

Assessment of the

BIOENERGY PROVISIONS

in the 2008 Farm Bill



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B IOMASS PRODUCTION IS A POTENTIAL GAME-CHANGER

for U.S. landscapes and ecosystems. Communication, collaboration, and cooperation are extremely important if bioenergy and fish, wildlife, and biodiversity are to be integrated in ways that are truly sustainable. *Legislators and other policymakers have choices.*

ASSESSMENT OF THE BIOENERGY PROVISIONS IN THE 2008 FARM BILL

A Report Prepared for the Association of Fish and Wildlife Agencies
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EXECUTIVE SUMMARY

CONCERN about the cost of energy, U.S. dependence on foreign oil, and increasing global energy demand is generating attention to bioenergy. Congress created a Biomass Caucus and the White House issued the 2011 Blueprint for a Secure Energy Future to further engage federal agencies (U.S. Departments of Agriculture, Defense, Energy, Transportation, and the Environmental Protection Agency), industry, agriculture producers, private organizations, and citizens in the discussion of a bioenergy future.

Many aspects of federal bioenergy policy pertaining to agriculture have roots in the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill), as well as the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill), which contained over \$1 billion in mandatory funding for energy efficiency and renewable energy. The production of biomass is a game-changer regarding land-use because of the profit potential on lands not historically suited to farming. It will be important to proceed with thought and attention to conserving the nation's irreplaceable natural resources, including fish, wildlife, and their native habitats. Sustainability of species is at stake as is the viability of the \$730 billion/year outdoor industry that supports 6.5 million jobs (1 out of 20 of all U.S. jobs)¹.

This study provides an overview of the bioenergy movement and policy rooted in the 2008 Farm Bill. The risks and opportunities of bioenergy production related to fish, wildlife, and their native habitats include: land conversion; use of aggressive plants that invade and degrade native plant communities; monoculture plantings that reduce diversity; management that diminishes habitat; and, decline in water quantity/quality. In addition to review of the 2008 Farm Bill, the report addresses the use of aggressive and genetically modified (GM) plant materials; guidelines for integrating fish and wildlife needs with bioenergy; environmental services in the context of bioenergy and fish and wildlife resources; and examples of bioenergy production that integrate fish and wildlife needs.

Bioenergy is not new; wood has been burned since the early days of mankind. Wood, grasses and other organic materials remain an important part of the modern biomass stream, particularly with increasing demand for pelletized wood from North America (European and Asian markets in particular)² and growing export interest in areas with access to deep water ports. Liquid biofuels also have a long history. Camelina, an oil seed crop pursued as a feedstock for jet fuel, provided lamp oil in the Bronze Age.³ Ethanol was the fuel for an engine developed in 1826 by Samuel Morley and the Model T was introduced as a flexible fuel vehicle in 1908. But World War I drove up ethanol demand and by the 1920s gasoline dominated. In 1974, following a time of food and fuel concern, the Solar Energy Research, Development, and Demonstration Act of

1974 promoted ethanol as an additive to gasoline. The Energy Policy Act of 2005 mandated the use of ethanol through the Renewable Fuel Standard (RFS). The Energy Independence and Security Act of 2007 raised the RFS target to 36 billion gallons of ethanol by 2022⁴. These legislative actions are game-changers because they mandate ethanol use. Interest in bioenergy feedstock includes terrestrial native and non-native plants as well as aquatics such as cyanobacteria, lemna (duckweed), and plankton. One of the most unusual possibilities is described in a 2007 article as "synthetic life," a concept in which the U.S. Department of Energy (DOE) is reported as committing \$125 million to tailor an organism by using genetics from several organisms.⁵

Pelletized biomass to generate energy is the most active current market, but there is much interest in liquid biofuels from cellulosic sources as well. 'First-generation biofuels' are produced from corn-kernel starch or soybeans (biodiesel) and 'advanced biofuels' comes from about anything else.⁶ Because first generation biofuels use crops also grown for food (40% of the 2011 corn crop grown on about 92 million acres were reportedly to be used for ethanol production), many have voiced concern about the diversion of food crops to fuel purposes. Other concerns are that the intensive cultivation needed for first-generation biofuel production may lead to increased soil erosion, decreased water quantity/quality, and conversion/deterioration of already diminished wildlife habitat while yielding only modest greenhouse gas savings. The commonly-communicated advantage of using cellulosic biomass is that it can be derived as a co-product of crops grown for first generation biofuels or grown as dedicated energy crops on land too poor for food production.⁷ Residue from ecologically site-appropriate and sustainably managed native forest, grasslands, etc. have considerable potential to generate biomass in ways that contribute to our energy independence while conserving irreplaceable natural resources and aspects of the U.S. economy that depend on them.

A report sponsored by the DOE titled the *U.S. Billion-Ton Update*⁸ indicates that biomass production by 2030 could be increased from the current 473 million dry tons per year to as much as 1.6 billion dry tons per year (more than enough to offset 30% of current U.S. petroleum consumption).

The report indicates that this could be done with reliance on advances in plant breeding, genetic modification, and production technology along with crop residues from agricultural production (corn stover) and dedicated energy crops like short-rotation willow, eucalyptus, giant miscanthus, hybrid switchgrass, and others with biomass potentials of 17.1 to 24.3 dry tons/acre/year. By contrast, annual yields for corn are reported at about 250 gallons/acre and sugar cane at about 450 gallons/acre.⁹ *Even with dedicated energy crops, an area the size of Iowa and Missouri (79 million acres) reportedly would be needed. Can this be done without conversion of remaining native ecosystems that are important to society for many reasons?*

The energy crop paradigm includes the use of contract-grown, high-yielding, monoculture crops that are easy to harvest and use lands not suited to food production. The idea is to use less land than if biomass were produced as a co-product of other land uses. In order for this paradigm to produce environmentally sustainable results, safeguards are essential in order to prevent unintended consequences. Otherwise, direct or indirect land conversion, overuse of water, soil erosion, and loss or degradation of native ecosystems could result. *It is especially important that public policy encouraging bioenergy production contains safeguards to prevent unintended consequences for which society would need to pay separately to correct.* Approaches that optimize production among many societal needs seem wise given finite U.S. land and water resources as well as a growing population.

Although Congress addresses bioenergy through other legislation, the Food, Conservation and Energy Act of 2008 (2008 Farm Bill) is key to agriculture. Eight Titles of the 2008 Farm Bill contain bioenergy provisions: Conservation; Rural Development; Research and Related Matters; Forestry; Energy; Livestock; Commodity Programs; and Trade and Tax Provisions. Bioenergy provisions are few in some Titles. Title I – Commodity Programs contain a provision regarding the use of excess sugar (not needed to meet human consumption needs) for biofuel production. Title II – Conservation has only one bioenergy provision, which allows managed harvesting for biomass on Conservation Reserve Program (CRP) lands as long as it is done in a way that ensures conservation of wildlife. Although the U.S. Department of Agriculture (USDA) has guidelines for forage harvest in association with Conservation Reserve Program (CRP), these do not address the significant harvest differences (to wildlife habitat) for biomass — *USDA guidelines are needed to address biomass as well as livestock forage harvest on CRP.*

Title VI – Rural Development is important due to funding opportunities as well as establishment of the Northern Great Plains Regional Authority and Regional Rural Investment Boards, which stimulate the economics of

bioenergy in ways that enhance the environment. These entities are designed to represent many perspectives, including natural resources. Title VII – Research and Related Matters, is an important driver of bioenergy because of the advisory groups created to set priorities for bioenergy research as well as grants and other funding provided through the Agriculture and Food Research Initiative (NIFA), and the Sun Centers, which provide a regional focus regarding renewable energy. *State fish and wildlife agencies, the U.S. Fish and Wildlife Service (USFWS), and the outdoor recreation industry appear absent or not often engaged in activities under both Titles but should be involved.*

Title VIII – Forestry contains one bioenergy provision which pertains to the Cooperative Forestry Assistance Act of 1978 and adds the production of renewable energy as a national private forest conservation priority (along with air, water quality, soil conservation, biological diversity, etc.). This could be positive to biodiversity if sustainability of ecologically site-appropriate native forest results, but negative to biodiversity if such forest is converted. *Coordination between the forestry and wildlife communities is needed to ensure forest-related efforts continue to sustain fish, forest, and wildlife resources.*

An important bioenergy aspect of the 2008 Farm Bill is Title IX – Energy. In addition to directing studies on bioenergy issues, this Title contains funding to focus on bioenergy such as the Biomass Research and Development Board that includes many federal agencies, organizations, and industry. The Biomass Crop Assistance Program (BCAP) is a provision of the Energy Title. The BCAP helps agriculture producers to establish biomass production to supply biomass conversion facilities. The program offers cost-share establish biomass crops as well as payments for collection, transportation, and storage. The 2008 Farm Bill contains direction to exclude potentially invasive plants, and the Joint Explanatory Statement of the Committee of Conference clarified that wildlife concerns are meant to be addressed and conversion of native forest discouraged. These directives do not appear to be followed through during implementation as indicated by the use of giant miscanthus (a plant that can reproduce and spread via rhizomes if not by seed), the optional (not required) inclusion of wildlife in BCAP practice standards and specifications and/or Forest Stewardship Plans (which do not have to address at-risk species), and the lack of mechanisms to discourage forest conversion. *USDA reconsideration of using aggressive plants, safeguards to deter native forest conversion, and processes to ensure integration of wildlife are needed.*

Title XI – Livestock contains a single provision regarding a study to address the use of livestock manure as a bioenergy feedstock. Title V – Trade and Tax Provisions

contains forestry bond authorities – the \$1.01 per gallon tax credit for cellulosic ethanol production – and directs a study (National Academies suggested) concerning biofuels production, capacity, the environment, and other issues.

Developing bioenergy markets offers opportunities to optimize many societal needs while stimulating diverse industries and sustaining natural resources that include fish, wildlife, and their native habitats. Native plants, in particular, offer potential because they are disease/insect resistant and adapted to the soils and climate. And, *whereas many dedicated energy crop choices are suitable only for energy uses, native grasses and forbs can also be used for livestock forage if its demand rises above that for biomass.* Low-hanging fruit available for biomass includes: sustainable management of ecologically site-appropriate native forest (including woody residue to reduce wildfire risk); removal of woody encroachment from prairie landscapes and restoration of other ecosystems; residue generated from natural disaster; management of highway and other rights-of-way; and the use of native plants that fit the native ecosystem in which the land is located. On a local or regional scale, there is increasing use of local waste to help meet energy needs. These products may be small individually, but added together the gains can become a significant boon to the local economy.

The bioenergy movement is global and not unique to the U.S. Less dependence on imported oil and affordable energy are commonly cited as drivers. Bioenergy production is usually framed as environmentally advantageous and good for the economy. Biomass production tends to be discussed in terms of better soil, water, and wildlife habitat versus annual crops. However, if biomass crops trigger direct or indirect land conversion or diminishment of native ecosystems then a negative effect on biodiversity of the native ecosystem is the more likely result.

The key to how biomass crops affect fish and wildlife lies in cover replacement and compatibility of the biomass crop with the native ecosystem. Although effects of specific bioenergy crops on U.S. wildlife have been little researched, there is a large body of research that speaks to the effect of density, structure, cover-type, plant diversity, and other habitat characteristics on wildlife. Bioenergy and wildlife decisions can be based on this research while conducting studies in knowledge gaps.

The use of aggressive non-native or genetically modified plants that invade and replace native plant communities can also have an effect on wildlife. *It is important to determine who will be responsible and pay for controlling aggressive, non-native or genetically-modified bioenergy plants that escape and invade other private or public lands.* Will it be the company, the producer that plants the crop,

the private landowner/government agency whose lands are invaded, or the general public through taxation? In the case of genetically modified and patented plant materials, is it the company that holds patent rights or someone else? *These questions are beyond the scope of this report, but need answers.*

In addition to bioenergy needs in the U.S., international demand is in play with rapidly increasing export of pelletized and chipped wood as well as ethanol. An unknown is whether international demand for biomass will create land-conversion pressures in the U.S. in addition to those from efforts to meet U.S. RFS goals. Will economic opportunity and pressures from foreign countries trigger over exploitation of U.S. natural resources? The issue is not simply the nation's energy and food, it is global. How much can the U.S. sustainably contribute to global food and energy needs while addressing our own? Many native ecosystems have already given much through loss and diminishment and many species of fish and wildlife that depend on the diminished ecosystems are threatened, endangered, or declining.

A healthy economy is vitally important and the U.S. consists of many economies. Unravel one and others are affected. Adequate food, water, and energy are important to all citizens. There are choices regarding production of bioenergy and those choices will affect fish, wildlife, and their habitats. It will be important to pursue bioenergy policy in ways that conserve all natural resources and the diverse economies that depend on these resources. Congress, the White House and many agencies have been actively encouraging bioenergy, but, surprisingly, state fish and wildlife agencies responsible for fish and wildlife resources within their borders appear absent from most bioenergy discussions. Nor does the USFWS (responsible for federal trust species) appear engaged in many bioenergy policy processes. Some agencies engaged in bioenergy involve their own biologists, which is good but not nearly as productive as involving the agencies closest to the status and needs of the fish and wildlife resources of the nation.

Fish and wildlife resources seem seldom mentioned in bioenergy communications from the government, industry, academia, and other sources. However, communications frequently characterize bioenergy as environmentally sustainable. It seems reasonable to think that the public may believe that bioenergy is pursued in ways that conserve all natural resources, including fish, wildlife, and their habitats. There also seems an assumption that Farm Bill programs contain adequate safeguards to prevent conversion of native habitats and that planning with agriculture producers and forest owners includes adequate attention to wildlife. However, such safeguards appear lacking or inadequate. *State fish and wildlife agencies and the USFWS should be included in*

aspects of bioenergy that pertain to biodiversity. And, state fish and wildlife agencies and the USFWS should step up efforts to raise awareness of the implications of bioenergy choices on fish, wildlife, and their native habitats.

Most government policy and bioenergy industry communication focuses on use of dedicated and contract-grown biomass to maximize yields. This paradigm is quite different from habitat needed to sustain wildlife. Many agricultural producers prefer this model because it mirrors how other crops are grown and focuses on maximizing per acre yield, which equates to profit goals. Given the ups and downs of the marketplace, however, producing more does not always mean profit. Many energy crops under consideration are good for only energy and prices could fail to materialize if production exceeds demand. On the other hand, mixtures of native grasses/forbs can provide livestock forage and income when biomass markets are lagging. Sustainable management of ecologically site-appropriate native forest can provide diverse markets for forest products compared with specialized energy crops. *Agricultural producers and forest owners could find advantage in optimizing so as to maintain market flexibility versus growing a single purpose crop.*

Either of the following alternatives have potential to sustain fish, wildlife, and their habitats in concert with bioenergy production. Residue from sustainable management of forest lands, urban waste, natural disasters, invasive species control, highway rights-of-way, etc. should be emphasized in either approach.

Optimal Production:

- Sustainable and wildlife-friendly management of ecologically site-appropriate native forest and other native ecosystems and safeguards that deter use of public funds to convert these habitats.
- Biomass produced through eradication of invasive species.
- Maximized use of urban waste (including yard waste), woody debris generated by weather events, right-of-way energy plantings, etc.
- Emphasis on diverse native-grass/forbs, particularly on grassland landscapes that offer flexibility to use for bioenergy or livestock forage (and on marginally productive cropland or non-native pasture).
- Management (including plantings) of existing plantation forest, cropland, and pasture in cover not suited to wildlife, consistent with best management guidelines included in this report.

Maximum Production:

- Reliance on contract-grown energy crops on existing cropland, pasture, or plantation forest, using as few acres as possible, and growing species that do not have aggressive/invasive characteristics (or with commitments from those that patent or plant such species to pay the cost of monitoring, rapid response, eradication, or control).
- Establish safeguards (date-certain as of the date of enactment of the 2008 Farm Bill) to preclude the use of public funds (for cost-share, incentive payments, risk reduction, etc.) to convert native sod, ecologically site-appropriate native forest, wetlands, or other native ecosystems.
- Coordination between state fish and wildlife agencies, USDA, and bioenergy conversion facilities (including utilities) to assess individual situations and achieve common-ground agreement on feedstock compatibility with fish and wildlife resources and native habitats as well as the tailoring of Best Management Guidelines (Appendix A of this report) to the local situation.

It makes sense to first use biomass produced in ways that do not compete with other societal needs. Production of dedicated energy crops may be necessary to produce biomass at the scale needed, but policy and governmental initiatives should encourage production only within the capacity of U.S. natural resources (including fish and wildlife) to remain sustainable. Global demand and markets should not be a reason to exceed the capacity of U.S. natural resources to contribute sustainably.

Biomass production is a potential game-changer for U.S. landscapes and ecosystems. Biomass can be grown in places not suitable for traditional crops. There are many bioenergy stakeholders and many agencies are communicating with one another but too often, state fish and wildlife agencies and the USFWS appear left out of the bioenergy loop. Unless that changes, the nation's fish and wildlife resources are at significant risk and will likely suffer – as will the outdoor industry that supports 6.5 million U.S. jobs (about 1 in 20). Communication, collaboration, and cooperation are extremely important if bioenergy and fish, wildlife, and biodiversity are to be integrated in ways that are truly sustainable. *Legislators and other policymakers have choices.*



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Representatives of many state fish and wildlife agencies, non-governmental organizations, and federal agencies contributed perspective, insight, and information in regard to developing bioenergy policy and sustainability of fish, wildlife, and their native habitats. Members (too numerous to name) of the following Association of Fish and Wildlife Agencies committees and working groups were particularly helpful during the many meetings, teleconferences, and document review processes during the course of this policy analysis project: The Bioenergy, Conservation Reserve Program, and Forestry Working Groups of the Agriculture Conservation Committee; and, the Invasive Species Committee.

Notice of Project Intent and Limitations:

This project was undertaken to focus on federal policy, initiatives, and Executive Branch processes that are grounded in the bioenergy provisions of the 2008 Farm Bill. Complexity of federal bioenergy policy, bioenergy elements in the 2008 Farm Bill sometimes led to other legislation and/or federal agency connections beyond the expected USDA connection with regard to implementation of farm bill programs. It was also necessary to gain insight and understanding of the bioenergy movement, both national and international, in order to identify and refine implications associated with fish, wildlife, and their native habitats. The following report was developed based on the best information and data that could be found (and interpretation thereof) and issues were identified, described, and framed with objectivity, transparency, and clarity as the guides.

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INTRODUCTION

RISING ENERGY COSTS, concern about dependence on foreign petroleum, and increasing global energy demand is generating interest in bioenergy. Attention to bioenergy escalated over the last decade in legislative, policy, industry, and academia settings. Bioenergy provisions were included in the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill), and were a prominent feature of the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) which contained over \$1 billion in mandatory funding for energy efficiency and renewable energy. Bioenergy is likely to be a key element of U.S. policy well into the future. Biomass production is a game-changer regarding land-use because of the profit potential on lands that have not historically been suited to agricultural production. It is important that bioenergy production proceed with thought and attention to ways that conserve and sustain the nation's irreplaceable natural resources, including fish and wildlife, because of their integral importance to the economy and society as a whole.

This analysis focuses on policy that is grounded in the 2008 Farm Bill and has implications for fish, wildlife, and their native habitats. Legislative and corresponding policy and program initiatives that encourage production of bioenergy feedstock have considerable potential to impact land and water resources at the local and landscape-scale levels. How land and water are used has a direct effect on fish and wildlife resources. This study examines the risks and opportunities of developing bioenergy policy in regard to state fish and wildlife agency responsibilities for conservation and management of fish and wildlife resources. Issues of emphasis in this report are: Implications regarding the use of aggressive and GMO (genetically modified organisms) plant materials for biomass feedstock; guidelines for integrating fish and wildlife needs with bioenergy production; how bioenergy, fish/wildlife, and the concept of environmental services can best mesh; working examples of bioenergy production that integrate sustainability of fish, wildlife, and their native habitats; and, importantly, review of 2008 Farm Bill bioenergy provisions. Recommendations to the Association of Fish and Wildlife Agencies (AFWA) are highlighted.

A survey of all state agencies with responsibility for fish and wildlife resources, combined with a series of regional conference calls, were used to identify and refine state fish and wildlife agency perspective on bioenergy issues. These methods were supplemented with discussion at AFWA committee and working group meetings involving representatives of most state fish and wildlife agencies as well as many partner groups (governmental and non-governmental). Subsequent review of the 2008 Farm Bill, Joint Explanatory Statement of the Committee of Conference, pertinent rulemaking documents, program handbooks, and related materials helped bring policy issues and developing trends into focus and formulate recommendations.

PHOTO: Giant Miscanthus (the taller grass) Next to Native Prairie Grasses (Photo by Bill McGuire)

It is important that bioenergy production **proceed with thought and attention** to ways that conserve and sustain the nation's irreplaceable natural resources.

BACKGROUND

THE USE OF ORGANIC MATERIALS to produce energy is not new. Wood has been burned for heat since the early years of mankind. Wood, grasses, and other organic materials are an important part of the modern biomass stream. When used to generate electricity, wood and other organic materials are typically pelletized. Reports indicate increasing international demand for pelletized wood from North America (European and Asian markets in particular)¹ and export interest appears strongest in areas with the easiest access to deep water ports.

Liquid biofuels also have a long history. Camelina, an oil seed crop, dates to the Bronze Age in northern Europe where it was used for lamp oil and other purposes.² Camelina is now pursued as a feedstock for jet fuel and biodiesel. The U.S. Energy Information Administration (EIA) reports that ethanol was the fuel for an engine developed in 1826 by Samuel Morley. In 1906, Congress removed an existing tax on ethanol, making it an alternative to gasoline and the Model T was introduced as a flexible fuel vehicle in 1908. World War I drove up ethanol demand and by the 1920s, gasoline was the fuel of choice. Ethanol continued to be used off and on as a supplement to gasoline and in 1974, in a time of food and fuel concern, the first of many legislative actions came about to promote ethanol and the conversion of cellulose and other organic materials into fuel (Solar Energy Research, Development, and Demonstration Act of 1974). The Energy Policy Act of 2005 mandated that gasoline sold in the U.S. contain renewable fuel (i.e. the Renewable Fuel Standard or RFS) while setting a national goal to double the

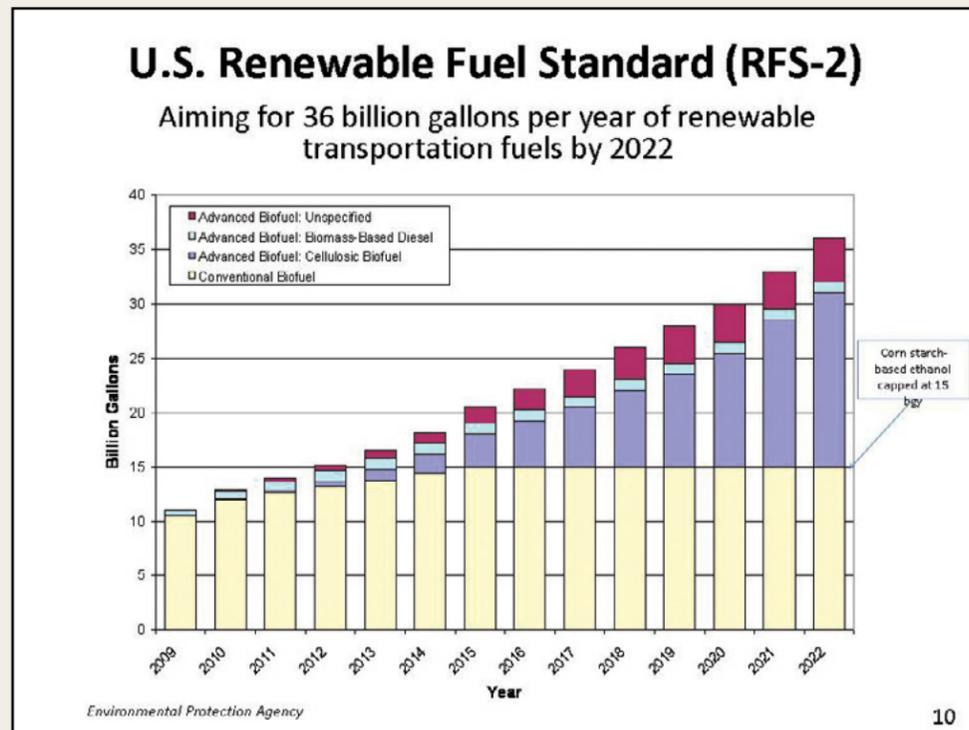
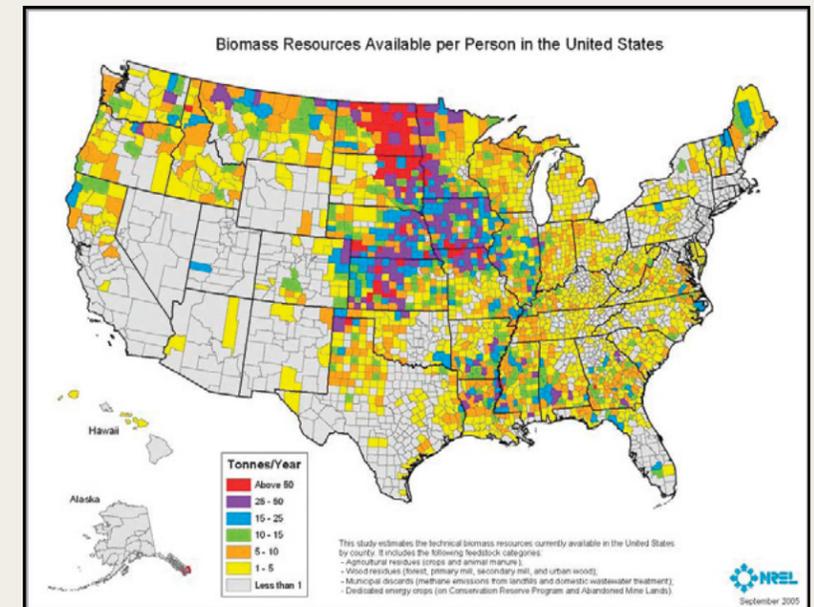


Figure 1. U.S. Renewable Fuel Standard (provided courtesy of DOE/NREL)

use of renewable fuel (mostly corn-based ethanol) by 2012. The Energy Independence and Security Act of 2007 built on this renewable fuel foundation by raising the RFS targets to blend 36 billion gallons of ethanol and other fuels into gasoline, diesel, and jet fuel by 2022³. These last two legislative actions were game-changers in regard to production and use of ethanol in the United States.

Wood and other biomass (usually pelletized) to generate heat and electricity constitutes the greatest current market for biomass, particularly in the Southeastern, Northwestern, and Northeastern U.S. in conjunction with domestic and international markets. Although still developing, there is also much interest in liquid biofuels. There are varying definitions of biofuel and bioenergy produced from differing feedstocks. It is generally accepted that 'first-generation biofuels' are produced from corn-kernel starch or soybeans (biodiesel) and 'advanced biofuels' comes from about anything else (cellulose, hemicellulose, lignin, and sugar/starch other than cornstarch).⁴ Because first generation biofuels use crops that are also grown for food (corn and soybeans), many have voiced concern about the diversion of too much food crops to fuel purposes. Other concerns are that the intensive cultivation needed for first-generation biofuel production includes the potential for increased soil erosion, decreased water quantity/quality, and conversion/deterioration of already diminished wildlife habitat while providing only modest greenhouse gas savings. The commonly communicated advantage of using cellulosic biomass is that

Figure 2. Biomass Resources of the United States (created by the National Renewable Energy Laboratory for the Department of Energy (courtesy DOE/NREL)



it can be derived as a co-product of crops grown for first generation biofuels or grown as dedicated energy crops on land too poor for food crop production.⁵ Importantly, residue from ecologically site-appropriate and sustainably managed native forest, grasslands, etc. offers the best potential to generate biomass in ways that contribute to energy independence while conserving irreplaceable natural resources and the many aspects of the U.S. economy that depend on them.

A recently released report sponsored by the DOE titled the *U.S. Billion-Ton Update*⁶, is a follow-up to a similar study done in 2005 (Billion-Ton Study) and seeks to determine whether U.S. agriculture and forest resources can supply enough biomass annually to offset 30% of present U.S. petroleum consumption. The *Billion-Ton Update* indicates that biomass production by 2030 could be increased from the current 473 million dry tons per year to as much as 1.6 billion dry tons per year, depending on the assumptions used in regard to energy crop productivity. The study relies heavily on residues from agricultural production (corn stover, etc.) and dedicated energy crops to achieve much of the additive biomass production between now and 2030. Some of the energy crops and current yields reported in the study are shown in Figure 3.

These *Billion-Ton Update* energy crop yields are based on data from field trials across the country and the study reflects expectation that yields would increase due to plant breeding, genetic modification, and production technology (up to 17.1-24.3 dry tons/acre/year possible by 2030). The *Billion-Ton Update* illuminates land-use needs by providing an example of what it would take to sustain a 50 million gallon bio-refinery (588,000 dry tons/year at a conversion rate of 85 gallons of ethanol/dry ton). Specifically, the report indicates it would take 336,000 acres of native tallgrass prairie yielding 2.5 dry tons/acre/year (27% of the land within a 25-mile radius of the biorefinery) to supply the biorefinery. Using hybrid switchgrass at a yield of 9.4 dry tons/acre/year, would reportedly require a smaller imprint of 62,600 acres to supply the biorefinery - 5% of the land within a 25-mile radius. The idea is to use high-yielding monoculture energy crops that would require less land than other choices. However, this approach provides fewer societal benefits than approaches that take advantage of biomass production as a co-product with other uses. It merits consideration of land use approaches that optimize among many societal benefits given finite land and water resources combined with a growing population. There is also significant potential for negative and unintended consequences to develop in association with land conversion; use of species with invasive tendencies for biomass production; impact on water resources, fish, and wildlife (and associated outdoor economies); and other aspects of biomass production, which will be examined in this report.

The biofuel production of these terrestrial plantings could be eclipsed by algal biomass that exude oils similar to petroleum and can yield 2,000 gallons or more of fuel per acre each year. By contrast, annual yields for corn are reported at about 250 gallons/acre and sugar cane at about 450 gallons/acre⁷. The bioenergy industry is moving forward so rapidly that many other forms of life are being looked at as avenues for bioenergy including cyanobacteria, lemna (duckweed), and plankton. A 2007 article refers to "synthetic life" and reports that the DOE committed \$125 million to an effort to tailor an organism by using genetics from several organisms.⁸

On March 30, 2011, the White House released the *Blueprint for a Secure Energy Future* and the use of bioenergy to reduce reliance on oil is a significant element of this report. In November 2010, the DOE produced the detailed

FEEDSTOCK	DRY TONS/ACRE/YEAR
Managed prairie (planting)	2.5
Switchgrass	5.0
Hybrid Switchgrass	9.4
Miscanthus	13.2
Willow	12
Poplar	4.5-9
Eucalyptus	6-14
Southern pine	5.5

Figure 3. Yield of Various Energy Crops

Biomass Multi-Year Program Plan and stated its mission as the pursuit of biomass and biofuel production through partnerships (public and private). In a 2011 USDA news release, Agriculture Secretary Tom Vilsack outlined the policy direction for the current administration: “the Obama Administration is committed to providing financial opportunities to rural communities, farmers and ranchers to produce biomass which will be converted to renewable fuels and increase America’s energy independence.”⁹

Over the past few years, legislation, governmental policy, publicly funded programs, academia, and private sector interest combined to escalate attention on bioenergy. A rapidly evolving bioenergy industry has developed with research, technology, and programs to establish energy crops leading the way. Mechanisms to establish biorefinery capacity and transportation systems are in the mix as well, although this aspect of the industry is moving more slowly. The industry is coalescing and organizing piece by piece with support from many sectors of government (i.e. energy, agriculture, transportation). Although interest includes utilization of residual biomass from management of forests and from other lands and sources, attention to dedicated energy crops seems the strong focus.



Willow – courtesy DOE/NREL

An energy crop paradigm is a focus of interest in energy policy and industry settings. This paradigm follows:

- High-yield monoculture plantings of consistent quality and energy content
- Contract grown to ensure production and supply
- Easy to manage, harvest, and aggregate
- Close to bioconversion facilities to minimize transportation costs
- Polyculture landscape (several monoculture crops to ensure year-round supply)
- Grown on marginal cropland or pastureland so as to not compete with food production
- Minimal imprint on the land (i.e. maximum yield on as few acres as necessary)

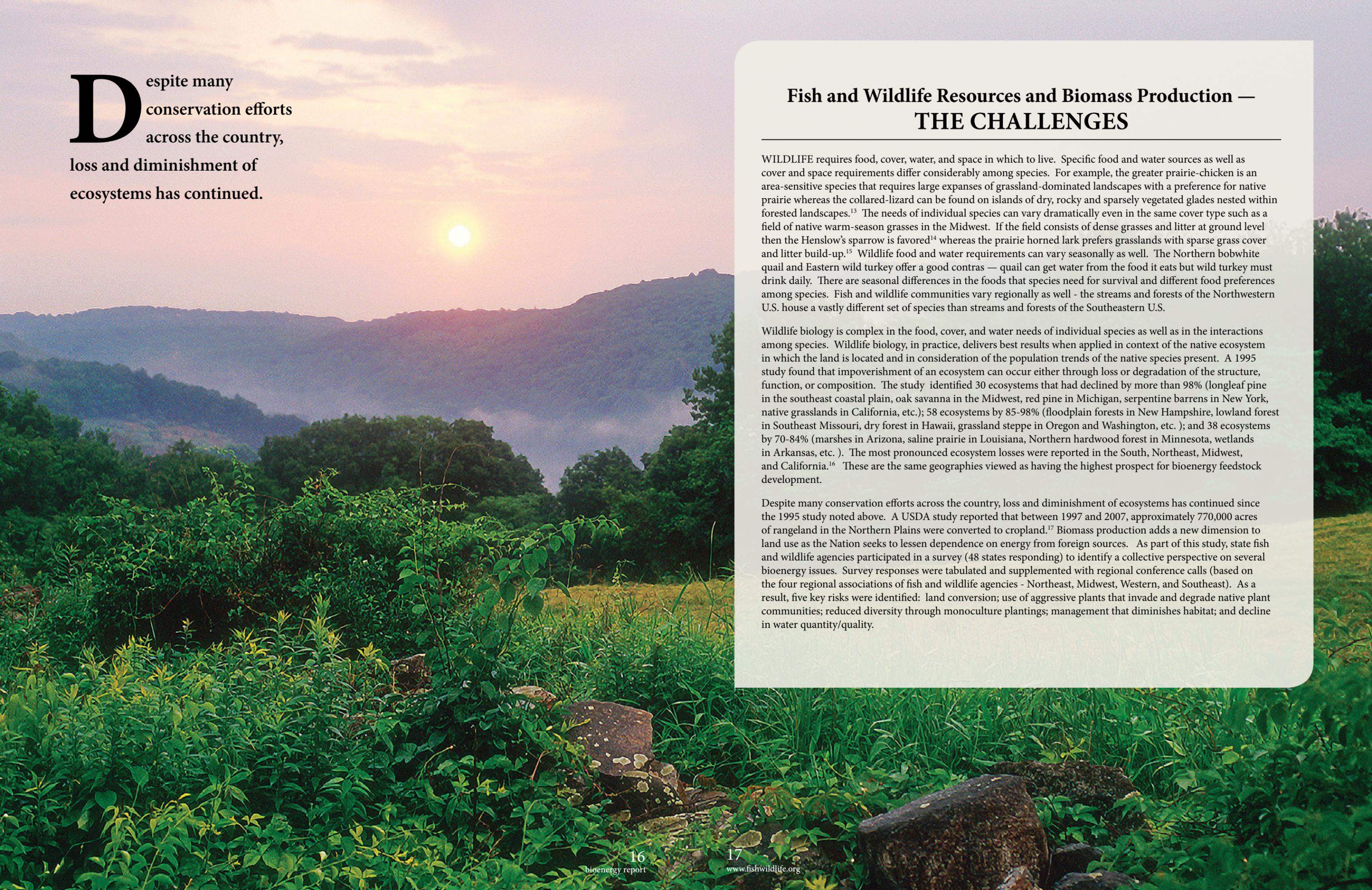
The characterization of ‘environmental sustainability’ frequently accompanies the above paradigm. But fish and wildlife resources are often not mentioned or simply discussed in the context of habitat benefits from the use of perennial vegetation versus annual row crops like corn. Fish and wildlife biology is complex and there is significant risk in overlooking impact on already highly diminished native ecosystems and species in decline as well as other bioenergy paradigms that could better serve multiple societal needs.

The move toward dedicated and cultivated energy crops appears to favor minimizing the industry footprint on the landscape while maximizing biomass production and income from energy crops. In order for this paradigm to produce results that are environmentally sustainable, safeguards need to be in place to prevent unintended consequences. In the absence of adequate safeguards, direct or indirect land conversion, overuse of water resources, soil erosion, and loss or degradation of native ecosystems, among others, may occur. It is especially important that public policy and funding to encourage/incentivize bioenergy production contain safeguards to prevent unintended consequences for which society would need to pay separately and significantly to correct.

Widespread planting of biomass crops on fragile soils could exacerbate soil erosion. Biomass crops that increase local water use could contribute to existing water quantity/quality issues in many U.S. regions. Other avenues that could lead to unintended consequences include inattention to use of residue from sustainable management of native and ecologically site-appropriate native forest as well as too much emphasis on high-yielding energy crops that have little utility for other purposes in broader supply-demand cycles that wax and wane. A major unintended consequence would be for government programs and initiatives to fail to encourage sustainability in concert with biomass production and, instead, encourage or enable diminishment or conversion of already greatly diminished native ecosystems such as longleaf pine in the southeast or native prairie. Invasive species cost the U.S. \$2-\$3 billion per year in crop losses alone,¹⁰ not to mention costs associated with controlling detrimental plants in pasture or rangeland settings or on other private lands.

The impact and cost of efforts to control aggressive and invasive species in the context of native ecosystems and fish and wildlife resources are very real but harder to quantify. A significant indicator is that invasive species contribute to the risk associated with over 40% of U.S. species that are listed as threatened or endangered.¹¹ In the case of fish and wildlife resources, unintended consequences can be irreversible (i.e. vanishing species and ecosystems which, once lost, cannot be recovered) and can cost jobs and economic stimulus. Fish and wildlife and their native habitats support a large fishing, hunting, and wildlife-associated recreation community and the 2006 Survey of Fishing, Hunting, and Wildlife-Associated Recreation reported 87.5 million participants that stimulated the economy to the tune of \$122.3 billion.¹² However, fish, wildlife, and their native habitats are seldom addressed in bioenergy literature or discussions. Unless this trend is reversed, significant unintended consequences are very likely.





Despite many conservation efforts across the country, loss and diminishment of ecosystems has continued.

Fish and Wildlife Resources and Biomass Production — THE CHALLENGES

WILDLIFE requires food, cover, water, and space in which to live. Specific food and water sources as well as cover and space requirements differ considerably among species. For example, the greater prairie-chicken is an area-sensitive species that requires large expanses of grassland-dominated landscapes with a preference for native prairie whereas the collared-lizard can be found on islands of dry, rocky and sparsely vegetated glades nested within forested landscapes.¹³ The needs of individual species can vary dramatically even in the same cover type such as a field of native warm-season grasses in the Midwest. If the field consists of dense grasses and litter at ground level then the Henslow's sparrow is favored¹⁴ whereas the prairie horned lark prefers grasslands with sparse grass cover and litter build-up.¹⁵ Wildlife food and water requirements can vary seasonally as well. The Northern bobwhite quail and Eastern wild turkey offer a good contrast — quail can get water from the food it eats but wild turkey must drink daily. There are seasonal differences in the foods that species need for survival and different food preferences among species. Fish and wildlife communities vary regionally as well - the streams and forests of the Northwestern U.S. house a vastly different set of species than streams and forests of the Southeastern U.S.

Wildlife biology is complex in the food, cover, and water needs of individual species as well as in the interactions among species. Wildlife biology, in practice, delivers best results when applied in context of the native ecosystem in which the land is located and in consideration of the population trends of the native species present. A 1995 study found that impoverishment of an ecosystem can occur either through loss or degradation of the structure, function, or composition. The study identified 30 ecosystems that had declined by more than 98% (longleaf pine in the southeast coastal plain, oak savanna in the Midwest, red pine in Michigan, serpentine barrens in New York, native grasslands in California, etc.); 58 ecosystems by 85-98% (floodplain forests in New Hampshire, lowland forest in Southeast Missouri, dry forest in Hawaii, grassland steppe in Oregon and Washington, etc.); and 38 ecosystems by 70-84% (marshes in Arizona, saline prairie in Louisiana, Northern hardwood forest in Minnesota, wetlands in Arkansas, etc.). The most pronounced ecosystem losses were reported in the South, Northeast, Midwest, and California.¹⁶ These are the same geographies viewed as having the highest prospect for bioenergy feedstock development.

Despite many conservation efforts across the country, loss and diminishment of ecosystems has continued since the 1995 study noted above. A USDA study reported that between 1997 and 2007, approximately 770,000 acres of rangeland in the Northern Plains were converted to cropland.¹⁷ Biomass production adds a new dimension to land use as the Nation seeks to lessen dependence on energy from foreign sources. As part of this study, state fish and wildlife agencies participated in a survey (48 states responding) to identify a collective perspective on several bioenergy issues. Survey responses were tabulated and supplemented with regional conference calls (based on the four regional associations of fish and wildlife agencies - Northeast, Midwest, Western, and Southeast). As a result, five key risks were identified: land conversion; use of aggressive plants that invade and degrade native plant communities; reduced diversity through monoculture plantings; management that diminishes habitat; and decline in water quantity/quality.

Land Conversion

The total land area of the U.S. is about 2.3 billion acres. In pre-pre-settlement times, forests accounted for about half of the total land area, but since then nearly 300 million acres of forest have been cleared (primarily for agriculture in the 1800s) and forests now occupy only about 747 million acres. Approximately 907 million acres of the total land area of the U.S. is now cropland, pasture, or rangeland that is in private ownership and managed for agricultural production.¹⁸ The many unique U.S. ecosystems and the plants and animals that comprise them have contributed significantly through conversion to agriculture and development to meet the needs of all citizens. As reported previously, the native plant and animal communities that comprise many ecosystems are now dramatically reduced in size due to land conversion uses. An example is wetlands in the 48 conterminous United States that sustained a loss of about 53% by the 1980s¹⁹ but, losses have since slowed due to wetland restoration efforts that include DOI initiatives associated with the North American Waterfowl Management Act (NAWCA) as well as USDA efforts in conjunction with Swampbuster (1985 Farm Bill) and the Wetland Reserve Program (1990 Farm Bill). Another example is the longleaf pine ecosystem which once occupied 93 million acres of the Southeastern U.S. but has been reduced to about 3 million acres, largely due to conversion to plantation forests (loblolly or slash pine).²⁰ Longleaf pine ecosystems are among the most diverse of all ecosystems other than in the tropics.²¹ Even though loblolly and slash pine are species native to the southeastern U.S., replacing longleaf pine ecosystems with either of these tree species results in biodiversity loss because of the impact on species associated with already highly diminished longleaf pine ecosystems.



Courtesy DOE/NREL, V. Tolbert — hybrid poplar

Even without the advent of bioenergy, conversion of native prairie and rangeland to cropland has continued as has conversion of other native habitats for agricultural and other uses. Bioenergy efforts have been launched with government mandates and incentives that encourage the production of ethanol and crops from which to produce ethanol. In 2011, reports indicated that 40% of the 2011 U.S. corn crop of 92 million acres went to ethanol production. This puts tremendous pressure on existing land to produce higher yields and/or breaking new land for corn production.

The fledgling cellulosic ethanol industry is also the recipient of numerous government incentives. The DOE's *U.S. Billion-Ton Update* projects (under the highest-price scenario for biomass) conversion of 30 million acres of cropland and 49 million acres of pastureland to energy crops (79 million acres total — about the size of Missouri and Iowa combined) would be needed by 2030 to meet liquid biofuel production goals. This scenario seems to assume no change in CRP acreage and does not appear to address possible conversion of other land types to replace cropland or pastureland used for energy crops (i.e. conversion of forestland to cropland), presumably because of safeguards. Pasture intensification is mentioned as the way livestock forage acres would be replaced as forage lands are converted to energy production. Projections include about half of the energy crops going to woody and half to perennial grass plantings. The report recognizes the significance of the land use changes (establishment of energy crops on millions of acres per year) and notes that this level of land-use change has been seen in the past for major commodity crops.

It does not seem likely that an area the size of Iowa and Missouri combined could be converted in the United States to energy crops, especially in the absence of sound safeguards, without triggering conversion of remaining and greatly diminished ecosystems. Whether the conversion is direct (ecologically site-appropriate native forest to short-rotation willow or prairie to cropland) or indirect (forest converted to replace pastureland that is converted to energy crops), this is the risk of bioenergy production to U.S. fish, wildlife, and native ecosystems. The bioenergy survey of state fish and wildlife agencies showed that 91% of respondents view land conversion as a significant risk and 82% believe that indirect land conversion in their area is likely. Safeguards in the Farm Bill and other public policy programs and efforts will be absolutely essential if unintended land conversions are to be averted.

Use of Aggressive Plants that Invade and Degrade Native Plant Communities

Established by the President on February 3, 1999, Executive Order 13112 defined an invasive species as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” The National Invasive Species Management Plan (2008 Plan)²² provides an excellent overview of invasive species problems and challenges. Invasive species make it to the U.S. in a number of ways, including as uninvited hitchhikers on cargo while others are brought here deliberately for ornamental, crop, food, recreation, or other purposes. Prevention is the first and best line of defense and if that fails then early detection, rapid assessment, and rapid response form the second line of defense against encroachment. The 2008 Plan explains how invasive species cause problems. Among other damage, aquatic invasive species can clog water supply systems while invasive terrestrial species can reduce crop yields, alter ecosystem or increase the severity of human allergies. Although it is difficult to quantify the overall cost of invasive species control, the 2008 Plan reports \$2-3 billion per year simply in crop losses. A white paper prepared by The National Invasive Species Council (NISC)²³ further illuminates the cost of invasive species by listing specific examples. Some of these are: Spotted knapweed and leafy spurge in the Western U.S. interfere with grazing productivity; Eurasian water milfoil forms aquatic mats, limit water access and devalue shoreline properties in New Hampshire, the Midwest, and elsewhere; non-native algae fouls beaches and disrupts tourism in Hawaii, costing the island of Maui alone an approximate \$20 million annually.

The effect of invasive species on native fish, wildlife, and the natural ecosystems in which they live is considerable. The Five-Year Review of Executive Order 13112 on Invasive Species²⁴ reports that invasive species impacts contribute to the risk associated with over 40% of U.S. species listed as threatened or endangered. Not all introduced plants are so aggressive that they become considered invasive and harmful. However, introduced plants that become aggressive and invasive have common characteristics. These include rapid growth; deep roots; prolific flowering and production of many easily dispersed seeds; grow on a wide variety of sites; long seed dormancy; reproduction through above- or below-ground runners; growth timing that provides advantage over native plants; ability to outgrow and shade native plants; release growth inhibiting chemicals into the soil; and, grazing resistance.²⁵

The bioenergy risk for fish, wildlife, and their habitats is that many energy crop choices are either introduced species or genetically modified organisms (GMO) that have characteristics similar to those of species that are now commonly viewed as invasive. In particular, preferred bioenergy feedstock traits are: ease of establishment, fast and robust growth, adaptability, and ability to outcompete other plant species. A few bioenergy choices under consideration or in production are:

Algae — prolific production of oils that can be collected and processed (GMO varieties pursued)

Camolina — European plant considered for jet fuel potential and that can be grown in cool/dry climates

Canola — derived from rapeseed (Asia/Europe) and can grow in cool/dry climates

Energy cane — a cultivar of sugar cane

Eucalyptus (GMO) — Australian tree that is cold hardy replacement for pine in the Southeastern U.S.

Giant Reed — Asia/Africa origin and very aggressive

GMO switchgrass — increased water efficiency and double the yield of native switchgrass

Hybrid sorghum — biomass in California and elsewhere

Jatropha — Mexico/Latin America plant that is prolific but needs sub-tropical conditions

Miscanthus — European grass that forms tall and dense stands

Napiergrass — African origin, also called elephant grass, is cane-like and likes wet areas

Willow — densely grown and harvested on a cycle of 3 to 5 years

The rush to find the highest yielding producers of biomass or oils is advancing rapidly and difficult to follow. Nearly any species imaginable is open to consideration. Duckweed (lemna) and cyanobacteria are among the candidates as is a technology that produces something referred to as “synthetic cell” technology²⁶ in which DNA is synthesized in the lab to design a new genome that is inserted in and takes-over a host cell. One goal is reportedly to create an algae genome that would produce a super-productive organism.

Even early-on, some bioenergy plants were controversial. One of the parents of the triploid variety of miscanthus is considered invasive. Miscanthus will be addressed more fully later in this report (Farm Bill analysis section — Biomass Crop Assistance Program discussion), but it is notable that efforts are reportedly underway to further increase the

productivity and adaptability of miscanthus by crossing it with sugarcane and sorghum. An article in *The Organic and Non-GMO report*²⁷ describes GM canola escaping onto roadsides and farm fields where it was not intended — the same article refers to GM canola escaping into the wild areas of North Dakota. Giant reed, a plant that looks similar to sugar cane or bamboo, was discussed in an article in *Biofuels News*²⁸ and characterized as one of the fastest growing plants on earth and considered a noxious weed in many countries. The article cites problems associated with the plant in California even though it is directed at the Australian consideration of giant reed as a biomass crop. As indicated above, giant reed is also one of the plants under consideration for biomass production in the United States.

The advent of GMO plants spurs questions of ethics and responsibility. An article in a Duke University publication²⁹, advances the issue of ownership of transgenic trees and who will take responsibility if seed from the tree makes it into an unmanaged ecosystem and replicates. Sterility is often cited as the containment approach for organisms that are not otherwise confined, like giant miscanthus, which is currently being planted for energy crop purposes. However, sterility doesn't always work as in the case of the callery (Bradford) pear, a popular ornamental that was originally developed to bear sterile fruits. Recent cultivars of this tree, bred to help keep it from splitting in snow cover or high winds, have produced viable fruit and the tree now invades unmanaged land.³⁰ Figure 4 provides insight into the ability of the callery pear to invade lands where it was not planted. Sterility may not always work and, in regard to algae and other organisms that reproduce vigorously and in ways other than by seed, invasiveness may be impossible to prevent once they enter an open system like a stream, river, lake, ocean, or terrestrial habitat in which invading species are difficult to locate and eliminate.

Regarding responsibility, a 2004 publication³¹ addresses some of the issues, including potential liability of farmers growing GM crops and seed companies that sell GM seed. This is an important area that could benefit from legal attention and outreach in order to foster a better understanding of responsibility and liability. The importance of clear responsibility is sharply illuminated by the recently reported payment of up to \$750 million by a major corporation to settle several lawsuits with U.S. farmers over contamination of their crops by GM rice.³² An unresolved issue is who pays when GM and aggressive species used for bioenergy production escape and interfere with management of native ecosystems (whether in public or private ownership) and eradication is necessary.

The risk associated with the use of aggressive and invasive or potentially invasive species to produce biomass for conversion to bioenergy is that these species will invade and diminish fish and wildlife habitats, particularly ecologically site-appropriate native plant communities. Once invasive species have infested native habitats, the cost of control can be significant and sap conservation funds that, even in good economic times, are chronically insufficient.

Reduced Diversity Through Monoculture Plantings

Much of the current information and interest in increasing bioenergy production connects with monoculture energy crops that are managed to maximize biomass. Crops include corn grain and stover, perennial grasses like miscanthus, woody species like willow, and others. Production methods often include dense plantings that are managed to preclude other plants, increased fertilization and irrigation to maximize production, and harvest near or after the end of the growing season. Without careful planning each of these elements of biomass production can have a negative effect on wildlife.

There are many studies that address monoculture versus diversity in the context of wildlife habitat. An excellent information source is an extensive literature review conducted by Stephen J. Brady.³³ The study noted the ability of individual species to adapt to land-use change in relation to agriculture (some do better than others) but reported that past experience has shown that the majority of wildlife species decline as agriculture expands to the point of replacing large blocks of native habitats. The study concludes that wildlife do best on agricultural landscapes when there is interspersed land uses that preserve as much as possible of the natural integrity (diverse natural plant communities). This includes riparian areas, wetlands, woodlots, odd areas that aren't farmed, etc. The study also notes that wildlife may utilize the individual habitat components for different parts of their life cycle.



Figure 4. Callery Pear Invasion in Missouri — Photo by Bill McGuire

Most studies regarding monoculture plantings in agricultural settings involve herbaceous species. The addition of short-rotation woody plantings to the equation adds a new dimension to cover types in agricultural settings, although they are logically similar to the first few years of plantation forests. A study by Andre Dhondt et al.³⁴ sheds light on bird species richness in monoculture short-rotation willow and poplar (coppiced at 3-5 year intervals) that reported bird species use similar to what could be expected in open-habitat and woodland settings (abandoned fields, second-growth forests, and regenerating clear cuts). The study concludes that short-rotation willow or poplar plantations provide habitat for bird species that rely on early successional habitats. The study offers the thought that landscapes with large blocks of such plantations would maintain a diverse bird community, but that also may not always be the case. This is because the study appears focused on the presence of individual species and nesting and nest success within the short-rotation woody plantations during the period April through September. An important consideration is to what extent other cover types on the landscape helped meet the needs of the bird species — nor did the study seem to address bird use during the fall through the early spring.

However, even more important is the risk in assuming that a higher diversity of bird species in short-rotation woody plantations is always a good thing and the risk of assuming that the results of this study apply to all agricultural settings. The prairie regions of the nation provide a premier example. A report by Douglas H. Johnson³⁵ illuminates the extensive loss of tallgrass prairie (99% in many states) and mid-grass prairie (70-80% loss) and verifies that grasslands invaded by woody vegetation can contain more species than those that lack woody encroachment. But, the species associated with grasslands with woody vegetation are usually generalist species that have habitat elsewhere and are not in decline. Prairie bird species are more specialized and require open grasslands. Woody vegetation fragments grassland habitat; deters some species from using the area; puts prairie species at increased risk of predation by raptors and other predators; and attracts generalist species that then compete with prairie species that are in decline.

Regarding monocultures, it is one thing to replace a monoculture with another monoculture — habitat for wildlife could increase if the replacement monoculture introduces habitat that is in short supply on the landscape and fits the ecosystem (use of woody materials like short rotation willow on prairie landscapes could further fragment habitat to the detriment of prairie wildlife species). It is quite another, and counter to wildlife conservation, when monoculture crops replace native and ecologically site-appropriate habitat. This is the case even when the ecosystem is already diminished because even diminished ecosystems are still more diverse than monocultures and usually have potential for restoration for at least some of their lost functions and values.

Management that Diminishes Habitat

There are implications regarding how lands are managed to produce biomass whether as a byproduct of management (i.e. forest residue) or as the primary product from the land. D. Todd Jones-Farrand et al.³⁶ provides an extensive literature review that explores the wildlife benefits of perennial cover versus annual cropping. Management of perennial cover in ways that benefit wildlife is mostly about minimizing disturbance during the nesting season, with particular attention to protecting nests during the primary part of the nesting season. Maximizing plant diversity increases food and cover options for wildlife and allows a greater variety of wildlife to use the site since a variety of plants provides options for wildlife and the insects on which wildlife feed (particularly the young) as well as structure of the vegetation within the field (plants of differing height and growth patterns). Residual (often from regrowth after harvest in the latter part of the growing season) is also important to provide cover for wildlife during the cold winter months and residual cover for nest initiation in the spring before grasses begin their growth. It is important to note that individual species respond differently to each stage of succession and some like more open ground while others prefer dense cover. The study reports that a wider variety of species will be supported through a mosaic of grassland successional stages and that uniform management applied on a landscape reduces the value for wildlife.

Management of perennial herbaceous plantings for biomass will dictate the value and risk to wildlife. On one hand, harvest pressure for biomass is expected to be at the end or after the growing season but before green-up the following spring. This avoids disturbance to ground nesting wildlife and their broods as they grow and develop. However, harvest at the end of the growing season could leave wildlife with no residual cover during the winter or for early nest initiation in the spring. In addition, biomass plantings are typically intended to be established and managed to maximize stem density and biomass yield. The density may deter wildlife use at ground level, which is essential for nesting and ability of wildlife young to forage for food. Harvest timing that produces a lack of winter or early spring cover, stand density that precludes wildlife use, and lack of plant diversity and structural diversity are the risks of perennial biomass plantings to wildlife.

Ecologically site-appropriate native forest is defined in this report as forest consisting of plant and animal species richness, composition, and structure (ground cover, understory, and canopy) consistent with the ecological classification of the

forest type in which the specific forest tract is located. The greatest risk to native, ecologically site-appropriate forest is conversion, whether it happens suddenly (i.e. clearing and converting to cropland or grassland or plantation forest) or gradually through management that diminishes diversity and displaces normal and expected functions of forest ecosystems. The DOE *U.S. Billion-Ton Update* speaks to this in reporting that existing research indicates that crops of perennial woody species cannot equal natural forests.³⁷

A national stakeholder group in 2009 identified several troubling trends pertaining to the nation's forest land. Decline in forest health was one of these trends.³⁸ Management is described as the means of restoring forest health in the USDA Forest Service Strategic Plan for FY2007-2012.³⁹ The Forest Service Strategic Plan illuminates the importance and role of management in association with objectives listed under Goal 1 (Restore, Sustain, and Enhance the Nation's Forests and Grasslands) of the Strategic Plan and some of these are: "restore fire-adapted ecosystems that are (1) moved toward desired conditions and (2) maintained in desired condition"; "acres restored and/or protected from invasive species"; and, "acres needing reforestation or timber stand improvement." The nation's forests are very diverse and the various successional stages within each forest type often provide for different species of wildlife.⁴⁰ Management of ecologically site-appropriate native forest is best tailored to the forest type and site, providing best for the needs of the wildlife that rely on such habitats.

Plantation forests occupy large tracts of land in some parts of the U.S. — particularly in the Southeast. A report by Robert D. Perlack et al., prepared by the Oak Ridge National Laboratory for the DOE,⁴¹ describes ways that wildlife needs can be met by matching trees to woodland areas and grasses to prairie areas and managing forests in ways that provide wildlife pathways and habitat as well as reduce forest fragmentation. The report findings go on to indicate that extensive, monoculture biomass plantations can be counter to biodiversity when native habitats are displaced. Plantation forests established on cropland/grassland that were formerly forest, can reduce forest fragmentation and benefit biodiversity — particularly when tree species selection is done to best fit the original forest ecosystem.

The bioenergy risk of management to fish, wildlife, and their habitats is greatest when management leads to diminishment or gradual conversion of ecologically site-appropriate native habitat as well as management of plantings of dissimilar plantings than the cover they replace to the native ecosystem in which the land is located.

Decline in Water Quality/Quantity

In a country as large as the U.S., flooding often occurs while drought persists elsewhere. Flood and drought come and go; they are the boom and bust of the water cycle. However, water availability (and its' dependability) is becoming a key issue. A 2009 article⁴² indicates that there is good news in that the efficiency of water use is getting better in a national sense, but demand on water resources is increasing in parts of the U.S. due to population growth. As a result, water resources continue to be strained. Examples cited in the article are: Too much of the Colorado River has substantially reduced flow; too much use and contamination put the Ogallala aquifer (that supplies much of the Great Plains) at risk; and, growing water conflicts in the Southeastern states. An article in Science Daily⁴³ reports on a study that climate change could exacerbate water shortages in one out of three U.S. counties — particularly in states in the Southern, Southwestern, and Southern Great Plains areas.

Water availability is critically important to all citizens, industries, and the economy. Water quality is an important aspect of water resources, particularly when the water is used for human consumption. Fertilizer, pesticides, and herbicides used in agriculture find their way into water and affect quality. Information from the EPA⁴⁴ indicates non-point source pollution from agriculture is the leading cause of impairment to surveyed rivers and lakes and a major contributor to impairment of estuaries, wetlands degradation, and contamination of ground water. A 2008 report by The Heinz Center⁴⁵ indicates that when tested for contaminants, human health benchmarks were exceeded in a fifth of stream samples and one-third of wells while benchmarks for aquatic life were exceeded in half of streams tested nationwide.

Reed Noss, et al.⁴⁶ reported that 81% of fish communities in the U.S. were in diminished condition. The National Oceanic and Atmospheric Administration (NOAA) address the danger of hypoxia to aquatic life. Hypoxia refers to a cycle in which too many nutrients in water (such as excess fertilizer in runoff from agricultural lands) lead to depletion of dissolved oxygen to a level that cannot sustain aquatic life. The dead zone in the Gulf of Mexico is a premier example that affects sustainability of a major ecosystem as well as seafood availability and aspects of the economy that go to commercial and recreational fishing and other outdoor pursuits.

As previously discussed, the advent of bioenergy feedstock production includes the potential need to convert up to 49 million acres of pasture land plus redirection of 30 million acres of cropland to biomass crops. The bulk of these plantings

would most likely occur in the Midwest (including the Northern Great Plains), Southeast, Northeast, and far West. The species of plants selected for biomass plantings and how they are managed will affect water quantity and quality, particularly in the Southwestern and Southeastern U.S. where water quantity issues are escalating and in the central part of the country where nutrients in agricultural runoff and groundwater are already important resource concerns.

Irrigated biomass crops or biomass crops that use more water than the crops or other cover they replace could strain water resources for people and aquatic life. Similarly, biomass crops that require fertilizer or herbicides/pesticides (as is expected of many species under consideration) could lead to further diminishment of already degraded aquatic systems. These are two of the three key risks of bioenergy production to aquatic species. The third risk, as discussed earlier, is through the use of genetically modified organisms that cannot be contained, escape into the wild, and displace native aquatic species either directly or indirectly by interrupting the food chain. Introduced or genetically modified strains of algae, duckweed, and cyanobacteria could be particularly detrimental if they cannot be fully contained in production settings.



BIOENERGY PROVISIONS in the 2008 Farm Bill

THE FOOD, CONSERVATION AND ENERGY ACT of 2008 (2008 Farm Bill)⁴⁷ was created by the 110th Congress and was signed into law by the President on June 18, 2008. The 2008 Farm Bill contains 15 Titles and no bioenergy provisions were found in the following: Title III (Trade); Title IV (Nutrition); Title V (Credit); Title X (Horticulture and Organic Agriculture); Title XII (Crop Insurance and Agricultural Disaster Assistance); Title XIII (Commodity Futures); and, Title XIV (Miscellaneous).

Eight Titles were found to contain bioenergy provisions and these are: Title I (Commodity Programs); Title II (Conservation); Title VI (Rural Development); Title VII (Research and Related Matters); Title VIII (Forestry); Title IX (Energy); Title XI (Livestock); and, Title XV (Trade and Tax Provisions). The bioenergy provisions of some Titles were limited but extensive in others. The Joint Explanatory Statement of the Committee of Conference,⁴⁸ rule-making, environmental assessments, programmatic, and other documents were reviewed to identify the roots of current bioenergy policy and initiatives as well as to identify gaps and future needs in the policy arena. The bioenergy provisions of each Title are identified and discussed as follows:

Title I – Commodity Programs

Two references to bioenergy were found. One is in **Section 1614 (Storage Facility Loans)** that enables low interest storage loans to agricultural producers for agricultural commodities including biomass. This has little implication for fish and wildlife resources.

The other reference is in **Section 1401 (Sugar Program)**, which includes provisions to stabilize sugar production and price. This Section directs the Secretary of Agriculture to avoid forfeiture of excess sugar to the Commodity Credit Corporation by providing a commercial use for crops (bioenergy) when producers are asked to reduce the amount of sugar beets or sugarcane they have already planted. Section 1401 appears intended as a common-sense means of ensuring that sugar supply and price stay reasonable in a way that saves taxpayer funds and allows excess sugar to be marketed for energy purposes. The effect of this provision on fish and wildlife resources should be minimal as long as the focus is to manage sugar supply and price associated with human consumption. Risk to fish and wildlife habitats could develop if financial aspects of this provision, combined with other provisions (i.e. crop insurance, bioenergy incentives and subsidies, etc.) become financially attractive enough to encourage producers to convert already diminished native prairie and other remaining native ecosystems to sugar beets or sugar cane in excess of sugar consumption targets.

RECOMMENDATION: The geographic scope and extent of sugar program acreage should be monitored in regard to developing land conversion trends (i.e. ecosystems such as native sod) that might develop as an unintended consequence of sugar supply/price stabilization efforts.

The risks of developing and implementing bioenergy technology and production do not have to lead to diminishment of native and ecologically site-appropriate biodiversity.

Title II – Conservation

Section 2108 (Managed Haying, Grazing, or other Commercial Use of Forage on Enrolled Land and Installation of Wind Turbines) of Subtitle B (Conservation Reserve Program – CRP) contains the sole bioenergy provision in the Conservation Title. This provision has roots in the 2002 Farm Bill when biomass harvest was added to the program. The *Joint Explanatory Statement of the Committee of Conference* (2002 Farm Bill) states that “the Secretary shall ensure that all precautions are taken to protect against overgrazing or haying or use of land during a period that may adversely impact wildlife habitat or wildlife directly, especially ensuring that activities take place after nesting season is completed.” This direction suggests that wildlife is an important program objective and should not be adversely impacted by such activity (“especially” but not exclusively during the nesting season). The Committee of Conference further indicated that: “USDA, with the State Technical Committees, will develop appropriate vegetation management requirements including appropriate harvesting and grazing periods” and “in determining the appropriate use of CRP lands for haying and grazing (including the frequency and time period), the Secretary shall require the State Technical Committees to consider the type of grass (shrubs, forbs, or bushes) on the land as well as the local ecosystem.”

A Programmatic Environmental Impact Statement (PEIS) was prepared for CRP in 2003. This evaluated the environmental consequences of implementing the 2002 Farm Bill provisions of CRP. The PEIS addressed the impact of haying on wildlife habitat and stated that “haying and grazing may destroy nesting habitat and cover for waterfowl, songbirds, and upland game birds; kill chicks in the nest; and force birds to locate to other suitable habitat.” The PEIS addressed direct managed harvest impact on wildlife and nesting during the growing season in the context of traditional livestock forage production.

In and about the time of the 2002 Farm Bill, six biomass pilot projects were authorized to explore the concept of harvesting biomass from lands enrolled in CRP: Illinois – switchgrass; Iowa – warm and cool season grasses; Minnesota – hybrid poplar; New York – willow; Oklahoma – Old World bluestem and native grasses; and Pennsylvania – switchgrass.

Section 2108 of the 2008 Farm Bill added grazing as a means of controlling invasive species; reaffirmed the purposes of CRP; and restated authorization for managed harvest for biomass by directing as follows in part (a) to “not conduct any harvesting or grazing, nor otherwise make commercial use of the forage, on land that is subject to the contract, nor adopt any similar practice specified in the contract by the Secretary as a practice that would tend to defeat the purposes of the contract except that the Secretary may permit, consistent with the conservation of soil, water quality, and wildlife habitat (including habitat during nesting seasons for birds in the area) – (A) managed harvesting (including the managed harvesting of biomass), except that in permitting managed harvesting, the Secretary, in coordination with the State Technical Committee – (i) shall develop appropriate vegetation management requirements; and (ii) shall identify periods during which managed harvesting may be conducted.”

A Supplemental Environmental Impact Statement (SEIS) was prepared as a supplement to the PEIS and addressed changes to CRP as a result of the 2008 Farm Bill. The SEIS specifically mentions managed harvest that includes biomass and states “these activities must not defeat the purpose of CRP contract and must be consistent with the conservation of soil, water quality, and wildlife habitat (including habitat during nesting season for birds).” The SEIS also indicates in Alternative 1, the Preferred Alternative, that changes to determination of the primary nesting season, harvest timing, and length and frequency would require individual NEPA analysis by the state requesting change. The SEIS (2.6.6.1 of the Preferred Alternative) makes a distinction between managed haying for livestock feeding and biomass harvest for uses other than livestock food. However, the impact on wildlife and habitat of managed harvest for forage versus managed harvest for biomass does not appear to be addressed.



Photo by Larry Kruckenberg

A CRP Record of Decision (CRP ROD) was issued on July 22, 2010 regarding decisions concerning selection of the Preferred Alternative.

The CRP Interim Rule was published on July 28, 2010 and it reaffirms that activities allowed on CRP lands should not defeat the conservation purposes of the program and that permissive uses “must be consistent with the conservation of soil, water quality, and wildlife habitat, including habitat during nesting season for birds in the area.” As in the

legislation, conservation of wildlife habitat is conveyed as important in a broad sense with particular but not exclusive attention to conserving habitat during nesting season. The Rule goes on to direct that biomass harvesting must be consistent with the conservation purposes of the contract and that vegetation management requirements should include timing, frequency and duration compatible with conservation purposes.

In converting direction in the CRP Interim Rule to program operation, the Farm Service Agency (FSA) uses a form in Exhibit 48 (Par. 664, 680, 716) Terms and Conditions for Managed Haying as a way that CRP participants can request authorization for managed haying (including for biomass). They must agree to re-establish any destroyed cover, remove all hay in a timely manner, and not hay and graze the same acres. FSA guidance (at the time of development of this report – fall of 2011) in 2-CRP (Rev. 5) Amendment 1 identifies certain lands as ineligible (useful life easements, land within 120 feet of a stream or permanent water for certain practices) and defines the frequency (no more frequently than one out of three years) and requires consultation with the State Technical Committee to set the dates for primary nesting season and for establishing the frequency of the managed harvesting period. The guidance on page 19-3 goes on to state that “the harvesting plan must be site specific and reflect the local wildlife needs and concerns.”

CRP was created by the Food Security Act of 1985 (1985 Farm Bill) and it has been a centerpiece of Farm Bill conservation progress since inception. It is notable to remember that CRP was created in large part to address conservation issues brought about by food and energy challenges of the 1970s. CRP has accomplished tremendous conservation good as soil, water, and wildlife have benefited. In addition, in most years, CRP has provided a source of emergency forage for livestock producers during severe weather events such as drought. The enrollment authority of CRP was 45 million acres under the 1985 Farm Bill and has been significantly reduced over the years to the current 32 million acre level. CRP has been able to perform well for conservation or as a strategic forage reserve for livestock producers (i.e. emergency use) because it has continually been targeted and adjusted to maximize benefits among all purposes.

However, production pressures and natural resource challenges are escalating and there is a limit to how much CRP can shrink and still provide the benefits that society wants and expects. In addition, managed harvest for biomass is a relatively new permissive use that exerts significantly different pressures on CRP wildlife habitat than managed harvest for livestock forage. Specifically, producers prefer to harvest livestock forage during the growing season when forage quality and palatability to livestock is best. This exerts pressure on wildlife nesting and brood rearing success, but typically allows time for grass to regrow and provide residual for winter cover and nest initiation in the early spring. By contrast, biomass harvest of herbaceous perennials is typically done at or after the end of growing season when vegetation has matured and can be cut short to maximize biomass yield; this can eliminate winter and spring cover for early nest initiation. The differing effect of these harvest pressures on wildlife and habitat does not appear to be addressed in the PEIS, SEIS, or other USDA documents that were reviewed. This appears an important discrepancy between direction provided by Congress and how CRP is implemented. If unaddressed, significant negative impact on wildlife could result.

RECOMMENDATIONS:

CRP biomass harvest guidelines are needed to address the significantly different harvest timing/methods associated with biomass versus livestock forage harvest.

CRP should maintain a conservation focus with managed harvest, including for biomass, as compatible uses that are permitted only if conservation purposes are maintained.

The importance of emergency use provisions of CRP (and value to livestock producers) should be recognized as an important benefit of the program.

Congress and USDA leadership should be encouraged to consider the extent that CRP cover delivers soil, water, and wildlife benefits while being flexible enough to be used for bioenergy and livestock forage as national needs and demands change.

Title VI - Rural Development

Three Rural Development Subtitles reference bioenergy. The first is **Subtitle A (Consolidated Farm and Rural Development Act)**, which includes three sections that amend the Consolidated Farm and Rural Development Act in various ways. **Section 6016 (Appropriate Technology Transfer for Rural Areas)** provides support to agricultural producers by establishing a technology transfer program. This program is to help rural areas with developing technology. Diversification of operations that includes energy crops and energy generation is a goal. Another goal is to “expand markets for agricultural commodities produced by the producers using practices that enhance the environment, natural resource base, and quality of life.”

Section 6026 (Northern Great Plains Regional Authority) adds renewable energy development and transmission as one of the economic issues to be addressed by the Northern Great Plains Regional Authority which provides assistance to states in developing economic plans and funding community development grants.

RECOMMENDATION: State fish and wildlife agencies should consider establishing communication with the Northern Great Plains Authority and provide periodic updates regarding the status of fish and wildlife resources in relation to bioenergy (Midwest Association of Fish and Wildlife Agencies suggested).

Section 6028 (Rural Collaborative Investment Program) pertains to establishment and operation of Regional Rural Investment Boards. A Board is to be made up of residents of the region that are “broadly representative of diverse public, non-profit and private sector interests in investment in the region.” Government (local, multi-jurisdictional, or state level) and (among others), agriculture, natural resource, and other related industries are to be included. This Section includes authority and funding for a Regional Innovation Grants Program and Boards can use the grants “to enhance the value-added production, marketing, and use of agriculture and natural resources within the region, including activities relating to renewable and alternative energy production and usage.” State fish and wildlife agencies have responsibility for fish and wildlife resources within their respective states and (by way of population monitoring, research and management efforts) have the best information on these resources at the local and regional levels. The USFWS has public trust responsibilities for migratory and species that are federally listed as threatened or endangered. It makes sense for state fish and wildlife agencies and the USFWS to be involved in these regional processes if bioenergy is to be environmentally sustainable.

RECOMMENDATIONS:

Rural Regional Investment Boards should include State Fish and Wildlife Agency (Regional Associations – NEAFWA, MAFWA, SEAFWA, and WAFWA) and U.S. Fish and Wildlife Service representation.

Rural Regional Investment Boards should include outdoor industry representation.

Subtitle B (Rural Electrification Act of 1936) amends the Rural Electrification Act of 1936 to define “renewable energy” to include solar, wind, hydropower, biomass, or geothermal forms of energy. Clarification regarding loans is provided to extend eligibility to generation of electricity from renewable sources and resale to rural and non-rural residents.

Subtitle C (Miscellaneous) includes one Section (Study of Rural Transportation Issues) that directs the Secretary of Agriculture and Secretary of Transportation to jointly study transportation issues associated with the movement of agricultural products that include renewable fuels and domestically produced generation of electricity for rural parts of the U.S.

RECOMMENDATION: A study is needed to assess the potential unintended introduction of invasive plant species (harvested to eliminate populations) and aggressive non-native species (grown for energy crops) to roadsides, native ecosystems, and other lands during transportation operations. This study should include development of Best Management Practices to avoid “escape” of these plants as well as address escapes that do occur.

The Rural Development Title of the Farm Bill has a strong role in bioenergy development and application. Bioenergy, in part, is viewed as a way to stimulate jobs in rural parts of the U.S. and help rural areas and the nation to be less dependent on imported energy. This Title contains key entities such as the Northern Great Plains Authority and Rural Regional Investment Boards and provides them with financial tools for the purpose of planning and stimulating renewable energy development. Fish and wildlife are resources of national interest and are particularly important to rural economies where hunting, fishing, and outdoor recreation creates many jobs and stimulates the economy. It makes sense for the wildlife community and/or related industries to have on-going dialog with other interest groups in processes where the Northern Great Plains Authority and Rural Regional Investment Boards consider bioenergy. It is important to foster increased understanding of fish and wildlife resources and associated industries critical to conservation of natural resources and sustainability of rural economies.



Kudzu invasion – (photo by Bill McGuire)

Title VII – Research and Related Matters

Renewable energy provisions increased notably in this Title versus the 2002 Farm Bill. There are several provisions of Subtitle A -National Agricultural Research, Extension, and Teaching Policy Act of 1977 that relate to bioenergy. **Section 7101 (Definitions)** adds renewable energy. **Section 7102 (National Agriculture Research, Extension, Education, and Economics Advisory Board - NAREEEAB)** advises the Secretary of Agriculture and land grant colleges and universities regarding highest priorities and policies for food and agriculture research. Members of the NAREEEAB are intended to include broad representation from agriculture and aquaculture and forestry are included as are a national conservation or natural resource groups. The fish and wildlife community or industry is not specifically included although rural agricultural lands are strongly tied to outdoor recreation economies in many parts of the U.S. and agriculture producers sometimes derive income from these activities.

RECOMMENDATION: The NAAREEEAB should include state fish and wildlife agency (AFWA suggested) and fish and wildlife recreation industry representation to help ensure that priority fish and wildlife resources are integrated and addressed in research endeavors.

Section 7104 (Renewable Energy Committee – REC) establishes the REC to study research extension and economics programs in the context of renewable energy. The REC is to consult with the Biomass Research and Development Technical Committee, which is made up of industry, academia, and non-profit groups to advise the Secretaries of Energy and Agriculture as well as to facilitate partnership and consultation among diverse groups that include state government.

RECOMMENDATION: The REC should include state fish and wildlife agency (AFWA suggested) representation to include consideration of fish and wildlife needs as well as ways to produce bioenergy that sustain fish, wildlife, and their native habitats.

Sections 7110 (Grants for Research on Production and Marketing of Alcohols and Industrial Hydrocarbons from Agricultural Commodities and Forest Products) and **7129 (Hispanic-Serving Colleges and Universities)** establish competitive grant programs that can accommodate bioenergy studies along with other aspects of agricultural production. **Section 7137 (New Era Rural Technology Program)** enables grants to develop technology, applied research, and training necessary to foster an agriculture-based renewable energy workforce.

Subtitle B – Food, Agriculture, Conservation, and Trade Act of 1990 amends several Sections to incorporate and advance bioenergy in regard to the role of research. **Section 7204 (High-Priority Research and Extension Areas)** provides grants for the study of biochar, **Section 7205 (Nutrient Management Research and Extension Initiative)** provides grants for innovative uses of livestock waste, including for energy.

Section 7207 (Agricultural, Bioenergy Feedstock and Energy Efficiency Research and Extension Initiative) establishes an initiative of the same name to enhance production of biomass crops and energy efficiency of agricultural operations. Energy crop species, plant genetics and breeding, best management practices, harvesting, collection, and other aspects of bioenergy production are included. Section 7207, in particular, has considerable potential to include consideration of fish and wildlife resources particularly in plant species selection and assessment of best management practices and harvest/collection methods.

RECOMMENDATION: Communicate routinely (AFWA Biofuels Working Group suggested) with the Agricultural, Bioenergy Feedstock and Energy Efficiency Research and Extension Initiative to raise awareness of fish and wildlife issues related to biomass production and how fish and wildlife needs can be integrated in best management practices.

Subtitle D – Other Laws contains only one bioenergy provision but it is very important to the fish/wildlife and bioenergy connection. **Section 7406 (Agriculture and Food Research Initiative - NIFA)** which establishes the Agriculture and Food Research Initiative that provides competitive grants in applied research, extension and education (food and agriculture sciences). The areas of study are plant genomes (including improved production and disease resistant traits), renewable energy, forestry, and biodiversity. Authorized annual appropriations (2008 through 2012) are \$700 million.

RECOMMENDATION: Continue annual attention (AFWA Biofuels Working Group suggested) to the Agriculture and Food Research Initiative (AFRI) grant process and submission of research proposals that help answer key questions about biomass production, harvest collection, and fish and wildlife and native ecosystem priorities.

RECOMMENDATION: AFRI should be encouraged to develop Best Management Practices that guard against “escape” of invasive species (harvested for biomass in eradication efforts) and for aggressive and exotic species planted as energy crops.

Subtitle E – Miscellaneous pertains to reorganization at the Undersecretary level to include a Division Chief to lead in the area of renewable energy, natural resources, and environment to clearly connect these interrelated areas in a single supervisory chain.

RECOMMENDATION: AFWA should consider establishing a communication link with the Division Chief for renewable energy, natural resources, and environment and provide periodic updates on bioenergy issues that relate to fish and wildlife resources (same advice for the USFWS).

Section 7526 (Sun Grant Program) is important to how well biomass feedstock production incorporates fish and wildlife needs. This Section establishes five (5) Sun Grant Centers (North Central – Cornell University; South Central – Oklahoma State University; Western – Oregon State University; Southeast – University of Tennessee; and North Central – South Dakota State University) and 1 Sub-Center (University of Hawaii). The Sun Grant Program addresses national energy security through development, distribution, and implementation of bioenergy technologies. Each Sun Center was directed to submit a plan regarding how they would address research priorities. Funding for the Sun Grant Initiative (authorized in the 2002 Farm Bill) is through the U.S. Department of Transportation as well as DOE and USDA. An expected outcome is to stimulate rural economic development and contribute to the vitality of farming communities through production of bio-based renewable energy feedstock. The mission includes to “promote environmentally sustainable and diversified production opportunities for agricultural and forestry resources.” There is a National Sun Grant Association that is comprised of representatives of each Sun Center and coordinates activities on a national level. The Sun Grant Centers administer grant funding competitively and the Regional Biomass Feedstock Partnership is part of this which includes 96 scientists from universities and the USDA ARS (halfway through a six year project to do 110 field trials in 39 states).

RECOMMENDATION: State fish and wildlife agencies should consider establishing on-going communication with each of the Sun Centers to convey a regional sense of bioenergy and the interface with fish and wildlife resources.

This Title plays a very important role in the identification, development, and deployment of technology related to bioenergy. Research and extension are well connected and respected by agriculture producers, industry, and policy makers and leaders at all levels of government. The groundwork produced by way of initiatives and efforts authorized in this Title has and will continue to be the foundation on which bioenergy production and natural resource conservation resides. However, consideration of fish and wildlife resources and their habitats does not appear to be integrated. Many species of fish and wildlife depend on habitat on agricultural landscapes and must survive there if they are to survive at all. In addition, many rural economies benefit from hunting, fishing, and other outdoor recreation in addition to agriculture maintaining both is the key to economic and resource sustainability that benefits all citizens. Research and related activities are key drivers in the bioenergy movement, but fish and wildlife needs cannot be adequately integrated with bioenergy research and production unless fish and wildlife interests are at the table. It is very important that state fish and wildlife agencies and the USFWS be involved at this level.

Title VIII – Forestry

Only one reference to bioenergy was found in the Forestry Title, **Section 8001 (National Priorities for Private Forest Conservation)** of Subtitle A (Amendments to Cooperative Forestry Assistance Act of 1978). The provision has the effect of including production of renewable energy as a national private forest conservation priority along with air, water quality, soil conservation, biological diversity, carbon storage, forest products, forestry-related jobs, wildlife, wildlife corridors, wildlife habitat, and recreation.

The addition of renewable energy to the list could be positive or negative to fish and wildlife resources. This is because the logic of characterizing production of renewable energy is not clear. If production of renewable energy (i.e. growing trees to harvest and convert to energy) is conservation then some could interpret growing corn grain as conservation if energy was the intended product. Conservation is most commonly viewed as the wise use of natural resources such as air, soil, water, wildlife, etc. rather than production in and of itself. Production of renewable energy is a good thing just as the production of food is a good thing. However, it seems most logical to consider conservation as how natural resources are treated as each is produced (i.e. do trees grown for energy conserve the soil, water, wildlife, and other resources on the landscape where they are grown). The addition of renewable energy to this aspect of the Cooperative Forestry Assistance Act of 1978 could be benign to fish and wildlife if renewable energy feedstock is derived from forest land in ways that conserve and sustain ecologically site-appropriate native forest. However, production of renewable energy could be

negative to fish and wildlife if this ‘conservation priority’ designation opens the door to conversion of ecologically site-appropriate native forest to plantation forest, short-duration woody crops like willow, or to exotic species, or reduces structural or species diversity or impedes management that would normally maintain the forest ecosystem.

In the context of bioenergy production and this change to the Cooperative Forestry Assistance Act of 1978, it is also important that this legislation houses Forest Stewardship, which is often referenced as the site-specific safeguard for fish and wildlife resources in forest settings (including biomass production). The Forest Stewardship planning process seems to work well in some places but not so well in others. Some of the factors that may contribute to differing views on how well it works are: First, it is not necessary to engage a biologist to address fish and wildlife aspects of the Forest Stewardship plan; second, development of Forest Stewardship plans that address commonly abundant species of wildlife but overlook needs of species that are in decline; third, wildlife species of landowner choice are addressed in ways that do not always address wildlife in need of attention. Clear guidelines and expectations regarding Forest Stewardship plan requirements and involvement of a wildlife biologist in development of plans is a key to Forest Stewardship working well as a tool for the integration of bioenergy production in forest settings for wildlife and biodiversity. Foresters are the experts on growing and managing forests just as biologists are the experts on fish and wildlife that reside on forested landscapes. It does not seem sound technical footing for one to unilaterally replace the expertise of the other.

RECOMMENDATIONS:

State fish and wildlife agencies and the USFWS should consider coordinating with the U.S. Forest Service (USFS) and National Association of State Foresters (NASF) to discuss production of renewable energy in forests and clarify the meaning of designation of renewable energy as a conservation priority.

State fish and wildlife agencies and the USFWS should consider working with USFS and NASF to pursue clarification and/or changes to ensure that Forest Stewardship planning is done in ways that do not convert ecologically site-appropriate native forest, are consistent with the needs of species of concern, and involve a biologist or BMPs prepared by a biologist.

State-wide assessments and strategies for forest resources (Section 8002 of the 2008 Farm Bill) should address biomass potential and related impact on wildlife (at risk forest species as well as those that exhibit declining populations).

Title IX - Energy

The Energy Title contains \$1.1 billion in mandatory funding (FY2008 through FY2012). By contrast, the authorized level in the 2002 Farm Bill was \$800 million (FY2002 through FY2007). Most of the increase is in the Biorefinery Assistance Program (\$600 million higher than in the 2002 Farm Bill).⁴⁹ This Title is a particularly important driver of bioenergy initiatives that have potential to affect fish and wildlife and their habitats that include ecologically site-appropriate native plant communities. The Biomass Crop Assistance Program is of particular importance and is discussed in detail at the end of the Energy Title analysis.

Several sections simply provide definitions, program flexibility, or identify needed studies. **Section 9001 (Definitions)** defines ‘advanced biofuels’ to exclude corn starch but not cellulosic sources. **Section 9010 (Feedstock Flexibility Program for Bioenergy Producers)** authorizes the Secretary of Agriculture to purchase sugar produced for human consumption and use it for biofuels feedstock but only in years when sugar is in excess (sugar program cost containment measure). **Section 9002 (Biofuels Infrastructure Study)** requests that USDA, DOE, DOT and EPA report on infrastructure needs necessary to expand domestic production and distribute biofuels. **Section 9003 (Renewable Fertilizer Study)** requires a report on potential to derive fertilizer from renewable energy sources.



University of Missouri Biofuel Garden (photo by Bill McGuire)

Section 9003 (Biorefinery Assistance) authorizes grants for development, construction, and demonstration of commercial processes to convert renewable biomass to advanced biofuels. The Biorefinery Assistance Program promotes resource conservation and diversifies agricultural and forest products markets and create jobs. Criteria used in awarding grants includes whether applicants establish that they will have a positive impact on resource conservation, public health, and the environment. The quality of selected projects in relation to conservation and the environment will hinge on how well these goals are encouraged when requests for proposal are announced and later ranked in the selection process. Loan guarantees can be up to \$250 million or 80% of project costs. Loan guarantees encourage development of biorefineries as well as the feedstock sources they need. **Section 9004 (Repowering Assistance)** is directed at existing biorefineries to encourage them to convert to renewable energy power sources. **Section 9005 (Bioenergy Program for Advanced Biofuels)** is also directed at biorefineries to stimulate production of advanced biofuels with the emphasis on smaller producers (not more than 5% of funding can go to facilities exceeding 150 million gallons per year).

RECOMMENDATION: State fish and wildlife agencies (AFWA suggested) are encouraged to open a dialog with USDA regarding fish and wildlife aspects of environmental criteria currently used to solicit/select projects and provide constructive recommendations to help integrate fish and wildlife needs.

A program for rural parts of the U.S. is included in **Section 9007 (Rural Energy for America Program - REAP)** that focuses on energy efficiency and support for the use of renewable energy. A combination of grants (up to 25% of cost and 20% of funds must be for grants of \$20,000 or less) and loan guarantees (up to \$25 million) are provided. In essence, this provision provides incentives for qualifying units of government, land-grant institutions, utility companies, and others to increase energy efficiency and make use of renewable forms of energy. This program is rural and grassroots and there is much local potential for renewable energy elements to provide positive or negative impact on fish and wildlife resources. Information (or lack thereof) will be a driver.

RECOMMENDATION: State fish and wildlife agencies are encouraged to develop a fact sheet or other easy to distribute information regarding how rural renewable energy projects can benefit fish and wildlife resources and distribute broadly (preferably via USDA notices of grant opportunities). Follow-up in-state with those awarded grants to provide state-specific information (individual state fish and wildlife agencies).

Section 9008 (Biomass Research and Development) establishes a mechanism for the coordination of policies and procedures to promote biofuel and bio-based product research and development. Importantly, establishment of a Biomass Research and Development Board is included and consists of USDA and DOE Co-chairs, DOI, EPA, National Science Foundation, and Office of Science and Technology. A Biomass Research and Development Technical Committee is also established with members to include representation from the biofuels industry, bio-based products industry, academia, trade associations, environmental or conservation organizations, state government (biofuels or bio-based expertise) and experts in energy, economics, plant biology, agronomy, soil science, and others as invited. Grant, contract, and financial assistance authorities are included for the purpose of advancing biofuels and bio-based products in ways that are sustainable and foster environmental quality (including evaluations of the impact of expanded biofuel production on the environment). This process is likely an important driver of bioenergy efforts and fish and wildlife community involvement and participation will be necessary to raise awareness and integrate priority fish, wildlife, and native ecosystem needs.

RECOMMENDATIONS:

State fish and wildlife agencies (AFWA suggested) should consider on-going dialog with the Biomass Research and Development Board and invite the DOI representative on the Board to meet at least once a year with the AFWA Biofuels Working Group.

State fish and wildlife agencies (AFWA suggested) should consider requesting representation on the Biomass Research and Development Technical Committee.

Section 9012 (Forest Biomass for Energy) requests a USFS study about the use of low-value biomass produced as a byproduct of forest health treatments, hazardous fuel reduction, and other treatments. The study is also to develop processes that would improve the production of trees for renewable energy. The study appears to be about sustainable use of native and ecologically site-appropriate native forest, but may also involve forest systems planted and designed to produce forest biomass. In either scenario, there are fish and wildlife implications and USFS attention to environmental tradeoffs is important.

RECOMMENDATION: State fish and wildlife agencies (AFWA suggested) should consider requesting to be included in USFS review of the draft document when available.

Section 9011 (Biomass Crop Assistance Program) establishes the Biomass Crop Assistance Program (BCAP), which is designed to help agricultural producers establish biomass production capacity sufficient to supply biomass conversion facilities. Project selection is to be competitive and project areas are to have specific boundaries that include contract arrangements between biomass producers and biomass conversion facilities. Title I crops, food waste, yard waste, and algae are excluded as are “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.” Applications must submit a variety of information, including a description of eligible lands, eligible crops, anticipated economic impact, harvest and post-harvest practices, and impact on soil, water, and related resources (wildlife included). Biomass producer commitments must include implementation of a conservation plan or forest stewardship plan (or equivalent), and be a contract of up to five years for annual or perennial crops or 15 years for woody biomass. Crop establishment cost-share of up to 75% and annual payments (to offset lost income while the crop is developing) are provided. Payments for collection, transportation, and storage are also allowed (\$1 per each \$1 per ton provided by the facility to the producer, not to exceed \$45 per ton for two years).

Review of the Joint Explanatory Statement of the Committee of Conference for the 2008 Farm Bill garnered the communication that contracts include resource conservation requirements and that wildlife-related resource concerns are meant to be included in the phrase ‘soil, water and related resources.’ In addition, and importantly, is reference to private forest land that direct the Secretary of Agriculture, prior to contracting with the owner of non-industrial private forest land, to encourage maintenance of native forests (including late successional) and discourage conversion of native forest to non-forest use.

A Programmatic Environmental Impact Statement for BCAP was issued by USDA in June of 2010. The PEIS recognizes that agricultural activity has diminished biodiversity on agricultural landscapes and recognizes that some species need larger blocks of habitat than others. However, the tradeoffs associated with diversity among patch types versus importance of diversity within cover types is not well described and leaves room for interpretation. Another issue is direct and indirect land conversion which the PEIS notes could be of significant impact to vegetation and wildlife, but does not appear addressed in a more specific way. The mitigation section of the PEIS (6.1.1 – Biological Resources) indicates that negative impact to wildlife will be reduced by way of the requirement that each program participant have a BCAP Conservation Plan or Forest Stewardship Plan or an equivalent. This leaves attention to wildlife needs largely to chance because while the NRCS Practice Standards used for bioenergy crop establishment and management/harvest can include wildlife considerations, attention to wildlife is not required. Forest Stewardship Plans do require attention to fish and wildlife, but leave the extent and species of attention to participant interest rather than requiring thought be given to the species actually in need of attention. In either process, wildlife species and habitats of conservation concern can get overlooked or purposely ignored. This is not the case for soil and water conservation aspects of either planning process, which must be addressed.

The BCAP Rule (Oct 27, 2010) reconfirms that the program is to assist owners and operators of agricultural and forest land with establishment and production of eligible crops in selected project areas for conversion to bioenergy as well as collection, harvest, storage, and transportation of biomass. The Rule Summary goes on to say that in 2008 Congress revised the Renewable Fuel Standard (RFS) by requiring 36 billion gallons of advanced biofuels in the national fuel pool by 2022. BCAP is expected to boost cellulosic ethanol production capacity in order to help meet the RFS mandate by providing risk-mitigation to landowners converting agricultural crops to bioenergy crops.

The background portion of the BCAP Rule explains that although BCAP is a crop cultivation program, wildlife and conservation protection are also important parts of the program. BCAP requires a conservation plan, forest stewardship plan, or equivalent plan. The presumption is that wildlife will be adequately addressed by way of these planning processes. In actuality, and as previously described, wildlife may not be addressed at all in conservation planning and the species in need of attention can be overlooked in Forest Stewardship plans. Either of these planning processes can be done without biologist expertise and in the absence of best management practices for species of conservation need in the area.

The Rule establishes that BCAP pays \$1 for each \$1 (per dry ton) paid by the biomass conversion facility up to \$45/dry ton with no differentiation among biomass types. The payment plan favors low cost crops that maximize yields but increases the potential for environmental harm by favoring selection of exotic and aggressive species that can negatively impact wildlife habitat and water quantity, water quality, and other resources. Although Title I crops like corn grain do not qualify for BCAP payments, corn cobs and corn stover do qualify when collected directly from the cropland. Further, the Rule states that establishment payments can be made for conversion of agricultural lands or non-industrial forest lands to an eligible crop and that these producers may also be eligible for annual payments. This appears to leave ecologically site-appropriate native forest like longleaf pine or oak-hickory forest in the southeast at-risk of diminishment or conversion. Loss of ecologically site-appropriate native forest is a loss to biodiversity. Extending the full array of BCAP payments to projects that convert ecologically site-appropriate native forest (including to other forest

types) is incentive to do so and seems counter to verbiage Congress provided in the Joint Explanatory Statement of the Committee of Conference. Exclusion of native sod is covered in the BCAP Rule and this should work as a safeguard as long as the date-certain (date of enactment of the 2008 Farm Bill) does not change to the date of enactment of the next Farm Bill. If that happens then it appears that producers that converted prairie to corn or other crops for a couple of years in the 2008 Farm Bill period could then enroll their land in BCAP and circumvent the prairie conversion safeguard.

The BCAP Rule discusses the issue of incorporating wildlife needs into BCAP projects, but the assessment communicated is that wildlife goals are compatible with BCAP but BCAP is not a wildlife or conservation program and is, instead, to promote new biomass crops. This interpretation leaves wildlife to chance and seems contrary to communication by Congress in the Joint Statement of the Committee of Conference for the 2008 Farm Bill (that indicates that wildlife is to be addressed). The Rule continues to suggest that actively managed energy crops confer significant wildlife benefits and that conservation planning will mitigate adverse effects. However, again, fish and wildlife needs are often left to chance in conservation planning (considered, but attention not required) and the value of energy crops to fish/wildlife resources does not compare favorably to ecologically site-appropriate native plant communities or many kinds of diverse plantings that are managed for other agricultural purposes.

Also in the BCAP Rule is an option for the Soil and Water Conservation District (SWCD) to waive the right to review the conservation plan and if they do, then Commodity Credit Corporation (CCC) can waive that action as well and the farmer or rancher could simply enroll. In situations where the SWCD declines to review conservation plans, wildlife and other resource needs are doubly left to chance. SWCD review has been a cornerstone of agriculture conservation for many years and it seems unwise to allow options to circumvent this process, especially considering bioenergy is a new arena and there is a need to learn and improve.

In May, 2011, USDA issued the final version of the BCAP Environmental Assessment (EA) for the Proposed BCAP Giant Miscanthus (*Miscanthus X giganteus*) Establishment and Production in Arkansas, Missouri, Ohio, and Pennsylvania. The EA concluded that giant miscanthus should not be considered invasive due to its sterility (triploid hybrid) in field trials and low rate of vegetative spread. The EA indicates that giant miscanthus was produced by crossing *Miscanthus sinensis* with *Miscanthus sacchariflorus* (both native to southeast Asia). The EA reports that *Miscanthus sinensis* is considered to be an invasive species in the U.S. and cites studies that indicate the species has potential to be invasive by way of ability to reproduce by re-sprouting underground and/or rhizome spread, which can be transported many ways (erosion, flooding, etc.). One study cited suggests careful monitoring for changes in fertility. The EA indicates that the required mitigation and monitoring plans would provide spread control mechanisms like buffers and field edge that would also address wildlife needs. However, the EA provides border criteria of 25 feet in width and exempts borders adjacent to cropland or actively managed pasture on the same ownership, and when borders are established, they can be planted to row crop or grasses or left in existing cover or kept clear by disking or with herbicide. In addition, there are indications that mowing may be required of field borders. There is little to nothing in these criteria for wildlife. Although control of giant miscanthus may be easier if it spreads from one field to another and if caught soon, the EA does not adequately address how giant miscanthus control will be accomplished if miscanthus moves (via erosion, rhizomes from contaminated equipment, etc.) to native habitat or unmanaged fields and is not noticed until after the plant is well-established.

It is notable to mention a document produced by NRCS⁵⁰ in which giant miscanthus as a biomass crop is discussed. A caution is provided regarding reported rate of spread as being slow and an Illinois experience is cited in which spread rate was 1.3 to 3.9 feet per year. A caution was also included in the report regarding production of fertile seeds and cited Townsend's cordgrass as an example of a sterile hybrid that began to produce viable seed after about two decades. The NRCS report indicates that giant miscanthus is not always easy to eradicate once it is established. It is difficult to understand how the EA justifies the use of giant miscanthus in the first place (given what seems specific Congressional direction regarding potentially invasive species) and remains in use in view of the NRCS report findings. The use of giant miscanthus needs reconsideration.

The BCAP Record of Decision (ROD) was issued Oct. 27, 2010 and states that Alternative #2 in the Draft PEIS was to be implemented. Explanation indicated that Alternative #2 was selected as the most consistent with the intent and language of the 2008 Farm Bill, while being environmentally responsible and reasonable to implement, and that would not have significant negative impacts. However, the ROD verbiage is consistent with conversion of ecologically site-appropriate native forest to short-duration woody biomass or other forest monoculture as well as perennial and herbaceous energy crops. The ROD states that project area proposals be evaluated on selection criteria that include impact on soil, water, and related resources (wildlife included). The ROD states that many dedicated energy crops have a higher habitat quality than traditional crops and this may be true in some cases, but the analysis overlooks the more important comparison of loss of native habitats and natural landscapes to produce the energy crops or to replace cropland or pasture/hayland converted to energy crops.

The BCAP ROD mentions conservation plans, forest stewardship plans, or equivalent plans as the way that resource needs (including wildlife) will be addressed and “no significant negative impacts on vegetation or wildlife” is the conclusion. This is reinforced elsewhere in the ROD in combination with the statement that “dedicated energy crops should be chosen based on local ecosystem characteristics to minimize potential disturbance to native wildlife species and vegetation by providing habitats comparable to those found in native habitats.” These statements sound positive and on the surface appear to adequately address wildlife but, unfortunately, do not appear followed through in implementation. First, even though soil, water, and wildlife are linked in earlier Farm Bills in co-equal fashion and the Committee of Conference appears to have done so in regard to BCAP as they explained their intentions, wildlife is not co-equal with soil and water in conservation planning. In no case is soil and water conservation at the discretion of program participants. All choices and implementation options must meet a basic level of conservation for soil and water but wildlife is optional and can be ignored by either the producer or technical assistance provider in most practice standards. The other flaw is that even when wildlife is addressed (a criteria for Forest Stewardship Plans), the species is left to landowner choice and this can leave at-risk species unaddressed. The more programs encourage actions that leave fish and wildlife conservation out of the equation, then the greater the amount of spending that will be likely be needed to restore conservation after the fact.

The FSA Handbook for the Biomass Crop Assistance Program provides direction to FSA at the state and local levels. Review of the Handbook (version provided by FSA on July 13, 2011) found it to be consistent with most aspects of the program as reflected in the 2008 Farm Bill, Rulemaking and related documents. Specifically, as relates to fish and wildlife resources, the BCAP Handbook describes intent to develop an economically and environmentally sustainable biomass industry and that long-term negative environmental impacts of project areas should include mitigation measures. The duties and roles of a State BCAP Review Team are described and include consideration of environmental impacts within proposed project areas including potential impact on native wildlife and vegetation. These Teams are to be chaired by the FSA State Executive Director and invite representation from USDA Rural Development, NRCS, and State Forester but do not include state fish and wildlife agencies or USFWS representation. Also included in the Handbook is direction that the producer must implement a conservation plan, Forest Stewardship plan, or equivalent plan.

A recent FSA news release⁵¹ reports the following BCAP approved and active Project Areas accepting enrollment:

Missouri/Kansas – up to 50,000 acres of perennial native grasses/forbs

Arkansas – up to 5,588 acres of giant miscanthus

Missouri (Central) – up to 3,000 acres of giant miscanthus

Missouri (Southwest) – up to 5,250 acres of giant miscanthus

Ohio/Pennsylvania – up to 5,344 acres of giant miscanthus

Oregon/Washington – up to 1,000 acres camelina

Kansas/Oklahoma – up to 20,000 acres perennial native grasses/forbs

California/Montana/Washington – 50,000 acres camelina

Oregon – up to 7,002 acres of hybrid poplar



Bobolink – courtesy USFWS/Steve Maslowski

It seems clear in the 2008 Farm Bill and Joint Explanatory Statement of the Committee of Conference that BCAP was meant to be implemented in a way that: requires conservation of natural resources, including wildlife; prohibits conversion of native sod; prohibits use of invasive species, including those with potential to be invasive; encourages maintenance and discourages conversion of native forest. Review of referenced program documents indicates that adequate prohibitions are in place to prevent conversion of native sod. However, the needs of wildlife species of conservation concern are left to chance in that the NRCS standards and specifications as well as in Forest Stewardship planning. Finally, no measures appear in place to encourage maintenance of native forest and discourage conversion of native forest. Environmental aspects of BCAP seem very weak in the context of wildlife conservation. Mechanisms to discourage or deter the planting of species that have potential to become invasive appear inadequate and this is particularly important because, although USDA APHIS monitors and regulates plants prior to release (to avoid introduction of problem species), regulation is absent if plants unexpectedly become invasive after release. It seems in the best interests of the public for a program like BCAP, that incentivize plantings with public funding, to avoid the use of species that exhibit characteristics of species that become invasive. The following could help BCAP deliver expected bioenergy products while conserving fish and wildlife resources and avoid on-going cost to the public to control plant species that become invasive.

RECOMMENDATIONS:

State fish and wildlife agencies need to be represented on the State BCAP Review Teams (like the State Foresters that are already included).

FSA should give consideration to allowing NRCS State Technical Committees the opportunity to review/comment regarding environmental aspects of project proposal.

Attention to fish and wildlife (species in need of attention at the minimum) should be required for NRCS practice standards pertaining to biomass establishment, production, management, and harvest.

Forest Stewardship plans should require attention to wildlife species that need priority attention (particularly at risk species), as well as biologist review or use of BMPs developed with biologist input.

FSA should reconsider the BCAP approach regarding ecologically site-appropriate native forest and issue clear guidance that mechanisms be incorporated to discourage forest conversion and encourage sustainable management of ecologically site-appropriate native forest.

FSA should reconsider giant miscanthus as eligible for BCAP in view of its potential invasiveness.

FSA should require weed risk assessment and a full review of the invasive potential of proposed feedstocks and require carefully controlled field trials to further assess any plant variety identified in the weed risk assessment as exhibiting characteristics of invasive species.

FSA should make selection criteria competitive to encourage projects that incorporate all aspects of sustainability, including for fish, wildlife, and their native habitats.

FSA should give priority to participants that pursue mixtures of native plants that are compatible with the native ecosystem in which the land is located.

Title XI – Livestock

Section 11014 (Study on Bioenergy Operations) directs the Secretary of Agriculture to study the use of animal fertilizer, which includes attention to increased competition for manure due to bioenergy production. The fertilizer question has water quality implications no matter how fertilizer is used, but the report suggests no clear advantage to whether manure is used for fertilizer or bioenergy production.

Title XV – Trade and Tax Provisions

Section 15316 (Qualified Forestry Conservation Bonds) includes Clean Renewable Energy Bonds (i.e. all forms of renewable energy) that allow qualified entities to borrow at zero interest in order to fund renewable energy projects. **Section 15321 (Credit for Production of Cellulosic Biofuel)** contains a tax credit of \$1.01 per gallon of cellulosic biofuel produced (minus other ethanol tax credits that are claimed for the fuel). This tax credit is intended to make cellulosic ethanol competitive with other forms of ethanol and gasoline. The effect is to stimulate cellulosic ethanol production facilities and help them be profitable enough to operate and, depending on the actual market price of ethanol versus gasoline, the tax credit could allow facilities to pay a higher price for feedstock and thereby stimulate biomass production. These provisions appear to incentivize the bioenergy industry particularly as relates to making cellulosic ethanol profitable enough to stimulate interest in development of conversion facilities, a bottleneck for cellulosic production.

Section 15322 (Comprehensive Study of Biofuels) directs the Secretary of the Treasury in consultation with the Secretaries of Agriculture and Energy as well as the Administrator of the EPA to work with the National Academies to analyze aspects of bioenergy. The direction is to produce a report that includes capacity of forests and farmlands to produce biomass, effect on the environment, cost of fuel as well as that of feed/grain/forest products, import/export of grains/forest products, commodity payment savings, expansion of refinery capacity, impact of tax credits and need for more science-based information. This report was completed in 2011 and indicates that meeting the mandate (RFS-2) of 16 billion gallons of liquid biofuel consumption by 2022 is unlikely unless there are major technology advances or policy adjustments. The report further indicates that use of energy crops would be necessary and recognizes the potential for land-use changes, including conversion of forests and grasslands.⁵²

Opportunities

The risks of developing and implementing bioenergy technology and production do not have to lead to diminishment of native and ecologically site-appropriate biodiversity. There are many opportunities for environmentally beneficial bioenergy production. U.S. forest lands are extensive and house much untapped capacity to generate biomass from sustainable management of ecologically site appropriate native forest as well as through restoration of savanna, glades, prairies (invaded by trees), and other ecosystems. Some of this is already being done, for example, harvest of mesquite and juniper from west Texas grasslands that provides biomass for power generation and restoring native grasslands. Considerable woody residue is generated from periodic disaster events (tornadoes, hurricanes, ice storms, etc.) that could be converted to bioenergy. There is much potential, particularly in the western U.S., to remove biomass for wildfire reduction reasons. Historically, much of this woody material has not been utilized. Biomass could also be obtained by way of efforts to eradicate invasive species elimination was the focus and not perpetuation or management of the invasive species to produce on-going biomass.

It is encouraging that there is increased attention to conversion of woody and other yard waste from cities, towns and communities to generate energy but it is doubtful that this source is fully tapped. A successful biofuel use example comes from Northwest Missouri State University (NWMSU), which started using bioenergy 20 years ago to meet campus power needs and the model has been recognized numerous times over the years. NWMSU uses mostly woody and paper waste to generate about 65% of the thermal energy the University needs to maintain comfort in 1.7 million square feet of building space at an average annual cost savings of \$375,000.⁵³ Others have adopted similar use of biomass and projects like these make a local difference and contribute to a national difference as local projects add up. Other untapped opportunities include biomass from management of highway and utility rights-of-way that could generate significant biomass in places where these areas are wide and could be easily and safely harvested. There could be significant cost savings to government and utility companies versus traditional management of highway rights-of-way.

The first approved BCAP project area serves as an example of how properly designed energy crops can be produced in concert with the needs of fish, wildlife, and their native habitats. This biomass conversion facility is the Sho Me Energy Cooperative and the project area includes 39 counties in Missouri (central and western portions of the state) and eastern Kansas. Approved feedstock consists of a variety of native grasses and forbs that are compatible with the prairie landscapes that dominate much of this geography.⁵⁴ These plantings will be particularly beneficial to help restore grassland biodiversity because less than 1% of historic native prairie remains in many of the counties within the project area. Reports from the area indicate that landowner interest has been strong and that the wildlife conservation aspects of the project popular among the rural constituency.

The National Wildlife Federation, in a publication on bioenergy⁵⁵ describes a project in the Mississippi River Delta region that restores flood-prone bottomland to hardwood forest by inter-planting faster growing cottonwood among slower growing hardwood tree species. The cottonwood trees can be harvested after a few years for biomass use in electricity generation and local energy markets and produce sprouts, which can be harvested again and again while the hardwood trees develop and provide sustainable harvest opportunities. The NWF publication reports that Farm Bill initiatives like CRP that have helped establish trees and companies like GreenTrees® have helped to integrate climate change aspects through links with companies seeking to meet greenhouse gas reduction goals. Landowners benefit from establishing flood tolerant forest cover on lands that have proven difficult to farm and unpredictable in terms of successful row crop production. Restored wetlands and associated groundwater recharge; water quality improvement; carbon storage; wildlife; and recreational opportunities are among the many other benefits of these restored bottomland forests.

RECOMMENDATIONS:

The Secretary of Energy, Secretary of Agriculture, and Secretary of Transportation should be encouraged to consider stronger focus on development of cost-efficient mobile conversion technology, equipment, and capacity to better enable use of biomass generated by natural disaster or in remote locations where it is not cost-effective to transport unprocessed biomass to conversion facilities.

The Secretary of Energy and Secretary of Transportation should be encouraged to study the use of rights-of-way (highway, pipeline, utility) to produce bioenergy feedstock while reducing traditional maintenance costs.

The *U.S. Billion-Ton Update*⁵⁶ touches on some but not all of the above biomass opportunities and does not factor contributions from algal or other aquatic options under consideration. The study projects that existing U.S. forests, croplands, and pastureland should be able to generate more than enough biomass to meet U.S. bioenergy goals established by RFS legislation. Information in the update suggests that much of the biomass production increase

would come from energy crops planted on existing cropland and pastureland with pasture intensification making up for loss of pasture for livestock. The implication is that bioenergy goals can be met without converting native ecosystems; which are already significantly diminished. This creates an excellent opportunity for the Nation to meet energy goals in ways that conserve and sustain remaining native ecosystems. However, the *U.S. Billion-Ton Update* observes that producers of biomass will make feedstock selections based on available land and profit. The study appears to assume safeguards to avert other land-use change and, indeed, safeguards will be necessary as governmental funds are made available to stimulate biomass production.

These findings create several important opportunities. One is that capacity to meet U.S. biomass goals by 2030 is feasible without converting remaining native habitat used by wildlife and that drives the \$122 billion/year fish and wildlife recreation industry. A second opportunity is that biomass plantings could benefit fish and wildlife if the feedstock type/location and management were designed to do so in concert with the natural ecosystem in which they are planted. Appendix A includes a framework for BMPs that reflects the collective sense of state fish and wildlife agencies. The benefits of BMPs can be maximized locally through consultation with the individual state fish and wildlife agency, which has responsibility for the fish and wildlife resources of the state and that, along with the USFWS for migratory and public trust species, will have the best information on the status and needs of fish and wildlife within each state.

A third opportunity regards *U.S. Billion-Ton Update* biomass production projections that exceed U.S. bioenergy goals. The flexibility provided by this additional capacity creates opportunity to pursue feedstock choices that optimize benefits among many societal needs, including sustainability and/or restoration of native ecosystems (such as mixtures of native prairie grasses/forbs, diverse hardwood forest restoration, etc.). Native species suited to the native ecosystem in which they are planted would have the advantage of being disease/insect resistant, adapted to soil type, and resilient to the vagaries of local weather patterns. In addition, most of the dedicated and high-yield energy crops are suited for only that purpose while the use of native species provides greater flexibility to shift back and forth between harvest for livestock forage or forest products as biomass and other markets wax and wane in accordance with demand. In a time of escalating diverse societal needs, and finite land resources, there is advantage in optimizing among many purposes versus maximizing for a single purpose such as too much focus on high-yielding energy crops that are not suited for other uses.

The use of native warm-season grasses and forbs (prairie species) for feedstock plantings has particular potential to deliver biomass while conserving fish and wildlife resources. A study of usable energy in low-input high-diversity (LIHD) native grassland perennials⁵⁷ found that LIHD (low intensity, high diversity) grasslands produced increasing bioenergy over time versus monoculture plantings, including monoculture plantings of switchgrass. A Michigan study⁵⁸ illuminated that perennial grasses yielded greater species richness than corn, but more importantly, that grassland wildlife specialists prefer mixed-grass prairie versus monoculture switchgrass. This is significant because it is the grassland specialist wildlife species that have been most affected as the great prairies of the nation have been converted to agricultural and other uses.

Biomass plantings of switchgrass may better provide for grassland birds (particularly generalist wildlife species that use many kinds of habitat) than annual crops like corn or many other perennial bioenergy plantings. However, diverse plantings of native grasses and forbs provide the best wildlife habitat among these choices. Native grasses and forb plantings provide societal benefits beyond the biomass or livestock forage produced and can contribute significantly to the contemporary concept of 'ecosystem services' that also includes societal benefits associated with soil, water, climate, nutrient cycling, disease regulation, pollination, biodiversity, aesthetic, recreation, tourism, and products like food, fiber, fuel, and other goods.⁵⁹ These products are important to all citizens although the relative importance of each is a matter of personal opinion. To agricultural producers, income is commonly an important factor in owning and managing land and it is not unusual for the highest priorities to become the production of food, fiber, biomass, and other products that return income. Conservation and sustainability of soil, water, nutrient cycling, and other factors necessary to sustain economic production may form a second tier of priorities for many production oriented landowners. A third tier may include aspects that are valued but less solidly tied to income, carbon sequestration, recreation, fish and wildlife, and their habitats may fall here. In these cases, environmental services for which there is no immediate economic return or advantage could get relegated to lower priority and be overlooked or set aside.

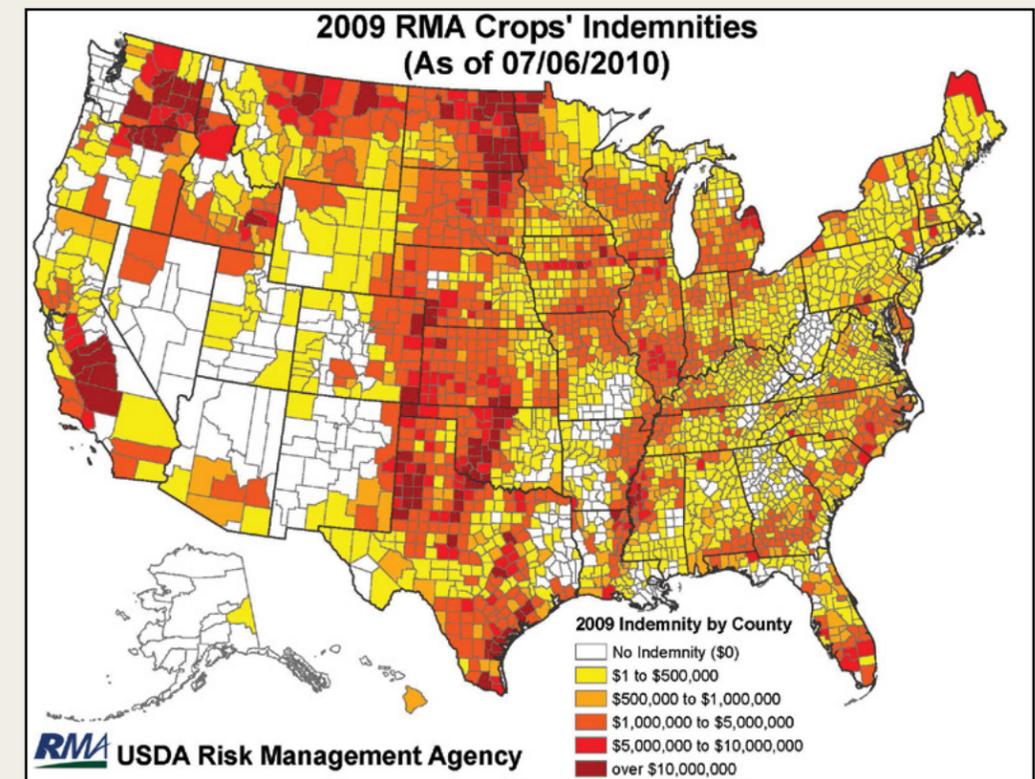
A 2011 study by the USDA Economic Research Service⁶⁰ found that about 770,000 acres of rangeland in the Northern Plains were converted to cropland between 1997 and 2007. The findings indicated that programs that reduce risk and encourage production (crop insurance, marketing loans, and disaster payments) increased cropland by about 686,000 acres. The study also observed that higher corn prices could be leading to additional cropland expansion. In addition

to the influence of production economics on the environmental services that agricultural lands produce, public funding through Farm Bill programs that support and encourage production can also encourage production over attention to fish, wildlife, and their habitats.

The Farm Bill currently subsidizes crop insurance by providing about 60% of the cost of the insurance premium. This insurance can provide coverage that replaces up to about 85% of the projected revenue of the expected crop yield at a set market price. The government pays an administrative fee to insurance companies to manage the program and the most risky claims can be shifted to the government to pay in the event of crop failure. Government expenditure on the crop insurance program is reported as about \$3.4 billion in 2001 and \$7.2 billion in 2009.⁶¹ As reported in the preceding paragraph, much rangeland to cropland conversion occurred in the Northern Plains and it is in this area that crop failure and crop insurance costs have escalated most dramatically (see Figure 5).

The most unfortunate part of this cycle is that, in the absence of safeguards, the use of public funds to support and encourage production will likely trigger unintended consequences for fish and wildlife and their native habitats. At present, adequate Farm Bill safeguards are not in place in regard to biomass and bioenergy production. The opportunity is that, with planning and action, safeguards could be established to avoid unintended consequences for which society would have to pay for separately and additionally to correct.

Figure 5. 2009 Crop Indemnities (Courtesy of the USDA Risk Management Agency)



RECOMMENDATIONS:

Consideration should be given to putting safeguards in place to deter the use of public funds to support conversion (direct or indirect) of remaining native ecosystems (including prairie, wetlands, and forest) or diminishment (such as through introduction of exotic, invasive species) through cost-share, incentives, or risk reduction programs.

Fish and wildlife should be treated the same as soil and water in NRCS standards and specifications (must meet a basic level of conservation for species of conservation need).

USDA should consider the potential of adjusting the Conservation Stewardship Program (CSP) to be a vehicle to encourage ecosystem services by establishing a per acre payment and allocating equal portions to soil, water, air (carbon sequestration), and fish/wildlife conservation (producers must treat all of these to get the full payment).

Discussion and Take Home Messages

The bioenergy movement is not unique to the United States; it is global. Lessened dependence on petroleum and cleaner and more affordable energy are, in large part, the driving factors. Bioenergy is framed in the context of environmental advantage over alternatives like petroleum and coal. The trend toward development and changing lifestyles in many emerging market countries, and escalating energy demand, is a contributing factor to the interest in bioenergy. Governments often view the developing technology, production of biomass, and associated industry as economic-drivers that create jobs and stimulate the economy, including in economically disadvantaged rural settings. Countries that are engaged in bioenergy in significant ways include Australia, Brazil, Columbia, France, Japan, Peru, Russia, Spain, Switzerland, the United Kingdom, and others. A global biomass exchange opened in Rotterdam in the Netherlands in November 2011.

Global interest in bioenergy usually includes the view that biofuels are carbon-neutral and result in lower petroleum emissions. Production of biomass is often discussed in the context of perennial crops on marginally productive farmland that produce better soil, water and wildlife habitat benefits compared with annual crop production. However, the environmental assertions are not without controversy. A leading issue is whether bioenergy production will actually reduce carbon dioxide emissions if biomass plantings lead to direct conversion of native grasslands or forests or indirect conversion to replace agricultural lands diverted to energy crop production. The same conversion issue applies if bioenergy crops lead to loss of ecologically site-appropriate native habitat for fish and wildlife, either directly or to replace pasture or cropland converted to bioenergy plantings including conversion of diverse native forests to plantation forests.

Even when perennial bioenergy crops replace annual crops or perennial pasture, it will not always be positive for wildlife. The key is the biomass choice versus what it replaces. For example, on a prairie ecosystem landscape, replacing corn with switchgrass is likely positive to wildlife, but replacing mixed native grass/forb grassland with a monoculture of giant miscanthus is a less beneficial choice in the context of grassland specialist species of wildlife. Some may say that there is a lack of research on which to form opinions about the impact of biomass choices like giant miscanthus on wildlife. It is true that research on individual bioenergy choices and wildlife is limited, but there is much research on the effect of plant diversity, importance of ecologically site-appropriate native plant communities, management and structure as relates to wildlife. There is plenty of research on which to base policy and management decisions related to fish and wildlife resources while research is conducted on specific energy crops and planting/management regimes. It is likely that current judgments about air, soil, water, and other natural resources (in relation to specific bioenergy crops) are also based on existing bodies of research versus research specific to bioenergy plants under consideration. To ensure that biomass plantings and management address locally declining species, additional research on wildlife response to specific bioenergy crops will be best directed at the effect on the habitat specialists associated with the natural ecosystem in which the plantings are to be made, rather than generalist species that do well in many settings.

In addition, the use of aggressive plants like giant miscanthus or hard-to-contain species like algae or genetically modified species, like recently developed varieties of switchgrass, raise the question of responsibility. **Who will pay for the cost of control if these introduced organisms escape onto other ownerships, including into native habitats on public or private land, establish and degrade fish and wildlife habitat or otherwise cause economic harm?** Will it be the company, the producer that establishes the energy crop, the private landowner whose lands are invaded, or the general public through taxation or other fees assessed by the government? In the case of patented genetically modified materials, is the company holding the patent responsible or is it the agricultural producer that plants such material or is the public to bear the cost of uncontrolled spread of something that is property-protected by patent? These questions need dialog and answers that transcend this study and report.

Water quality and quantity issues are also important to fish and wildlife habitats. Some biomass crops may use less water and fertilizer than annual crops, but may use more water and fertilizer than native plant choices. Water quantity and quality are already resources under pressure in parts of the country that are viewed as high potential for biomass plantings. Selection of biomass crops and the placement and extent of biomass crops on the landscape will be important.



Pelletized Biomass (photo by Bill McGuire)

The DOE (*U.S. Billion-Ton Update*) projects that it is feasible to achieve enough biomass production in the U.S. by 2022 to meet the cellulosic ethanol portion of U.S. Renewable Fuel Standards established by Congressional action. Importantly, the DOE document indicates that the biomass production goal can be met without compromising food production needs and without conversion of already diminished native ecosystems like native forests and grasslands. However, a newly released study by the National Academies⁶² indicates that producing the biomass is achievable, but that either major increases in agricultural yields or more land in crop production will be needed and that could trigger competition among land uses. Further, the National Academies report indicates that meeting this Renewable Fuel Standard might not be effective in the reduction of greenhouse gas emissions because of changes in land-use and how lands converted to biomass would be managed (air, water, and biodiversity potentially affected). The uncertainty of these contrasts and implications is serious in terms of sustainability of the nation's natural resources, including fish and wildlife, as well as the many diverse economies that rely on these resources.

In addition to the drive for renewable energy sources, other trends are developing that place additional demand on finite U.S. resources. Specifically, international demand for pelletized and chipped wood from the U.S. is increasing, particularly in European markets and demand in Asia is developing. A huge unknown is whether international demand for biomass will create land-conversion pressures in the U.S. additive to those that may result from efforts to meet RFS goals. Will economic opportunity and pressures from foreign countries lead to overexploitation of U.S. natural resources in the interests of short-term profit at a cost of long-term resource sustainability (including energy)? The issue is not simply energy, food, and other needs in the U.S. it is also fuel needs elsewhere in the world. How much can the U.S. sustainably (meaning all natural resources) contribute to global food and energy needs in addition to our own? Many native ecosystems have already given much land and water and are greatly diminished. Many species of fish and wildlife that depend on the diminished ecosystems are threatened or endangered and many others are declining. For example, 99% of tallgrass prairie has been converted to other uses and the associated grassland specialist species reflect greatly diminished populations.

The issue of land for food versus fuel production is central to the bioenergy movement. In general, governmental policy, industry, and other aspects of bioenergy are pursuing deployment of cellulosic bioenergy crops on lands that are not well-suited to food production. This is important because of the huge impact that production of corn-based ethanol has had on corn production. Current projections are that 40% of the 2011 corn crop (approximately 92 million acres planted) will be used to produce ethanol. This relatively sudden and significant development has attracted public attention and concerns over availability of corn for human consumption as well as food prices. The current bioenergy direction includes the view that cellulosic ethanol production does not contribute to food and food price concerns.

RECOMMENDATION: A study is needed to assess the effect of developing biomass export market opportunities on U.S. capacity to meet domestic biomass goals while conserving natural resources, including fish, wildlife, and native ecosystems (Secretary of Energy, Secretary of Commerce, Secretary of the Interior, and Secretary of Agriculture collaboration is suggested).

The land selected for bioenergy crop production, type of feedstock, and how it is managed will be very important to ensure a natural resource legacy for future generations. A 2006 report by the Outdoor Industry Foundation reported an outdoor industry economy of \$730 billion annually that supported 6.5 million jobs (one out of 20 of all U.S. jobs).⁶³ From seashore to mountain and prairie to desert, the many and diverse landscapes of the nation, including fish and wildlife, are important to the health of the outdoor industry as well as the citizens that participate in outdoor recreation.



Kayakers on the Lamoille River (photo by Dennis Curran)

A healthy economy is vitally important and the U.S. consists of many economies that are intertwined in ways that are not always apparent. Unravel one and others will be affected. Adequate food, water, and energy are important to all citizens. However, there are choices regarding how bioenergy production is pursued and those choices will affect fish, wildlife, and habitats that are key to their sustainability. It will be important to pursue bioenergy policy in ways that conserve all natural resources and the diverse economies that depend on these resources.

In the U.S., Congress has been active in its encouragement of bioenergy capacity and industry – the 2008 Farm Bill alone contains over \$1 billion in mandatory funding directly related to renewable energy and other legislation (energy, etc.) has made available many more billions of dollars to stimulate bioenergy through various agencies (loan guarantees, tax credits, incentives, cost-share, grants, etc.). Members of Congress recently boosted attention to bioenergy by creating a biomass caucus. The White House issued a renewable energy plan for the nation and the President and Congress engaged the Secretary of Agriculture, Secretary of Defense, Secretary of Energy, Secretary of the Interior, Secretary of Transportation, and the Administrator of the Environmental Protection Agency to advance bioenergy. The goals focus on development of speedy, efficient, and economical technology, capacity and delivery systems. Surprisingly, state fish and wildlife agencies with direct responsibility for fish and wildlife resources in individual states appear excluded from most bioenergy discussions and processes. Nor does the U.S. Fish and Wildlife Service (responsibility for federal trust species) appear to be engaged in most bioenergy policy arenas. Some federal agencies involved in bioenergy policy development and/or initiatives have staff biologists and their involvement is good but is not the same as involving the agencies and experts that are closest to the status and needs of the fish and wildlife resources of the nation.

Fish and wildlife resources are seldom mentioned in bioenergy communications from government, industry or other sources. However, communications frequently characterize bioenergy as environmentally sustainable and good for the environment. It seems reasonable to believe that the general public impression is that bioenergy is pursued at all levels (policy to academia to industry to agricultural production) in ways that conserve all natural resources, including fish, wildlife and their habitats. There also seems an assumption that Farm Bill programs and initiatives contain adequate safeguards to prevent conversion of native habitats and that planning with agriculture producers and forest owners includes adequate attention to wildlife. In actuality, most aspects of the Farm Bill lack adequate safeguards and mechanisms to ensure sustainability of fish, wildlife, and their native habitats.

RECOMMENDATIONS:

Consideration should be given (by Congress, the White House, DOE, DOT, EPA, USDA, etc.) to involving state fish and wildlife agencies as well as the U.S. Fish and Wildlife Service in all aspects of bioenergy (committees, etc.) that pertain to the environment and biodiversity.

State fish and wildlife agencies should consider increasing efforts to be involved in all aspects of bioenergy pertaining to the environment and biodiversity, including those in the energy, research, rural development, forestry, and conservation Titles of the Farm Bill.

State fish and wildlife agencies as well as the U.S. Fish and Wildlife Service should consider development of aggressive information and outreach efforts to ensure the public, policymaker, academia, and industry are well informed of biodiversity tradeoffs associated bioenergy production (the public has a right to be informed).

The review of specific bioenergy provisions in this policy analysis focus on specific areas that warrant attention as bioenergy policy continues to evolve. Several key issues and needs rise to the surface in this study:

Replacement of traditional commodity production supports (direct and counter-cyclical) by crop insurance which is not linked with Swampbuster and Conservation Compliance leaves wetlands at risk of conversion to bioenergy and other crop production purposes.

RECOMMENDATION: Relink crop insurance with Swampbuster and Conservation Compliance.

Native sod is not protected from indirect conversion to cropland (including bioenergy plantings) and can be farmed to produce a commodity crop (with risk protection via crop insurance). If the date-certain clause of BCAP (native sod ineligible as of the date of enactment of the 2008 Farm Bill) moves to the date of enactment of the next Farm Bill, then prairie conversion protections of BCAP will be compromised.

RECOMMENDATION: Retain “date of enactment of the 2008 Farm Bill” as the permanent BCAP date that precludes eligibility of land in native sod. A Farm Bill provision like “Sodsaver” (introduced but not enacted in the 2008 Farm Bill) is needed to provide an overall safeguard to deter conversion of remaining native sod.

Ecologically site-appropriate native forests are without protection from conversion to cropland, grassland, or plantation forest.

RECOMMENDATION: At a minimum, protections need to be implemented to preclude conversion of highly diminished ecologically-site appropriate native forest (like longleaf pine) to other land uses, including plantation forest.

There seems a perception that the conservation planning process and NRCS Standards and Specifications adequately address fish and wildlife needs but this is only true of a few practice standards that have wildlife as the priority. NRCS practice standards for biomass planting, management/harvest do not require that fish and wildlife be addressed at all. By contrast, all NRCS practice standards require that soil and water conservation be adequately addressed.

RECOMMENDATION: USDA practice standards should treat fish/wildlife in the same fundamental way that soil and water resources are treated. A minimum biomass planting and management/harvest practice standards should address (species of conservation concern for the native ecosystem in which the land is located).

There seems a perception that the Forest Stewardship planning process adequately addresses wildlife and biodiversity but, although attention to wildlife and biodiversity is required, attention can be minimal and/or directed at species that are commonly abundant rather than those in need of attention.

RECOMMENDATION: Forest Stewardship planning, in the context of biodiversity, should require attention to species of conservation concern, sustainability of existing ecologically site-appropriate native forest and/or use of fish and wildlife BMP's in plantation forests managed for biomass.

There is great potential to turn waste and residue generated in urban settings into bioenergy. There is great potential in using residue from sustainably managed native forests and from restoration of native ecosystems (i.e. prairie landscapes fragmented by woody invasion, etc.). There is also great potential in production of biomass while utilizing properly managed diverse plantings of native plant species that are suited to the native ecosystem in which the planting is made. More acres of native plant mixtures would be needed than if using dedicated energy crops but the lands would provide agricultural producers with more market flexibility as well as society with a more diverse array of benefits. Potential also exists to harvest biomass through eradication of invasive plants that are causing problems for agriculture, public land managers, and others. And, potential exists to make use of biomass generated from management of highway right-of-way (utility, pipeline, etc.). All of these approaches seek to optimize among many societal benefits.

Most government policy and bioenergy industry communication is focused on the concept of dedicated and contract-grown biomass that maximizes production. This paradigm is quite different from habitat needed to sustain wildlife but would help ensure a year-round supply of material of consistent quality at a predictable and reasonable cost, including for collection and transportation. Many agricultural producers prefer this model because it is consistent with how other crops are grown and the focus is to maximize per acre yield equated with profit.

However, producing more does not always mean profit given the ups and downs of the commodity market that is often the case in agriculture. Many of the energy crops under consideration are good for only energy and expected prices could fail to materialize if production exceeds capacity or demand. On the other hand, mixtures of native grasses/forbs can provide livestock forage and income in years when biomass markets do not pan out. Sustainable management of ecologically site-appropriate native forest can provide access to many markets for forest products compared with specialized woody energy crops. Agricultural producers and forest owners could benefit from optimizing benefits and considering market flexibility versus growing a single purpose crop as they make land-use choices.

All things considered, either of the following approaches hold promise to sustain fish, wildlife, and their habitats in concert with bioenergy production goals. Residue from sustainable management of forest lands, urban waste, natural disasters, invasive species control, highway right-of-way, etc. to produce bioenergy should be emphasized in both the optimal and maximum production scenarios shown below.

Optimal Production:

Sustainable and wildlife-friendly management of ecologically site-appropriate native forest (public and private land) and other native ecosystems and safeguards that deter use of public funds to convert these habitats.

Biomass produced through eradication of invasive species (including invasive woody species on prairie landscapes).

Maximized use of urban waste (including yard waste), woody debris generated by weather events, right-of-way energy plantings, etc.

Emphasis on diverse native-grass/forb plantings, particularly on grassland landscapes, that provide flexibility for bioenergy or livestock forage (to replace marginally productive cropland or pasture already in non-native cover).

Management (including plantings) of existing plantation forest, cropland, and pasture in cover not suited to wildlife, consistent with Best Management Guidelines in Appendix A.

Maximum Production:

Reliance on contract-grown energy crops on existing cropland, pasture, or plantation forest, using as few acres as possible, and growing species that do not have aggressive/invasive characteristics (or with commitments from those that patent or plant such species to pay the cost of monitoring, rapid response, eradication or control).

Establish safeguards (date-certain as of the date of enactment of the 2008 Farm Bill) to preclude the use of public funds (for cost-share, incentive payments, risk reduction, etc.) to convert native sod, ecologically site-appropriate native forest, wetlands, or other native ecosystems.

Coordination between state fish and wildlife agencies, USDA, and bioenergy conversion facilities (including utilities) to assess individual situations and achieve common-ground agreement on feedstock compatibility with fish and wildlife resources and native habitats as well as the tailoring of Best Management Guidelines (Appendix A) to the local situation.

Maximized use of urban waste (including yard waste), woody debris generated by weather events, right-of-way energy plantings, etc.

There is logic to tailoring governmental policy and initiatives to first encourage the use of biomass produced in ways that do not compete with other societal needs or trigger direct or indirect land conversion. Production of energy crops on lands dedicated to that purpose may be necessary to produce biomass at the scale that is needed, but policy and governmental initiatives should only encourage and enable such production within the capacity of U.S. natural resources (including fish and wildlife and their native habitats) to remain sustainable. Global demand and markets should not be a reason to exceed the capacity of U.S. natural resources to contribute sustainably in addition to addressing U.S. needs.

Bioenergy and biomass production has considerable potential to be a game-changer in regard to the landscapes and ecosystems of the United States. Bioenergy crops can be grown in places not suitable for traditional crops and the plant genetics is evolving so rapidly that major advances in drought tolerance and cold-hardiness and other traits are feasible. Congress, the White House, many agencies of the executive branch of government, academia, the energy industry, agricultural producers, the outdoor industry, and many others are active stakeholders in the bioenergy movement. Many federal agencies are communicating with one another and that is a start. However, state fish and wildlife agencies and the USFWS appear left out of the bioenergy loop. Unless that changes, the nation's fish and wildlife resources are at significant risk and will likely suffer from the inattention which will logically have an effect on the 6.5 million jobs in the outdoor industry. Communication, collaboration, and cooperation are extremely important if bioenergy and fish, wildlife and biodiversity are to be integrated in ways that are truly sustainable. Legislators and other policymakers have choices.



APPENDIX A

Guidelines for the Integration of Fish and Wildlife Conservation with Biomass Production

THE FOLLOWING REFLECT THE SENSE of state fish and wildlife agencies in regard to how bioenergy can be advanced in ways that conserve native ecosystems and associated fish and wildlife resources. These guidelines are not meant to be exhaustive and fish and wildlife needs can be most effectively integrated with bioenergy when localized Best Management Practices are developed and implemented in consultation with state fish and wildlife agencies.

Native Plant Communities

Publicly funded programs, subsidies, grants, or other financial supports should not permit direct or encourage indirect conversion of native plant communities (prairie, forest, savanna, wetland, etc.) to species composition that is other than ecologically site-appropriate.

In order for plantings to be most compatible with the ecosystems in which they are planted, it is important to use herbaceous species on grassland soils, trees/shrubs on forest soils and either herbaceous or woody species on transitional soils.

Native plant community restorations such as prairie or forest that include biomass production purposes should be accomplished using diverse mixtures of ecologically site-appropriate species (locally adapted plant material).

Biomass should only be removed in accordance with a plan designed to maintain plant community composition, species diversity, and structural characteristics based upon habitat requirements important to conservation of wildlife species that rely on such habitat and are in need of conservation attention.

The introduction or migration (from adjacent biomass plantings on agricultural land) of invasive, hybrid, or genetically modified species into native plant communities should be avoided.

On forestland, Forest Stewardship (or equivalent plans) should, at a minimum, address species of conservation concern associated with the forest ecosystem in which the land is located as well as leave sufficient den trees, snags, and woody debris to ensure nutrient recycling in the forest.

Biomass Plantings on Agricultural Lands

Ecosystem-compatibility is important and cover type should be matched to historic cover type — herbaceous species on grassland soils, trees/shrubs on forest soils, and either herbaceous or woody species on transitional soils.

Native species are better wildlife habitat choices than non-native plants.

Include legumes in plantings to enhance value to wildlife.

Polyculture plantings (block monoculture plantings of differing species scattered on the landscape) that offer some landscape diversity offer more habitat potential than large expanses of monoculture plantings.

Mixed species plantings provide better habitat than monocultures.

Aggressive or genetically modified species are not well-suited to provide wildlife habitat and should not be used immediately adjacent to native plant communities and where safeguards cannot be put in place to prevent migration onto surrounding lands.

Monitoring shifting land use pattern shifts within biomass project areas is important to get a better handle on the unintended consequences of direct or indirect conversion of native ecosystems that has potential to develop through use of public funding (i.e. programs to encourage crop production such as in the case of biomass).

Avoid or minimize the use of herbicide on between-row ground cover within short-rotation woody plantings.

Development of BMPs for individual states would help ensure that fish and wildlife resources are adequately addressed as bioenergy efforts continue.

Utilize biomass crops that use water efficiently and minimize use of fertilizer, herbicides, and pesticides.

Aquatic

Wetlands, backwater of rivers/streams, or other aquatic ecosystems should not be used for production of biomass crops such as algae or other cultured or cultivated aquatic organisms.

Harvest of aquatic plant materials (i.e. invasive or aggressive plant species) should be limited to reduction or elimination of such species and in the absence of attempts to “manage” these species for long-term harvest.

Biomass production (whether sustainably managed native habitats or biomass plantings) that minimizes the use of water (to grow biomass) are preferred so as to help ensure adequate water for aquatic systems.

Algal biomass should be produced only in closed systems with safeguards (i.e. backup containment and containment plans) in place to help prevent introduction to water bodies outside the production area.

Vegetative buffers of native grasses/forbs should be included to separate biomass plantings from riparian areas and other water bodies.

Guidelines for Harvest

Harvest outside the nesting and brood rearing season for ground nesting wildlife and the fawning/calving season for large herbivore wildlife species.

Harvest in blocks rather than strips to lessen predation mortality to nesting species.

Winter cover can be provided by leaving biomass resistant to lodging (or portions of biomass fields), such as switchgrass, in the field until late winter or early spring.

A wildlife beneficial mosaic of vegetative heights can be created by harvesting a portion of biomass acres after the peak of nesting/broodrearing season but with time for fall regrowth to 10-12 inches for native grasses; harvest the remainder after dormancy in the fall or winter and leave patches of cover near field edges (stubble height of 10-12 inches).

Install and leave unharvested wildlife-friendly field borders around field perimeter (CP-33 mixes suggested).

Ensure that transportation of harvested non-native biomass and harvesting equipment does not spread invasive species to other lands.

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