals/MntrngStdsofSmlMmls.htm. Accessed July 2009.

Coppedge, B.R., Engle, D.M., Masters, R.E., and Gregory, M.S., 2001, Avian responses to landscape change in fragmented southern Great Plains grasslands: Ecological Applications, v. 11, p. 47-59.

Cornell University, 2005, Management of grasses for biofuel: Bioenergy information sheet #4., Cornell University, College of Agriculture and Life Sciences.

CTIC (Conservation Technology Information Center), 2007, National crop residue management survey conservation tillage data 1989-2004. http://www2.ctic.purdue.edu/CTIC/CRM.html. Accessed July 2009.

Culman, S., Glover, J.D., DuPont, S.T., Fick, G.W., Buckley, D., Young-Matthews, A., Ferris, H., Sánchez-Moreno, S., and Jackson, L.E., 2009, Comparing landscape biodiversity and community composition of soil food webs between cultivated fields and grasslands, 94th Annual Ecological Society of America Annual Meeting.

Czapar, G., 2008, Impacts of biofuel production on water resources, University of Illinois Extension.

De La Torre Ugarte, D.G., Ray, D.E., and Tiller, K.H., 1998, Using the POLYSYS modeling framework to evaluate environmental impacts in agriculture, *in* Robertson, T., English, B.C., and Alexander, R.R., eds., Evaluating natural resource use in agriculture Ames, IA, Iowa State University Press.

De La Torre Ugarte, D.G., and Ray, D.E., 2000, Biomass and bioenergy applications of the POLYSYS modeling framework: Biomass and Bioenergy, v. 18, p. 291-308.

De La Torre Ugarte, D.G., Walsh, M.E., Shapouri, H., and Slinsky, S.P., 2003, The economic impacts of bioenergy crop production on U.S. agriculture, Agricultural economic report 816: Washington, D.C., U.S. Department of Agriculture, Office of the Chief Economist.

De La Torre Ugarte, D.G., English, B.C., and Jensen, K., 2007, Sixty billion gallons by 2030: Economic and agricultural impacts of ethanol and biodiesel expansion: American Journal of Agricultural Economics, v. 89, p. 1290-1295.

Di Giulio, M., Edwards, P.J., and Meister, E., 2001, Enhancing insect diversity in agricultural grasslands: The roles of management and landscape structure: Journal of Applied Ecology, v. 38, p. 310-319.

DiTomaso, J.M., Barney, J.N., and Fox, A.M., 2007, Biofuel feedstocks: The risk of future invasions, CAST Commentary QTA 2007-1: Ames, IA, The Council for Agricultural Science and Technology (CAST).

DOE (U.S. Department of Energy), 2006, Breaking the biological barriers to cellulosic ethanol: A joint research agenda, DOE/SC-0095: Rockville, MD, U.S. Department of Energy Office of Science and Office of Energy Efficiency and Renewable Energy.

DOE (U.S. Department of Energy), 2009a, Introduction to Biomass: Biomass Overview, Biomass Energy Data Book: Energy Efficiency and Renewable Energy. http://cta.ornl.gov/bedb/introduction/Biomass_Overview.shtml. Accessed July 2009.

DOE (U.S. Department of Energy), 2009b, Biomass energy or biopower: Energy efficiency and renewable energy. http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10450. Accessed July 2009.

Elmqvist, T., Folke, C., Nystrom, M., Peterson, G., Bengtsson, J., Walker, B., and Norberg, J., 2003, Response diversity, ecosystem change, and resilience: Frontiers in Ecology and the Environment, v. 1, p. 488-494.

English, B.C., De La Torre Ugarte, D.G., Walsh, M.E., Hellwinckel, C.M., and Menard, J., 2006, Economic competitiveness of bioenergy production and effects on agriculture of the Southern Region: Journal of Agricultural and Applied Economics, v. 38, p. 389-402.

English, B.C., Menard, R.J., and Jensen, K., 2008, Risk, infrastructure and industry evolution: Proceedings of a conference June 24-25, 2008, in Berkeley, California, Farm Foundation, USDA's Office of Energy Policy and New Uses.

EPA (U.S. Environmental Protection Agency), 1998, The quality of our nation's waters, EPA 841-S-97-001: Washington, D.C., EPA Office of Water.

EPA (U.S. Environmental Protection Agency), 1999, Consideration of cumulative impacts in EPA review of NEPA documents, EPA 315-R-99-002: Washington, D.C., U.S. Environmental Protection Agency, Office of Federal Activities.

EPA (U.S. Environmental Protection Agency), 2008a, State adoption of numeric nutrient standards (1998-2008), EPA-821-F-08-007: Washington, D.C., Office of Water 4304.

EPA (U.S. Environmental Protection Agency), 2008b, EPA's report on the environment, U.S. EPA document number: EPA/600/R-07/045F: Washington, D.C., U.S. Environmental Protection Agency.

EPA (U.S. Environmental Protection Agency), 2008c, Polluted Runoff (Nonpoint Source Pollution), Chapter 2: Management Measures for Agricultural Sources - I. Introduction http://www.epa.gov/nps/MMGI/Chapter2/ch2-1.html. Accessed July 2009.

EPA (U.S. Environmental Protection Agency), 2009, US Department of Health & Human Services, Food and Drug Administration (FDA), Plant Biotechnology for Food and Feed, EPA regulation of pesticidal substances.

ERS (Economic Research Service), 2008, Rural America at a glance, 2008 edition, Economic information bulletin 40, U.S. Department of Agriculture.

ERS (Economic Research Service), 2009, Data sets - adoption of genetically engineered crops in the U.S.

Escobar, J.C., Lora, E.S., Venturini, O.J., Yanez, E.E., Castillo, E.F., and Almazan, O., 2009, Biofuels: Environment, technology and food security: Renewable and Sustainable Energy Reviews, v. 13, p. 1275-1287.

Farrand, D.T., and Ryan, M.R., 2005, Impact of the Conservation Reserve Program on wildlife conservation in the Midwest, *in* Haufler, J.B., ed., Fish and wildlife benefits of Farm Bill conservation programs: 2000–2005 update: Bethesda, MD, The Wildlife Society Technical Review 05-2.

Fernandez-Cornejo, J., and McBride, W.D., 2002, Adoption of Bioengineered Crops Agricultural Economic Report No. (AER810), p. 67.

Ferrel, J., 2009, DOE's Bioenergy Program, *in* Farm Foundation, ed., Conference on the role of extension in energy: Little Rock, AR.

Firbank, L.G., 2008, Assessing the ecological impacts of bioenergy projects: Bioenergy Research, v. 1, p. 12-19.

Firbank, L.G., Petit, S., Smart, S., Blain, A., and Fuller, R.J., 2008, Assessing the impacts of agricultural intensification on biodiversity: a British perspective: Philosophical Transactions B, v. 363, p. 777-787.

Fishcher, J., Lindenmayer, D.B., and Manning, A.D., 2006, Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes: Frontiers in Ecology and the Environment, v. 4, p. 80-86.

FSA (Farm Service Agency), 2003, Final programmatic environmental impact statement for the conservation reserve program (CRP): Washington, D.C., FSA.

FSA (Farm Service Agency), 2009, FSA handbook, Environmental quality programs for state and county offices (1-EQ Revision 2): Washington, D.C., U.S. Department of Agriculture, Farm Service Agency.

Gallagher, P., Dikeman, M., Fritz, J., Wailes, E., Gauther, W., and Shapouri, H., 2003, Biomass from crop residues: Cost and supply estimates, Agricultural Economic Report No. 819: Washington, D.C., U.S. Department of Agriculture, Office of the Chief Economist, Office of Energy Policy and New Uses.

Garland, C.D., 2008, Growing and harvesting switchgrass for ethanol production in Tennessee, Publication no. SP701-A: Knoxville, TN, University of Tennessee Extension.

Gates, J.M., 1965, Duck nesting and production on Wisconsin farmlands: Journal of Wildlife Management, v. 29, p. 515-523.

Giampietro, M., Ulgiati, S., and Pimentel, D., 1997, Feasibility of large-scale biofuel production: BioScience, v. 47, p. 587-600.

Gill, D.E., Blank, P., Parks, J., Lohr, B., Schwartzman, E., Gruber, J.G., Dodge, G., Rewa, C.A., and Sears, H.F., 2006, Plants and breeding bird response on a managed conservation reserve program grassland in Maryland: Wildlife Society Bulletin, v. 34, p. 944-956.

Goebel, J., 2007, Personal communication with J. Goebel regarding estimated C and KLSR factors for cropland, pastures, and CRP lands, USDA National Resource Conservation Service, April and June 2007.

Graham, R.L., Nelson, R., Sheehan, J., Perlack, R.D., and Wright, L.L., 2007, Current and potential U.S. corn stover supplies: Agronomy Journal, v. 99, p. 1-11.

Goklany, I.M., 2001, The precautionary principle: A cautionary appraisal of environment risk assessment: Washington D.C.

Graham, R.L., 1994, An analysis of the potential land base for energy crops in the conterminous United States: Biomass and Bioenergy, v. 6, p. 175-189.

Granfors, D.A., Church, K.E., and Smith, L.M., 1996, Eastern meadowlark nesting in rangelands and Conservation Reserve Program fields in Kansas: Journal of Field Ornithology, v. 67, p. 222-235.

Grant, W.E., Birney, E.C., French, N.R., and Swift, D.M., 1982, Structure and Productivity of Grassland Small Mammal Communities Related to Grazing-Induced Changes in Vegetative Cover: Journal of Mammalogy, v. 63, p. 248-260.

Hanowski, J.M., Niemi, G.J., and Christian, D.P., 1997, Influence of within-plantation heterogeneity and surrounding landscape composition on avian communities in hybrid poplar plantations: Conservation Biology.

Hansen E. A., and Netzer, D.A., 1985, Weed control using herbicides in short-rotation intensively cultured poplar plantations: Res. Pap. NC-260, USDA North Central Forest Experimental Station, St. Paul, MN.

Harper, C.A., and Keyser, P.D., 2008, Potential impacts on wildlife of switchgrass grown for biofuels, University of Tennessee Biofuels Initiative.

Haufler, J.B., and Ganguli, A.C., 2007, Benefits of farm bill grassland conservation practices to wildlife, *in* Society, T.W., ed., Fish and Wildlife response to Farm Bill conservation practices, Technical review 07-1: Bethesda, MD.

Heaton, E.A., Flavell, R.B., Mascia, P.N., Thomas, S.R., Dohleman, F.G., and Long, S.P., 2008, Herbaceous energy crop development: recent progress and future prospects: Current Opinion in Biotechnology, v. 19, p. 202-209.

Hoekman, S.K., 2009, Biofuels in the U.S. - Challenges and opportunities: Renewable Energy, v. 34, p. 14-22.

Horn, D.J., and Koford, R.R., 2000, Relation of grassland bird abundance to mowing of Conservation Reserve Program fields in North Dakota: Wildlife Society Bulletin, v. 28, p. 653-659.

Hughes, J.P., Robel, R.J., and Kemp, K.E., 2000, Factors influencing mourning dove nest success in CRP fields: Journal of Wildlife Management, v. 64, p. 1004-1008.

Hutson, S.S., Barber, N.L., Kenny, J.F., Linsey, K.S., Lumia, D.S., and Maupin, M.A., 2004, Estimated use of water in the United States, USGS Circular 1268: Reston, VA, U.S. Geological Survey.

Jackson, S., 2009, Personal communication with S. Jackson regarding transportation costs of switchgrass, Vice President Genera, Inc., June 2009.

Johnson, G.D., Perlik, M.K., Erickson, W.P., and Strickland, M.D., 2004, Bat activity, composition and collision mortality at a large wind plant in Minnesota: Wildlife Society Bulletin, v. 32, p. 1278-1288.

Jonas, J.L., Whiles, M.R., and R.E., C., 2002, Aboveground invertebrate responses to land management differences in central Kansas grassland: Environmental Entomology, v. 31, p. 1142-1152.

Jones-Farrand, D.T., Burger, L.W., Johnson, D.H., Jr., and Ryan, M.R., 2007, Grassland establishment for wildlife conservation, *in* Society, T.W., ed., Fish and wildlife response to Farm Bill conservation practices: Bethesda, MD, p. 25-43.

Kaufman, D.W., Finck, E.J., and Kaufman, G.A., 1990, Small mammals and grassland fires, *in* Collins S., and Wallace, L.L., eds., Fire in North American tallgrass prairies: Norman, Oklahoma, Univeristy of Oklahoma Press, p. 46-80.

King, J.W., and Savidge, J.A.-. 1995, Effects of the conservation reserve program on wildlife in southeast Nebraska: Wildlife Society Bulletin, v. 23, p. 377-385.

Kiniry, J.R., Lynd, L., Greene, N., Johnson, M.-V.V., Casler, M., and Laser, M.S., 2008, Biofuels and water use: Comparison of maize and switchgrass and general perspectives, *in* Wright, J.H., and Evans, D.A., eds., New research on biofuels, Nova Science Publishers, Inc.

Kline, K.L., and Dale, V.H., 2008, Biofuels: Effects on land and fire: Science, v. 321, p. 199-201.

Kline, K.L., Dale, V.H., Lee, R., and Leiby, P., 2009, In defense of biofuels, done right: Issues in Science and Technology, v. Spring 2009, p. 75-84.

Klute, D.S., 1994, Avian community structure, reproductive success, vegetative structure, and food availability in burned Conservation Reserve Program fields and grazed pastures in northeastern Kansas: Manhattan, Kansas, Kansas State University.

Knight, S.S., and Boyer, K.L., 2007, Effects of conservation practices on aquatic habitats and fauna, *in* Society, T.W., ed., Fish and Wildlife Response to Farm Bill Conservation Practices, p. 83-101.

Knopf, F.L., Johnson, R.R., Rich, T., Samson, F.B., and Szaro, R.C., 1988, Conservation of riparian ecosystems in the United States: Wilson Bulletin, v. 100, p. 272-284.

Koh, L.P., and Ghazoul, J., 2008, Biofuels, biodiversity, and people: Understanding the conflicts and finding opportunities: Biological Conservation, v. 141, p. 2450-2460.

Kort, J., Collins, M., and Ditsch, D., 1998, A review of potential soil erosion associated with biomass crops: Biomass and Bioenergy, v. 14, p. 351-359.

Kumar, A., and Sokhansanj, S., 2007, Switchgrass (*Panisum virgatum*, L.) delivery to a biorefinery using integrated biomass supply analysis and logistics (IBSAL) model: Bioresource Technology, v. 98, p. 1033-1044.

Labisky, R.F., 1957, Relation of hay harvesting to duck nesting under a refuge-permittee system: Journal of Wildlife Management, v. 21, p. 194-200.

LECG, 2009, Contribution of the ethanol industry to the economy of the United States, *in* Urbanchuk, J.D., ed.

Lindberg, J.E., Tolbert., V.R., Schiller, A., and Hanowski, J., 1998, Determining biomass crop management strategies to enhance habitat value for wildlife, BioEnergy '98: Expanding Bioenergy Partnerships: Madison, WI, Biofuels Systems Division, U.S. Department of Energy, under contract DE-AC05-96OR22464 with Lockheed Martin Energy Research Corporation.

Lindenmayer, D.B., and Franklin, J., 2002, Conserving forest biodiversity: Covelo, CA, Island Press.

Lines, I.L., and Perry, C.J., 1978, A numerical wildlife habitat evaluation procedure: North American Wildlife Conference, v. 43, p. 284-301.

Lokemoen, J.T., and Beiser, J.A., 1997, Bird use and nesting in conventional, minimum-tillage, and organic cropland: ournal of Wildlife Management, v. 61, p. 644-655.

Lubowski, R.N., Vesterby, M., Bucholtz, S., Baez, A., and Roberts, M.J., 2006, Major uses of land in the United States, 2002: Washington, D.C., U.S. Department of Agriculture, Economic Research Service.

Madden, E.M., Murphy, R.K., Hansen, A.J., and Murray, L., 2000, Models for Guiding Management of Prairie Bird Habitat in Northwestern North Dakota: American Midland Naturalist, v. 144, p. 377-392.

McCutchen, B.F., Robert V. Avant R.V. Jr., and Baltensperger, D., 2008, High-tonnage dedicated energy crops: The potential of sorghum and energy cane: National Agricultural Biotechnology Council, p. 119-122.

McIntyre, N.E., and Thompson, T.R., 2003, A comparison of Conservation Reserve Program habitat plantings with respect to arthropod prey for grassland birds: 150, p. 291-301.

McLaughlin, R.A., Pope, P.E., and Hansen, E.A., 1985, Nitrogen fertilization and ground cover hybrid poplar plantations: Effects on nitrate leaching: Journal Environmental Quality, v. 14, p. 241-245.

Milbrandt, A., 2005, A geographic perspective on the current biomass resource availability in the United States, National Renewable Energy Laboratory, NREL/TP-560-39181.

MIG (Minnesota IMPLAN Group), 2004, IMPLAN Professional Version 2.0, Social Accounting & Impact Analysis Software: Stillwater, MN, Minnestoa IMPLAN Group, Inc.

Miranowski, J.A., and Bender, R.L., 1982, Impact of erosion control policies on wildlife habitat on private lands: Journal of Soil and Water Conservation, v. 37, p. 288-291.

Monti, A., Fazio, S., and Venturi, G., in press, Cradle-to-farm gate life cycle assessment in perennial energy crops: European Journal of Agronomy, v. soi:10.1016/j.eja.2009.04.001.

Morris, M.G., 2000, The Effects of Structure and its Dynamics on the Ecology and Conservation of Arthropods in British Grasslands: Biological Conservation, v. 95, p. 129-142.

Morrison, M.L., Marcot, B.G., and Mannan, R.W., 1992, Wildlife-Habitat Relationships, Concepts and Applications: Madison, Wisconsin, University of Wisconsin Press.

Murray, L.D., and Best, B., 2003, Short-term bird response to harvesting switchgrass for biomass in Iowa: Journal of Wildlife Management, v. 67, p. 611-621.

National Academy of Sciences, 2007, Water implications of biofuels production in the United States: Report in brief: Washington, D.C., National Academies, National Research Council.

NASS (National Agricultural Statistics Service), 2008a, Data and statistics: Quick stats. http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp, USDA National Agricultural Statistics Service. Accessed July 2009.

NASS (National Agricultural Statistics Service), 2008b, Prospective plantings 2008: Washington, D.C., USDA National Agricultural Statistics Service, Agricultural Statistics Board.

NASS (National Agricultural Statistics Service), 2009a, Quick stats, crops, United States and all states. http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp, U.S. Department of Agriculture. Accessed July 2009.

NASS (National Agricultural Statistics Service), 2009b, Crop production historical track records, USDA National Agricultural Statistics Service.

NASS (National Agricultural Statistics Service), 2009c, Crop production 2008 summary, USDA National Agricultural Statistics Service.

NASS (National Agricultural Statistics Service), 2009d, Prospective plantings 2009: Washington, D.C., USDA National Agricultural Statistics Service, Agricultural Statistics Board.

Nelson, R.G., Hellwinckel, C.M., Brandt, C.C., West, T.O., De La Torre Ugarte, D.G., and Marland, G., 2009, Energy use and carbon dioxide emissions from cropland production in the United States, 1990-2004: Journal of Environmental Quality, v. 38, p. 418-425.

NISC (The National Invasive Species Council), 2008, 2008-2012 National Invasive Species Management Plan: Washington, D.C., NISC, Department of the Interior.

NRCS (USDA Natural Resources Conservation Service), 1999, Grassland Birds NRCS Fish and Wildlife Habitat Management Leaflet No. 8. ftp://ftp-fc.egov.usda.gov/WHMI/WEB/pdf/GRASS1.pdf. Accessed July 2009.

NRCS (USDA Natural Resources Conservation Service), 2001, Technical Notes, TN Plant Materials No. 28, Glossary of terms for use in plant materials

NRCS (USDA Natural Resources Conservation Service), 2005, Native Warm-Season Grasses and Wildlife Leaflet, No. 25. ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/TechnicalLeaflets/WarmGrass.pdf. Accessed July 2009.

NRCS (USDA Natural Resources Conservation Service). 2006a. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. USDA Natural Resources Conservation Service.

NRCS (USDA Natural Resources Conservation Service), 2006b, Amphibians and Reptiles. Fish and Wildlife Habitat Management Leaflet, No. 35. ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/TechnicalLeaflets/AmphibiansReptiles.pdf. Accessed July 2009.

NRCS (USDA Natural Resources Conservation Service), 2007a, Effects of Conservation Reserve Program on Priority Mixed-Grass Prairie Birds. Conservation Effects Assessment Project. http://www.nrcs.usda.gov/TECHNICAL/nri/ceap/library.html. Accessed July 2009.

NRCS (USDA Natural Resources Conservation Service), 2007b, National resources inventory 2003 annual NRI state level summary data.

NRCS (USDA Natural Resources Conservation Service), 2007c, Watersheds, hydrologic units, hydrologic unit codes, watershed approach, and rapid watershed assessments: Washington, D.C., USDA National Resource Conservation Service.

NRCS (USDA Natural Resources Conservation Service), 2008, Estimated CRP benefits to mixed-grass prairie birds, CEAP conservation insight, USDA National Resources Conservation Service.

NRCS (USDA Natural Resources Conservation Service), 2009, Plants Database. http://plants.usda.gov/. Accessed July 2009.

Oberbillig, D.R. n.d. State wildlife action plans. http://www.wildlifeactionplans.org/index.html. Accessed July 2009.

Ogle, S.M., 2008, Recent Trends in CO_2 Flux between U.S. Agricultural Soils and the Atmosphere. NREL Agroecosystems Research Group Website. http://www.nrel.colostate.edu/projects/agecosys/insider. Accessed July 2009.

ORNL (Oak Ridge National Laboratory), 2008a, Total availability of logging residue from timberlands, 2007, Bioenergy resource and engineering systems program, Oak Ridge National Laboratory, Oak Ridge, TN. http://cta.ornl.gov/bedb/feedstocks/Forest_Residues/Total_Logging_Residue-Map.xls. Accessed June 2009.

ORNL (Oak Ridge National Laboratory), 2008b, Total availability of fuel treatment thinnings from timberlands, 2007, Bioenergy resource and engineering systems program, Oak Ridge National Laboratory, Oak Ridge, TN. http://cta.ornl.gov/bedb/feedstocks/Forest_Residues/Fuel_Treatment_Thinnings-Map.xls. Accessed June 2009.

ORNL (Oak Ridge National Laboratory), 2008c, Total availability of corn stover residue, 2007, Bioenergy resource and engineering systems program, Oak Ridge National Laboratory, Oak Ridge, TN. http://cta.ornl.gov/bedb/feedstocks/Agricultural_Residues/Total_Corn_Stover-Map.xls. Accessed June 2009.

ORNL (Oak Ridge National Laboratory), 2009, Bioenergy and biomass frequently asked questions: Oak Ridge National Laboratory. http://bioenergy.ornl.gov/faqs/index.html. Accessed July 2009.

PARC (Partners in Amphibian and Reptile Conservation), 2008, Habitat Management Guidelines for Amphibians and Reptiles of the Mid-West. http://herpcenter.ipfw.edu/index.htm?http://herpcenter.ipfw.edu/outreach/MWHabitatGuide/&2. Accessed July 2009.

Perlack, R.D., Wright, L.L., Turhollow, A.F., Graham, R.L., Stokes, B., and Erback, D.C., 2005, Biomass as a feedstock for a bioenergy and biproducts industry: The technical feasibility of a billion-ton annual supply, ORNL/TM-2005/66, Oak Ridge National Laboratory, USDA-DOE.

Pianka, E.R., 1966, Convexity, desert lizards, and spatial heterogeneity: Ecology, v. 47, p. 1055-1059.

Raghu, S., Anderson, R.C., Daehler, C.C., Davis, A.S., Wiedenmann, R.N., Simberloff, D., and Mack, R.N., 2006, Adding biofuels to the invasive species fire?: Science, v. 313, p. 1742.

Rahmig, C.J., Jensen., W.E., and With, K.A., 2009, Grassland bird responses to land management in the largest remaining tallgrass prairie: Conservation Biology, v. 23, p. 420-432.

Ranney, J.W., and Mann, L.K., 1994, Environmental considerations in energy crop production: Biomass and Bioenergy, v. 6, p. 211-228.

Ray, D.E., Richardson, J.W., de La Torre Ugarte, D.G., and Tiller, K.H., 1998, Estimating price variability in agriculture: Implications for decision makers: Journal of Agricultural and Applied Economics, v. 30, p. 21-33.

Renfrew, R.B., Ribic, C.A., and Nack, J.L., 2005, Edge avoidance by nesting grassland birds: A futile strategy in a fragmented landscape: The Auk, v. 122, p. 618-636.

Renner, R.W., Reynolds, R.E., and Batt, B.D.J., 1995, The impact of haying Conservation Reserve Program lands on productivity of ducks nesting in the Prairie Pothole Region of North and South Dakota: Transactions of the North American Wildlife and Natural Resources Conference, v. 60, p. 221-229.

Reynolds, R.E., Shaffer, T.L., Renner, R.W., Newton, W.E., and Batt, B.D.J., 2001, Impact of the conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region: Journal of Wildlife Management, v. 65, p. 765-780.

RFA (Renewable Fuels Association), 2009a, Biorefinery locations. http://www.ethanolrfa.org/industry/locations/. Accessed July 2009.

RFA (Renewable Fuels Association), 2009b, Ethanol industry statistics. http://www.ethanolrfa.org/industry/statistics/#A. Accessed July 2009.

Richard, E.J., and Tew, T., 2007, Development of energy cane and related grass species for an integrated feedstock production system, *in* USDA (U.S. Department of Agriculture) Agricultural Research Service, ed.: Houma, LA, Mid-South Area's Southern Regional Research Center's Sugarcane Research Unit.

Rickel, B., 2005, Small Mammals, Reptiles, and Amphibians, *in* Finch, D.M., ed., Assessment of grassland ecosystem conditions in the Southwestern United States, Volume 2: Fort Collins, CO, p. 35-70.

Riffell, S.K., Burger, L.W., and Scognamillo, D., 2006, Estimating wildlife response to the Conservation Reserve Program: Bobwhite and grassland birds, Mississippi State University.

Rodgers, R.D., 1999, Why haven't pheasant populations in western Kansas increased with CRP?: Wildlife Society Bulletin, v. 27, p. 654-665.

Roth, A.M., Sample, D.W., Ribic, C.A., Paine, L., Undersander, D.J., and Bartelt, G.A., 2004, Grassland bird response to harvesting switchgrass as a biomass energy crop: Biomass and Bioenergy, v. 28, p. 490-498.

Ryan, M.R., Burger, J., L.W., and Kurzejeski, E.W., 1998, The impact of CRP on avian wildlife: a review: Journal of Production Agriculture, v. 11, p. 61-66.

Saab, V.A., Bock, C.E., Rich, T.D., and Dobkin, D.S., 1995, Livestock grazing effects in western North America, *in* Martin, T.E., and Finch, D.M., eds., Ecology and management of Neotropical migratory birds: New York, NY, Oxford University Press, p. 311-353.

Sample, D.W., Paine, L., and Roth, A., 1998, Harvested switchgrass fields provide habitat for declining grassland birds, BioEnergy '98: Expanding Bioenergy partnerships: Madison, WI.

Sargent, M.S., and Carter, K.S., 1999, Managing Michigan wildlife: A landowners guide, part V: Grassland management, Introduction to grassland management: East Lansing, MI, Michigan United Conservation Clubs.

Shapouri, H., Duffield, J.A., and Wang, M., 2002, The energy balance of corn ethanol, Agricultural economic report number 813: Washington, D.C., United States Department of Agriculture.

Shelton, C.H., Tompkins, F.D., and Tyler, D.D., 1983, Soil erosion from five soybean tillage systems: Journal of Soil and Water Conservation, v. 38, p. 415-428.

Simpson, T.W., Sharpley, A.N., Howarth, R.W., Paerl, H.W., and Mankin, K.R., 2008, The new gold rush: Fueling ethanol production while protecting water quality: Journal Environmental Quality, v. 37, p. 318-324.

Sissine, F., Cunningham, L.J., and Gurevitz, M., 2008, Energy efficiency and renewable energy legislation in the 110th Congress, Congressional Research Service Report, RL33831: Washington, D.C., Congressional Research Service.

Smeets, E.M.W., Lewandowski, I.M., and Faaij, A.P.C., 2008, The economical and environmental performance of miscanthus and switchgrass production and supply chains in a European setting: Renewable and Sustainable Energy Reviews, v. 13, p. 1230-1245.

Snyder, S.A., 1991, Wildlife species accounts, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Fire Effects Information System.

Sopper, W.E., and Kerr, S.N., 1982, Utilization of municipal sludge for woody biomass production in mined land: Symposium on Surface Mining Hydrology, Sedimentology, and Reclamation, University of Kentucky, Lexington, Kentucky, p. 313-317.

SSSA (Soil Science Society of America), 2009, Glossary of soil science terms. https://www.soils.org/publications/soils-glossary. Accessed July 2009.

Staley, B.C., and Bradley, R., 2008, Plants at the pump: Reviewing biofuels' impacts and policy recommendations. http://pdf.wri.org/plants_at_the_pump_brief.pdf, World Resources Institute Climate and Energy Policy Series, July. Accessed May 2009.

Stone, E.R., 2007, Measuring impacts of restoration on small mammals in a mixed-grass Colorado prairie: Ecological Restoration, v. 25, p. 183-190.

Sugden, E.A., 1985, Pollinators of *Astragalus monoensis* Barneby (Fabaceae): New host records; potential impact of sheep grazing: Western Naturalist, v. 45, p. 299-311.

Sullivan, P., Hellerstein, D., Hansen, L., Johansson, R., Koenig, S., Lubowski, R., McBride, W., McGranahan, D., Roberts, M., Vogel, S., and Bucholtz, S., 2004, The conservation reserve program: Economic implications for rural America, Agricultural economic report NO. 834, USDA Economic Research Service.

Sun Grant BioWeb, 2009, Sun Grant BioWeb. http://bioweb.sungrant.org/Default. Accessed July 2009.

Swearingen, J., Reshetiloff, D., Slattery, B., and Zwicker, S., 2002, Plant invaders of mid-Atlantic natural areas. http://www.nps.gov/plants/alien/pubs/midatlantic/: Washington, D.C., National Park Service and U.S. Fish & Wildlife Service. Accessed July 2009.

Swengel, A.B., 2001, A literature review of insect responses to fire, compared to other conservation managements of open habitat: Biodiversity and Conservation, v. 10, p. 1141-1169.

Tilman, D., Hill, J., and Lehman, C., 2006, Carbon-negative biofuels from low-input high-diversity grassland biomass: Science, v. 314, p. 1598-1600.

Tolbert, V., Hanowski, R.J., Hoffman, W., Schiller, A., Christian, D., and Lindberg, J., 1997, Changes in bird community composition in response to growth changes in short-rotation woody crop plantings, *in* Overend, R.P., Chronet E., ed., Making a Business from Biomass Energy, Environment, Chemicals, Fibers, and Materials. Proceedings of the 3rd Biomass Conference of the Americas: Montreal, Quebec, Canada. p. 241-48.

Torre, I., Diaz, M., Martinez-Padilla, J., Bonal, R., Vinuela, J., and Fargallo, J.A., 2007, Cattle grazing, raptor abundance and small mammal communities in Mediterranean grasslands: Basic Applied Ecology, v. 8, p. 565-575.

Tyler, D.D., Wagger, M.G., McCracken, D.V., and Hargrove, W.L., 1994, Role of conservation tillage in sustainable agriculture in the southern United States, *in* Carter, M.R., ed., Conservation tillage in temperate agroecosystems: Boca Raton, FL, CRC Press, Inc., p. 209-229.

USCB (U.S. Census Bureau), 2008, National population estimates. http://www.census.gov/popest/national/national.html. Accessed July 2009.

USDA (U.S. Department of Agriculture), 2008, USDA agricultural projections to 2017, Long-term projections report OCE-2008-1, U.S. Department of Agriculture, Interagency Agricultural Projections Committee.

USDA (U.S. Department of Agriculture), 2009a, 2007 Census of agriculture: United States summary and state data, volume 1: Geographic area series, USDA National Agricultural Statistics Service.

USDA (U.S. Department of Agriculture), 2009b, Crops and plants: All wheat 2008 planted acres by county. http://www.nass.usda.gov/QuickStats/indexbysubject.jsp?Pass_group=Crops+%26+Plants, USDA National Agricultural Statistics Service. Accessed June 2009.

USDA (U.S. Department of Agriculture), 2009c, Crops and plants: Corn for all purposes 2008 planted acres by county. http://www.nass.usda.gov/GuickStats/indexbysubject.jsp?Pass_group=Crops+%26+Plants, USDA National Agricultural Statistics Service. Accessed June 2009.

USDA (U.S. Department of Agriculture), 2009d, Crops and plants: Sorghum 2008 planted acres by county. http://www.nass.usda.gov/QuickStats/index_by_subject.jsp?Pass_Group=Crops+%26+Plants, USDA National Agricultural Statistics Service. Accessed June 2009.

USDA (U.S. Department of Agriculture), 2009e, Crops and plants: Soybeans 2008 planted acres by county. http://www.nass.usda.gov/Quick_Stats/indexbysubject.jsp?Pass_group=Crops+%26+Plants, USDA National Agricultural Statistics Service. Accessed June 2009.

USDOI (U.S. Department of the Interior/U.S. Fish and Wildlife Service), and USDC (U.S. Department of Commerce/U.S. Census Bureau), 2008, 2006 National survey of fishing, hunting, and wildlife-associated recreation.

USFWS (U.S. Fish and Wildlife Service), 2009, What are Invasive Species? http://www.fws.gov/invasives/. Accessed July 2009.

USGS (U.S. Geological Survey), 2003, Ground-water depletion across the nation. http://pubs.usgs.gov/fs/fs-103-03/JBartolinoFS(2.13.04).pdf. Accessed July 2009.

USGS (U.S. Geological Survey), 2008, Surface water use in the United States. http://ga.water.usgs.gov/edu/wusw.html. Accessed July 2009.

Van Miegroet, H., and Cole, D.W., 1982, Effects of acid rain on the soil nutrient status and solution acidity: A discussion of basic mechanisms with special reference to forest soils of the Pacific Northwest, Technical Bulletin No. 390, National Council of Air and Stream Improvement Inc.

Veech, J.A., rev. 2006, A comparison of landscapes occupied by increasing and decreasing populations of grassland birds: Conservation Biology, v. 20, p. 1422-1432.

Walker, B., 1995, Conserving biological diversity through ecosystem resilience: Conservation Biology, v. 9, p. 747-752.

Walter, W.D., Vercauteren, K.C., Gysldorf, J.M., and Hyngstrom, S.E., 2009, Crop, native vegetation, and biofuels: Response of white-tailed deer to changing management priorities: journal of Wildlife Management, v. 73, p. 339-344.

Warner, R.E., Etter, S.L., David, L.M., and Mankin, P.C., 2000, Annual set-aside programs: a long-term perspective of habitat quality in Illinois and the Midwest: Wildlife Society Bulletin, v. 28, p. 347-354.

West, T.O., Brandt, C.C., Wilson, B.S., Hellwinckel, C.M., Tyler, D.D., Marland, G., De La Torre Ugarte, D.G., Larson, J.A., and Nelson, R.G., 2008, Estimating regional changes in soil carbon with high spatial resolution: Soil Science Society of America Journal, v. 72, p. 285-294.

West, T.O., and Marland, G., 2002a, Net carbon flux from agricultural ecosystems: methodology for full carbon cycle analyses: Environmental Pollution, v. 116, p. 439-444.

West, T.O., and Marland, G, 2002b, A synthesis of carbon sequestration, carbon emissions, and net carbon flux in agriculture: comparing tillage practices in the United States: Agriculture, Ecosystems, and Environment, v. 91, p. 217-232.

Whitaker, J.O., Jr., 2001, National Audubon Society Field Guide to North American Mammals: New York, NY.

Wilkerson, E., Perlack, R.D., Blackwelder, D.B., Muth, D.J., and Hess, J.R., 2008, A preliminary assessment of the state of harvest and collection technology for forest residues, ORNL/TM-2007/195: Oak Ridge, TN, Oak Ridge National Laboratory.

Wilson, E.O., 1988, Biodiversity, National Academy Press.

Wischmeier, W.H., and Smith, D.D., 1965, Predicting rainfall erosion losses from cropland east of the rocky mountains, Agricultural Handbook No. 282: Washington, DC, USDA

Wooley, J., George, R., Ohde, B., and Rybarczyk, W., 1982, Nesting Evaluations of Native Grass Pastures and Narrow-Row Soybeans, *in* Dahlgren, R.B., ed., Proceedings of the Midwest Agricultural Interfaces with Fish and Wildlife Workshop: Ames, Iowa, p. 5-6.

Wright, L., Boundy, B., Perlack, B., Davis, S., and Saulsbury, B., 2006, Biomass Energy Data Book: Edition 1, ORNL/TM-2006/571: Oak Ridge, TN, Oak Ridge National Laboratory.
Yarnell, R.W., Scott, D.M., Chimimba, C.T., and Metcalfe, D.J., 2007, Untangling the roles of fire, grazing and rainfall on small mammal communities in grassland ecosystems: Oecologia, v. 154, p. 387-402.
Zeman, N., 2007, Thermochemical versus biochemical, Biomass Magazine, Volume June 2007.

8.0 PREPARERS

Name	Organization	Experience	Project Role
Rae Lynn Schneider, M.P.P., B.S. President	Integrated Environmental Solutions, LLC	10 years	Project Management, Project Review
Tony Cecchi, M.B.A., B.S. V.P. of Planning	Geo-Marine, Inc.	18 years	Quality Assurance
John Bland, M.A. Senior NEPA Program Manager	Geo-Marine, Inc.	25 years	Quality Assurance, Recreation
John Ouellette, M.S. Senior Environmental Scientist	Geo-Marine, Inc.	16 years	Biological Resources
Susan Miller, M.A. Project Manager	Geo-Marine, Inc.	19 years	Chapters 1 and 2
Brian Bishop, M.S. Environmental Scientist	Geo-Marine, Inc.	3 years	Chapters 1 and 2
Felicia Griego NEPA Analyst	Geo-Marine, Inc.	4 years	
Lawanna Koch NEPA Analyst	Geo-Marine, Inc.	7 years	Chapters 1 and 2, Executive Summary, Public Comments Summary
Richard Watts, M.S. Senior Environmental Scientist	Geo-Marine, Inc.	35 years	Biological Resources
Jeffrey W. DeBerry, M.S. Project Manager/Wetland Scientist	Geo-Marine, Inc.	9 years	Terrestrial Ecology
Rhianna McCarter, B.S. GIS Analyst	Geo-Marine, Inc.	2 years	GIS Data/Mapping
Bob O'Malley GIS Analyst	Geo-Marine, Inc.	12 years	GIS Data/Mapping
Wendy Mooring Environmental Scientist	Geo-Marine, Inc.	8 years	Authorship and Research Support
Robin R. Ives, B.S. Wildlife Biologist	Geo-Marine, Inc.	4 years	Biological Resources, Wildlife

Name	Organization	Experience	Project Role
Mundy Hackett, Ph.D. Wildlife Ecologist	Geo-Marine, Inc.	15 years	Scientific Review
Christopher Lotts, B.S. Environmental Scientist	Geo-Marine, Inc.	6 years	Biological Literature Review and Writing
Meredith B. Malone, B.S., M.S. Environmental Scientist/Forest Ecologist	Geo-Marine, Inc.	8 years	Authorship and Research Support for National Forest System
Meredith Fagan, M.S. Sea Turtle Biologist/Marine Scientist	Geo-Marine, Inc.	7 years	References
Elizabeth Magdycz NEPA Intern	Geo-Marine, Inc.		Data Compilation
Dave Brown Document Manager	Geo-Marine, Inc.	26 years	Document Formatting and Production
Phyllis Fletcher, A.D. Document Production Manager, Editor	Geo-Marine, Inc.	14 years	Document Production, Editing
Katelyn Kowalczyk, B.S. Environmental Specialist	Integrated Environmental Solutions, LLC	1 year	Soil Resources, Waters Resources, GIS
Ransley Welch, M.S., B.A. Environmental Specialist	Integrated Environmental Solutions, LLC	5 years	GIS, Cumulative Effects
Halil Ceylan, Ph.D., M.S., B.S. Assistant Professor	Iowa State University	14 years	Transportation
Kenneth Moore, Ph.D., M.S., B.S. Professor of Agronomy	Iowa State University	26 years	Soil Resources, Water Resources, Crop Types, Agronomic Principles, Soil Carbon Storage, Air Quality
Daniel De La Torre Ugarte, Ph.D., M.S., B.S. Professor	University of Tennessee – Knoxville	22 years	Economics, Land Use, Air Quality

Name	Organization	Experience	Project Role
Donald Tyler, Ph.D., M.S., B.S. Professor of Agronomy	University of Tennessee – West Tennessee Experiment Station	31 years	Soil Resources, Water Resources, Crop Types, Agronomic Principles, Soil Carbon Storage, Air Quality
Burton C. English, Ph.D, M.S., B.S. Professor, Agricultural Economicst	University of Tennessee – Knoxville	31 years	Economics, Land Use Change
Tristram O. West, Ph.D, M.S., B.S. Staff Research Scientist	Advanced Natural Resources Services	10 years	Air Quality, Greenhouse Gas Emissions

This page intentionally left blank

9.0 PERSONS AND AGENCIES CONTACTED

Name	Organization/Agency
Proponent	
Robert Stephenson	Director, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Mike Linsenbigler	Deputy Director, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Matthew Ponish	National Environmental Compliance Manager , U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division, Washington D.C.
Bennett Horter	Federal Preservation Officer, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division, Washington D.C.
Paul Harte	U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Rich Iovanna	U.S. Department of Agriculture, Farm Service Agency, Economic & Policy Analysis Staff
Korah Abraham	U.S. Department of Agriculture, Rural Development
Neil Hoffman	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
Rebecca Stankiewicz-Gabel	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
Dave Walker	U.S. Fish and Wildlife Service
Mike Linsenbigler	U.S. Department of Agriculture, Farm Service Agency
Shawn Bucholtz	U.S. Department of Agriculture, Farm Service Agency

Agency Contacted	
U.S. Fish and Wildlife Service *Region 1* *Region 2* *Region 3* *Region 4* *Region 5* *Region 6* *Region 7* *Region 9*	Portland, OR Albuquerque, NM Fort Snelling, MN Atlanta, GA Hadley, MA Denver, CO Anchorage, AK Washington, D.C.
U.S. Environmental Protection Agency *EIS Filing Section* *Region 1* *Region 2* *Region 3* *Region 4* *Region 5* *Region 6* *Region 7* *Region 8* *Region 9* *Region 10*	Washington, D.C. Boston, MA New York, NY Philadelphia, PA Atlanta, GA Chicago, IL Dallas, TX Kansas City, KS Denver, CO San Francisco, CA Seattle, WA
U.S. Department of Agriculture	Rural Development, Animal and Plant Health Inspection Service, Natural Resource Conservation Service, Forest Service

10.0 INDEX

2008 Farm Bill, 1-3, 1, 1-1, 1-2, 1-3, 1-6, 1-8, 1-9, 1-10, 1-12, 1-15, 2-1, 2-2, 2-5, 2-6, 4-4, 5-2, **11-5**, **11-6**, **11-7**

Air Quality, 3-25, 4-76, 5-5, 8-2, 8-3

Carbon sequestration, 3-30, 3-33, **11-6**

CHST, 1-3, 1, 1-1, 1-2, 1-3, 1-4, 1-5, 1-12, 4-4, 4-16, 4-19, 4-30, 4-31, **11-5**, **11-6**, **11-7**, 11-10

Clean Air Act, 1-6, 3-25

Clean Water Act, 1-6, 1-7, 2-6

corn stover, 1-15, 3-29, 4-87, 4-90

crop residue, 1-3, 3-26, 3-28, 3-29, 3-30, 4-80, **11-5**, 11-10

cumulative effects, 5-1

debris, 1-11, 5-3, 11-11

Eligible, 1-3, 1-4, 1-9, 1-12, 2-1, **11-6**, **11-7**

Employment, 11-8

Endangered Species Act, 1-4, 1-6, 2-6, 11-10

energy crops, 1-10, 1-11, 1-12, 1-14, 3-27, 3-35, 3-36, 4-3, 4-4, 4-5, 4-16, 4-21, 4-23, 4-30, 4-31, 4-77, 4-90, 4-96, 5-1, 5-3, 6-3

erosion, 1-15, 2-6, 3-18, 3-30, 3-31, 3-32, 3-33, 3-35, 4-2, 4-82, 4-83, 4-84, 4-87, 4-89, 4-90, 11-8

Farm Prices, 3-1

feedstock, 1-4, 1-12, 4-2, 4-3, 4-4, 4-5, 4-6, 4-10, 4-12, 4-21, 4-22, 4-23, 4-30, 4-31, 5-3, **11-6**

fertilizers, 3-26, 3-35, 4-85, 4-90

floodplain, 2-6, 3-12, 3-22, 3-31, 3-33

Floodplain, 1-6, 2-6, 11-8

Floodplains, 2-6, 3-21, 11-8

Forage, 3-42, 3-43, 3-44, 3-45, 3-47, 3-48, 3-50, 3-51

forestry, 1-4, 1-11, 1-12, 3-28, 4-23, 4-31, **11-6**, 11-9

fossil fuels, 5-2

genetically engineered, 1-7

Government Payments, 3-1, 4-27

greenhouse gas, 2-5, 2-6, 3-25, 3-26, 4-76, 5-1, 11-9

Greenhouse Gas, **8-3**

groundwater, 2-6, 3-30, 3-34, 3-35, 3-36, 4-89, 4-90, 11-8

income, 2-5, 2-6, 2-7, 3-1, 3-23, 3-24, 4-1, 4-2, 4-3, 4-4, 4-6, 4-16, 4-19, 4-23, 4-30, 11-8, 11-9

irrigation, 3-11, 3-12, 3-14, 3-15, 3-16, 3-17, 3-24, 3-27, 3-30, 3-32, 3-34, 3-35, 3-36, 3-39, 3-40, 4-89, 4-90, 4-91, 4-96, 11-11

land use, 2-7, 3-2, 3-7, 3-11, 3-14, 3-16, 3-17, 3-31, 3-34, 3-35, 4-2, 4-3, 4-4, 4-6, 4-12, 4-16, 4-22, 4-24, 4-30, 4-31, 4-87, 4-89, 4-96, 4-97, 5-2

National Historic Preservation Act, 1-6, 2-8

Net Farm Income, 3-1, 4-6, 4-22, 4-23, 11-9

nutrients, 3-31, 3-33, 3-34, 3-35, 4-77, 4-84

oilseed, 11-10
pesticides, 3-33, 3-34, 3-35, 4-76, 4-84, 4-89
Recreation, 3-14, 3-23, 3-40, 4-97, 5-5, 8-1
renewable fuels, 5-1, 5-2
runoff, 1-15, 3-33, 3-34, 3-35, 4-83, 4-84, 4-89
sedimentation, 3-35, 4-82, 4-90
socioeconomic, 1-17, 3-1, 11-10
soil carbon, 3-26, 3-33, 4-76, 4-80, 4-81, 4-82, 4-83, 4-84
Soil Quality, 3-27, 4-82, 5-5
surface water, 3-30, 3-33, 3-34, 3-35, 3-36, 4-84, 4-89, 4-90
switchgrass, 1-12, 1-14, 3-26, 3-27, 3-35, 3-36, 4-3, 4-4, 4-5, 4-12, 4-16, 4-19, 4-24, 4-30, 4-79, 4-80, 4-83, 4-84, 4-87, 4-89, 4-90, 4-91
tillage, 3-26, 3-29, 3-33, 4-77, 4-82, 4-83, 4-87
Timberland, 1-13
transportation, 1-7, 1-9, 1-11, 1-15, 2-8, 3-1, 3-28, 4-2, 4-3, 4-4, 4-16, 4-19, 4-30, **11-5**, **11-6**, **11-8**
vegetation, 3-6, 3-9, 3-13, 3-14, 3-17, 3-19, 3-21, 3-24, 3-33, 3-34
Vegetation, 3-6, 3-9, 3-11, 3-12, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, 3-20, 3-21, 4-32, 4-34, 4-62, 4-68, 4-69, 5-5
vegetative cover, 3-34, 4-97
Water Quality, 1-7, 3-34, 4-89, 4-90, 5-5
wetland, 2-2, 3-19
Wetland, 2-6, 2-7, 8-1
Wildlife, 1-8, 1-10, 3-11, 3-12, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, 3-20, 3-21, 3-22, 3-23, 3-24, 3-25, 3-40, 3-42, 3-43, 3-50, 3-51, 3-52, 4-97, 5-4, 8-1, 8-2, 11-8
wood residues, 1-3, 1-11, 3-30, 11-10
woody biomass, 1-10, 1-14, 2-2, 3-27, 5-3

11.0 GLOSSARY

Action Alternative: A suggested alternate action to the Proposed Action that (a) meets basic purpose and need; (b) is achievable within the legislated time constraints for the program; (c) is achievable within the budget appropriated for the program; and (d) does not violate any existing laws.

Administrator: The Administrator of the Environmental Protection Agency

Advisory Committee: The Biomass Research and Development Technical Advisory Committee established by section 9008(d)(1) of Title IX of the 2008 Farm Bill.

Advanced Biofuel: (a) In general: Fuel derived from renewable biomass other than corn kernel starch; (b) Inclusions: (i) biofuel derived from cellulose, hemicelluloses, or lignin; (ii) biofuel derived from sugar and starch (other than ethanol derived from corn kernel starch); (iii) biofuel derived from waste material, including crop residue, other vegetative waste material, animal waste, food waste, and yard waste; (iv) diesel-equivalent fuel derived from renewable biomass, including vegetable oil and animal fat; (v) biogas (including landfill gas and sewage waste treatment gas) produced through the conversion of organic matter from renewable biomass; (vi) butanol or other alcohols produced through the conversion of organic matter from renewable biomoass; and (vii) other fuel derived from cellulosic biomass.

Animal Plant and Health Inspection Service: A USDA agency responsible for protecting U.S. agriculture from pests and diseases under the authority of the Plant Protection Act (PPA), Title IV of the Agricultural Risk Protection Act of 2000 (APHIS 2002).

Arm's-length Transaction: A transaction between ready, willing, and able disinterested parties who are not affiliated with or related to each other and have no security, monetary, or stockholder interest in each other, with the exception that members of either (a) an association of agricultural producers or (b) farmer cooperative organizations, or (c) a farmer cooperative, may deliver and sell at market rates eligible material to such associations, organizations or cooperatives they have a monetary or stockholder interest in and such transaction may be considered arm's length transactions.

BCAP: the Biomass Crop Assistance Program established under Title IX, Section 9011 of the Farm Security and Rural Investment Act of 2008. The program supports the establishment and production of biomass crops for conversion to bio-energy in approved project areas, and provides monetary assistance with collection, harvest, storage, and transportation (CHST) of eligible materials for use in a biomass conversion facility (BCF).

BCAP Project Area: An area that (a) has specified boundaries that are submitted to the Secretary by the project sponsor and subsequently approved by the Secretary; (b) includes producers with contract acreage that will supply a portion of the renewable biomass needed by a biomass conversion facility; and (c) is physically located within an economically practicable distance from the biomass conversion facility.

Bill of Lading: A document issued by a carrier to a shipper, acknowledging that specified goods have been received on board as cargo for conveyance to a named place for delivery to the consignee who is usually identified (also known as a ''BOL'' or ''B/L'').

Biobased CHST Product: A product, determined by the Deputy Administrator to be a commercial or industrial product (other than food or feed) that is: (a) composed in whole, or in significant part, of biological products, including renewable domestic agricultural materials and forestry materials; or (b) an intermediate ingredient or feedstock. Biobased product does not mean commercially produced timber, lumber, wood pulp or other finished wood products.

Biofuel: A fuel derived from renewable biomass.

Biomass Conversion Facility (BCF): A facility that converts or proposes to convert eligible material into: (a) heat; (b) power; (c) biobased products; or (d) advanced biofuels.

Biorefinery: A facility (including equipment and processes) that (a) converts renewable biomass into biofuels and biobased products; and (b) may produce electricity.

Board: The Biomass Research and Development Board established by section 9008(c) of Title IX of the 2008 Farm Bill.

Carbon sequestration: Or storage of carbon in cropping systems involves storage in non-removed crop residues and below ground root systems, as well as carbon being stored in the soil as organic matter in varying stages of decomposition.

CCC: the Commodity Credit Corporation.

CHST: Collection, harvest, storage, and transportation activities, or some combination thereof, for eligible material.

CHST Matching Payments: Those CCC payments provided at a rate of $1 for each $1 per dry ton paid by the CHST-qualified biomass conversion facility to the owner for delivery of eligible material to the facility in an amount not to exceed $45 per dry ton pursuant to the BCAP NOFA.

CHST Matching Payment Program: The program established by the BCAP NOFA for the collection, harvest, storage, and transportation of eligible material delivered to a qualified biomass conversion facility.

CHST Qualified Biomass Conversion Facility: A biomass conversion facility that meets all the requirements for qualification outlined in the BCAP NOFA, for which the facility owners enters into a memorandum of understanding (MOU) for such facility qualification with the Deputy Administrator.

Contract Acreage: Eligible land that is covered by a BCAP contract entered into with the Secretary.

Cooperating Agencies: Any Federal agency other than the lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in proposed legislation, a proposed action, or reasonable alternative. Cooperating agencies may include a State or local agency with similar qualifications, at the invitation of the lead Federal agency.

Corn Stover: The stalks, leaves and cobs that remain in corn fields after the grain harvest.

Crop Residue: Plant material remaining after harvesting, including leaves, stalks, roots (OECD 2001).

Cultural Resources: Prehistoric and historic districts, sites, buildings, structures or objects that may be archaeological, architectural or traditional cultural properties.

Deputy Administrator: the FSA Deputy Administrator for Farm Programs, FSA, or a designee.

Direct impacts measure the response of a given industry to a change in final demand for the industry. They include the backward linkages in the economy from the increase (decrease) in economic activities that occur from changes in inter-industry intermediate input demands within the region.

Environmental Impact Statement (EIS): A document providing full and fair discussion of significant environmental impacts for a proposed action and informing decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. A Federal agency must prepare an EIS when a proposed action or program constitutes a major Federal action that may have significant impacts to the natural or human environment.

Eligible Crop: (a) In general: A crop of renewable biomass; (b) Exclusions: (1) any crop that is eligible to receive payments under title I of the Food, Conservation, and Energy Act of 2008 or an amendment made by that title; or (2) any plant that is invasive or noxious or has the potential to become invasive or noxious, as determined by the Secretary, in consultation with other appropriate Federal or State departments and agencies.

Eligible Land: (a) In general: includes agricultural and nonindustrial private forest lands (as defined in section 5(c) of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. 2103a(c))); (b) Exclusions: (1) Federal- or State-owned land; (2) land that is native sod, as of the date of enactment of the Food, Conservation, and Energy Act of 2008; (3) land enrolled in the conservation reserve program established under subchapter B of chapter 1 of subtitle D of title XII of the Food Security Act of 1985 (16 U.S.C. 3831 et seq.); (4) land enrolled in the wetlands reserve program established under subchapter C of chapter 1 of subtitle D of title XII of that Act (16 U.S.C. 3837 et seq.).

Eligible Material: For purposes of the CHST matching payment program, renewable biomass with the following exclusions: (a) Harvested grains, fiber, or other commodities eligible to receive payments under Title I of the 2008 Farm Bill; (b) Animal waste and animal waste byproducts including fats, oils, greases, and manure; (c) Food waste and yard waste; or (d) Algae.

Eligible Material Owner: For purposes of the CHST matching payment program, a person having the right to collect or harvest eligible material and that has delivered the eligible material to a CHST qualified biomass conversion facility and including: (a) For eligible material collected from private lands, including cropland, the owner of the land, the operator or producer conducting farming operations on the land, or any other person designated by the owner of the land and; (b) For eligible material collected from public lands, those persons with the right to collect eligible material pursuant to a contract or permit with the Forest Service or other appropriate Federal agency, such as a timber sale contract, stewardship contract or agreement, service contract or permit, or related applicable Federal land permit or contract, and who have submitted the permit or contract authorizing such collection for reproduction by FSA.

EPA: the U.S. Environmental Protection Agency; the overarching environmental enforcement agency in the United States. It provides general guidance to all Federal agencies in the implementation of the NEPA Process and reviews all EIS produced by Federal agencies.

Establishment Payments: BCAP funds that will provide for up to 75 percent of establishment cost for perennial crops and includes cost of seed and/or stock and planting for perennials. In areas of non-industrial forest land, establishment payments will cover the cost of site preparation and tree planting.

Farm Cooperative: A farmer- or rancher-owned and controlled business from which benefits are derived and distributed equitably on the basis of use by each of the farmer or rancher owners.

Farm Price: The season average price received by farmers as they sell their production into the market. The farm price is usually determined by an aggregate market, usually national or global, with local differences created as a result of specific marketing conditions, such as distance to collection or consumption centers, storage availability, transportation, etc.

Farmer Cooperative Organization: A cooperative organization or an entity, not chartered as a cooperative that operates as a cooperative in that it is owned and operated for the benefit of its members, including the manner in which it distributes its dividends and assets.

Final demand: Employment compensation, proprietor income, returns to other property, and indirect business taxes

Fish and Wildlife Service: An agency within the U.S. Department of the Interior responsible for conserving the nature of America.

Floodplains: Defined by the Federal Emergency Management Agency (FEMA) as those low lying areas that are subject to inundation by a 100-year flood, a flood that has a one percent chance of being equaled or exceeded in any given year. They provide for flood and erosion control support that helps maintain water quality and contribute to sustaining groundwater levels. Floodplains also provide habitat for plant and animal species, recreational opportunities and aesthetic benefits.

Food Waste: A material composed primarily of food items, or originating from food items, or compounds from domestic, municipal, food service operations, or commercial sources, including food processing wastes, residues, or scraps.

Forest Lands: Lands at least ten percent of stocked by forest type trees of any size

Forest Service: A USDA agency that manages a portfolio of more than 193 million acres of national forest and grasslands throughout the United States.

FSA: the Farm Service Agency.

Government Payment: Any direct revenue received from the federal treasury as a result of performing agriculture related activities. There are two general types of payments – those linked to the change in prices and or production, and those that are fixed regardless of prices and/or production levels.

Greenhouse Gas Test: A test included in the Energy Independence and Security Act of 2007 that requires advanced biofuels produced by a biomass conversion facility to meet a defined percent of the full life cycle reduction in greenhouse gas gained over the production and use of conventional fuels.

Groundwater: The water that flows underground and is stored in natural geologic formations called aquifers.

Indian Tribe: Any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians (25 U.S.C. 450b).

Indirect impacts represent the response by all industries in the economy to a change in final demand for a specific industry. As changes in economic activity occur, changes in final demand occur.

Induced impacts represent the response by all industries in the economy to increased expenditures of new household income and inter-institutional transfers generated from the direct and indirect impacts of the change in final demand for a specific industry.

Institution of Higher Education: As defined in section 102(a) of the Higher Education Act of 1965 (20 U.S.C. 1002(a)), "(a) a proprietary institution of higher education (as defined in subsection (b) of this section); (b) a postsecondary vocational institution (as defined in subsection (c) of this section); and (c) only for the purposes of part B of title IV, an institution outside the United States that is comparable to an institution of higher education as defined in section 101and that has been approved."

Intermediate Ingredient or Feedstock: An ingredient or compound made in whole or in significant part from biological products, including renewable agricultural materials (including plant, animal, and marine materials), or forestry material that are subsequently used to make a more complex compound or product.

Land use shifts: Indicate the changes in what is planted in a particular area of cropland.

Native species: A species that, with respect to a particular ecosystem, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

Net Farm Income: The difference between total revenue and total expenses, including the gains or losses from the value of farm inventories.

No Action Alternative: A suggested alternative to the Proposed Action that assumes that no Federal program like BCAP is implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need of the proposed program, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

Noxious Weed: Any plant or plant product that can directly or indirectly bring harm to agriculture, the public health, navigation, irrigation, natural resources, or the environment.

Prime and Unique Farmland: Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops (7 CFR 657.5)

Procuring Agency: (a) Any Federal agency that is using Federal funds for procurement; or (b) a person that is a party to a contract with any Federal agency, with respect to work performed under such a contract

Producer: An owner or operator of contract acreage that is physically located within a BCAP project area

Programmatic Environmental Impact Statement (PEIS): An evaluation of the potential environmental consequences of implementing a new Federal program on a national scale. The BCAP PEIS assesses the potential impacts of the action and the No Action alternatives on potentially affected environmental and socioeconomic resources.

Project Sponsor: (a) a group of producers; or (b) a biomass conversion facility

Protected Species: Those species federally designated as threatened or endangered and protected by the Endangered Species Act (ESA).

Qualified Biomass Conversion Facility (BCF): A facility that meets all the requirements for qualification under the NOFA and has entered into a Memorandum of Understanding (MOU) for such qualifications with the Deputy Administrator.

Renewable biomass: is defined for purposes of the CHST matching payment program to include the following: (1) Materials, pre-commercial thinnings, or invasive species from National Forest System land and public lands (as defined in section 103 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1702)) that: (a) Are byproducts of preventive treatments that are removed to reduce hazardous fuels, to reduce or contain disease or insect infestation, or to restore ecosystem health; (b) Would not otherwise be used for higher-value products; and (c) Are harvested in accordance with applicable law and land management plans and the requirements for old growth maintenance, restoration, and management direction of section 102 (e)(2), (3), and (4) of the Healthy Forests Restoration Act of 2003 (16 U.S.C. 6512) and large-tree retention of subsection (f); OR (2) Any organic matter that is available on a renewable or recurring basis from non-Federal land or land belonging to an Indian or Indian Tribe that is held in trust by the United States or subject to a restriction against alienation imposed by the United States, including: Renewable plant material (including feed grains, other agricultural commodities, other plants and trees, algae), and waste material (including crop residue, other vegetative waste material (including wood waste and wood residues), animal waste and byproducts (including fats, oils, greases, and manure), food waste, and yard waste).

Renewable Energy: Energy derived from (a) a wind, solar, renewable biomass, ocean (including tidal, wave, current, and thermal), geothermal, or hydroelectric source; or (b) hydrogen derived from renewable biomass or water using an energy source described in subparagraph (A).

Rural Development: An agency of the USDA whose mission is to increase economic opportunity and improve quality of life for all rural Americans. This agency has been delegated authority for five programs relating specifically with rural energy and the advancement of rural energy opportunities.

Scoping: A process used to identify the scope and significance of issues related to a Proposed Action while involving the public and other key stakeholders in developing alternatives and weighing the importance of issues to be analyzed in the PEIS.

Secretary: the Secretary of Agriculture

Short-rotation Woody Crops: Tree crops grown primarily for their fuel value (USFS 2008)

Soil: "The unconsolidated mineral and organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants" (Soil Science Society of America [SSSA] 2008).

Surface Water: As defined by the EPA, surface waters are waters of the United States, such as rivers, streams, creeks, lakes, and reservoirs, supporting everyday life through uses such as drinking water and other public uses, irrigation, and industrial uses.

Timberland: is defined forest land that is producing or is capable of producing crops of industrial wood and which has not been withdrawn from timber utilization by statute or administrative regulation.

United States and Territories: Any of the 50 States of the United States, the Commonwealth of Puerto Rico, the District of Columbia, the U.S. Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.

Woody Biomass: The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management.

Yard waste: Material composed primarily of yard maintenance, cleanup materials, or debris removal items, originating from residential, municipal or commercial yards, lawns, landscaped areas, or related sites.

This page intentionally left blank