Agricultural Landscape Scenarios: 
Farm Bill Ideas and Images

Landscape Ecology, Perception, and Design Lab
Research Design to Develop Alternative Landscape Scenarios
Stakeholder Interview Results for Risk, Conservation & Public Perception
How Landscape Scenarios Relate to Risk, Conservation, & Public Perception

Compare Four Future Landscape Scenarios:
Existing Landscape
Scenario I
Scenario II
Scenario III

J.I. Nassauer, R.C. Corry, V.L. Murphy
School of Natural Resources and Environment, University of Michigan, USA*

How to use this website

This website is intended to challenge you to imagine the possible future of agricultural landscapes. Future agricultural landscapes are a consequence of decisions being made in agricultural and environmental policy today.

Can you imagine how the Corn Belt landscape could look 25 years from now? We did! This website will show you how Corn Belt watersheds could look in 2025, and describe what policy goals could encourage the changes you will see. As you browse this site, you will learn how we arrived at the images of the future.

Landscape images that are consequences of different policy assumptions

To study the future effects of federal agricultural and environmental policy on agricultural landscapes, three alternative landscape scenarios for two Corn Belt agricultural watersheds were used to provide precise landscape images. The landscape scenarios describe the landcover of each watershed in the year 2025. Each assumes different alternative policy emphases that could be adopted early in the 21st century, different relative public values and concerns, and different market conditions. The scenarios were designed to be a provocative but plausible basis for imagining future directions for federal agricultural policy. While none is a prescription, each draws out some of the implications of different potential policy emphasis. The scenarios in no way define a range of choices for agricultural policy. Rather they are intended to provoke consideration of some consequences of choices that could be made.
## Possible Futures: Landscape Scenarios for Corn Belt Agriculture in 2025

<table>
<thead>
<tr>
<th><strong>Compare Four Landscapes</strong></th>
<th><strong>Existing Landscape (1994)</strong></th>
<th><strong>Landscape Scenario I</strong></th>
<th><strong>Landscape Scenario II</strong></th>
<th><strong>Landscape Scenario III</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Landcover patterns resulting from agricultural policy to support prices, limit production, control erosion and improve wildlife habitat.</td>
<td>Landcover patterns respond to high world demand for Corn Belt grain crops with high use of production inputs.</td>
<td>Landcover patterns and agricultural enterprises have changed to the degree necessary for farmers to efficiently achieve acceptable water quality.</td>
<td>Landcover patterns have changed to increase habitat with innovative, profitable agricultural production methods.</td>
</tr>
</tbody>
</table>

## Research Design to Develop Alternative Landscape Scenarios for Corn Belt Agricultural Watersheds in the Year 2025*

To read results of our 1999 interviews with national agriculture stakeholders on...

**Risk, Conservation and Public Perception**

| Organizations Represented in Interviews | 15 Conservation Organizations, 12 Commodity Organizations, 12 Federal Agency Personnel, 2 Academic Institutions, 2 Congressional Offices |

## Risk, Conservation and Perception in Agricultural Policy Goals and Future Landscape Patterns

* - This research is part of Modeling Effects of Alternative Landscape Design and Management on Water Quality and Biodiversity in Midwest Agricultural Watersheds. Santelmann, et al. EPA-NSF #R8253335-01-0. This project is described at http://bufo.geo.orst.edu/tc/firma/ip/
Landscape Scenario III assumes that landcover patterns have been dramatically changed by policy interventions to increase indigenous biodiversity. Public investments are used to maintain and restore native plants and animals within a landscape that continues to support profitable agricultural production.

Research Design to Develop Alternative Landscape Scenarios for Corn Belt Agricultural Watersheds in the Year 2025

As part of an interdisciplinary project [1] involving Oregon State University, Iowa State University, the University of Michigan, the University of Minnesota, and Environment Canada, three prospective landscape scenarios [2] were designed and are being modeled for two central Iowa Corn Belt watersheds [3]. The designs and models are intended to suggest and test landscape consequences of different agricultural policy choices. Spatial models that incorporate geographic information systems (GIS) data, are being used to evaluate the potential response of plants, animals and water to landscape changes. Microeconomic models are being used to evaluate the economic impacts of the alternative future landscape scenarios to farmers. In interviews with Iowa farmers during the summer of 1998, public acceptance of the landscape scenarios was tested using digital imaging simulations (like the ones shown above).

The three landscape scenarios are distinguished by their different relative emphases on agricultural production, water quality, and biodiversity as public concerns. The scenarios portray land cover patterns in the year 2025 that might follow from alternative policy choices legislated in 2001.

All three scenarios incorporate the following assumptions:

1. The landscape will embody profitable agricultural production by private landowners.
2. The landscape will embody public concerns for water quality.
3. The landscape will embody public concerns for biodiversity.
4. The landscape will be affected by global markets.
5. The landscape will be affected by international and national agricultural policy as well as national, state, and local environmental policy.
6. Agricultural and environmental policy will reflect societal perceptions, values, and concerns.

Scenario Designs

Landscape Scenario I assumes that profitable agricultural production is the dominant objective of policy, and that profit is perceived as short term economic return.

Landscape Scenario II assumes that landcover patterns have evolved in response to federal policy that has enforced clear, measurable water quality performance standards for non-point source pollution of surface and groundwater on a farm by farm basis. Landcover patterns and agricultural enterprises have changed to the degree necessary for farmers to achieve mandated reductions in surface and groundwater pollution in the most efficient way.

Landscape Scenario III assumes that landcover patterns have been dramatically changed by policy interventions to increase indigenous biodiversity. Public investments are used to maintain and restore native plants and animals within a landscape that continues to support profitable agricultural production.

[3] Buck Creek watershed in Poweshiek County and Walnut Creek watershed in Story and Boone Counties.
Stakeholder Interviews: Risk, Conservation and Public Perception
Discussing and Understanding the Challenges

Farm legislation dating from the early 1930's provided a way for the nation to support and secure its food and fiber. To gauge the climate of current agricultural policy and perceptions, and to enrich the discussion of the research landscape scenarios outlined here, 43 agriculture policy stakeholders were interviewed in the summer of 1999. These interviews provide a basis for understanding the challenges facing U.S. agriculture and its policy makers. Representatives from Congressional staff, agency staff, conservation and commodity groups who work with or represent ranchers, farmers, and farm or rural interests were interviewed to paint a picture of the agricultural landscape concerns of the farm and non-farm public.

Among agency staff, conservation and commodity groups, and the congressional offices contacted, there was general consensus that the conservation provisions of the 1996 Federal Agricultural Improvement and Reform (FAIR) Act were an improvement over previous farm legislation. Several interviewees mentioned that this bill went further to address environmental quality (specifically water quality), and wildlife conservation - compared with previous farm legislation that primarily affected commodity supply and soil erosion. The interviewees seemed to agree too that public funds for conservation were a good public investment. Targeting programs meant conservation dollars were being spent on the perceived worst environmental problems first. The public benefited from having cleaner water and better wildlife habitat.

**Risk** - Some interviewees suggest that conservation could play a much larger role in providing a safety net for farmers. Some point out that farmers work on a narrow profit margin, and the concept of having to spend money (on conservation) to get money is not always possible. All agree that conservation measures can be expensive, and without adequate public environmental support, application of these measures can be prohibitive for average farmers even in conservation.

**Conservation** - Consistently, all groups of interviewees mentioned the inadequacy of funding for conservation as a real problem. They believe the conservation programs have been under-funded for both technical and financial assistance, and the demand for programs far outweighs the financial and technical assistance available. Some programs have reached or are about to reach their statutory or appropriation cap. There is concern that the political desire to continue or expand the funding for these programs does not exist or is overshadowed by the more immediate fiscal concerns in the farm sector. The problem facing agriculture and Congress at present rests in market and commodity management, specifically trade and risk assessment. These issues are dominating the discussion on agriculture policy to the exclusion of conservation debate.

**Commodity programs** - The commodity group representatives spoke more about the issues of safety nets, risk, and export markets than did the conservation groups. Most who commented on the commodity programs talked about the lack of a "safety net" for farmers. Most agree that the 1996 act fell short of providing a mechanism for abating risk. None could provide much information on specific tactics to address risk in legislation. Some of the commodity group representatives made reference to the fact that the FAIR Act was intended as a transition act, noting that the crafters of the bill knew revisions would have to be made and that other issues concerning trade barriers, regulatory constraints, and tax burdens would all influence the state of agricultural affairs in this country. Most commodity group representatives were not prepared to say the FAIR Act had failed. Many, including the conservation groups, point to the collapse of the Asian market as a contributor to the farm economic crisis. Most of the interviewees who commented on the public benefits of the commodity programs generally refer to the cheap and abundant food supply that Americans enjoy.

### Organizations Represented in Interviews
- 15 Conservation Organizations
- 12 Commodity Organizations
- 12 Federal Agency Personnel
- 2 Academic Institutions
- 2 Congressional Offices

*(Interview Questions)*
# Interview Questions

All of the interviews were conducted by phone in the summer 1999. The question sheet that follows was used to guide the interview process and to allow for consistency between interviews. All specific interview data is confidential.

## Interview Question Sheet

<table>
<thead>
<tr>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee:</td>
</tr>
</tbody>
</table>

Do you think recent farm legislation has helped farmers? The environment? The public?

What successes and failures do you see from the 1996 Freedom to Farm Bill?

Can you comment on any of the specific programs in the 1996 Farm Bill? Commodity Programs? Conservation Programs?

Do you think payments to farmers have increased or decreased since the Freedom to Farm Bill has been implemented? Commodity Programs? Conservation Programs? Do you know of any data to support that?

What issues do you see in the forefront of the American public today?

Are you aware of any straw polls or data that has been collected recently that gives an indication of the public's specific concerns about these issues?

Which of these issues are of most concern to you and your organization?

Are these issues being discussed in Congress? By whom and in what context?
Public perception - There was not consensus among the groups about what the American public views as important. Generally, the interviewees thought that the public did not think about farming and the environment, except when a local or national incident occurred. The interviewees agreed that the public is too far removed from the farm, operating more from popular perception than from specific knowledge. Of those mentioning specific topics that capture the public's attention, most referred to water quality and quantity, food safety in relation to chemical residue, biological risk (contaminated food) and bioengineered product categories, and urban sprawl (loss of open space).

Summary

Of the topics discussed in this interview process, there is general agreement that:

1) the conservation provisions of the 1996 FAIR Act have been successful but under-funded or under-programmed.

2) the commodity provisions of the same bill are least successful in farmer risk management and anticipating world trade effects, but most successful in providing flexibility to farmers for farm cropping decisions.

Agricultural policy discussions of the future will need to address a risk safety net for farmers to continue to supply Americans with a cheap, safe and abundant food source. Conservation provisions will need to continue to supply environmental benefits and assist in risk management to pull farming into the next century. Broad public perceptions, not only farmers' perceptions, will affect agricultural policy.
Risk, Conservation, and Perception: Agricultural Policy Goals and Future Landscape Patterns

In summary, the landscape scenarios being modeled in this study represent alternatives that have different effects on agricultural production, water quality, biodiversity, and public perception of the agricultural landscape. Risk, conservation, and perception have been addressed in the context of the scenarios’ possibilities and constraints. Policy choices made for the next federal farm bill can draw from these ideas to affect the condition of the landscape in the future. These scenarios describe landscapes as they might look in 2025, based on policy goals that could be adapted early in the 21st century.

<table>
<thead>
<tr>
<th>Landscape Scenario I - Agriculture policy primarily emphasizes commodity production.</th>
<th>Landscape Image in 2025</th>
<th>Landscape Pattern in 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk:</strong> Global markets determine farm planting decisions, commodity price and income. Federal farm policy supports crop insurance.</td>
<td><img src="image1.jpg" alt="View of field in Landscape Scenario I" /></td>
<td><img src="image2.jpg" alt="Landcover - Yellow connotes land under cultivation in production agriculture." /></td>
</tr>
<tr>
<td><strong>Conservation:</strong> Conservation tillage, traditional BMP’s, and precision farming are used for soil erosion and water conservation. No federal conservation reserves provide habitat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perception:</strong> The landscape is perceived as acceptable but uninviting and depopulated.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landscape Scenario II - Agriculture policy is redirected to emphasize water quality as a primary objective of profitable agricultural production.</th>
<th>Landscape Image in 2025</th>
<th>Landscape Pattern in 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk:</strong> Global markets influence agricultural enterprise decisions and federal policy encourages rotational livestock grazing. Federal policy reduces risk by supporting grazing enterprises and practices to improve water quality.</td>
<td><img src="image3.jpg" alt="View of same field as it would look under Landscape Scenario II" /></td>
<td><img src="image4.jpg" alt="Landcover - Darker blue-green connotes land providing water quality benefits including lands in production agriculture." /></td>
</tr>
<tr>
<td><strong>Conservation:</strong> Conservation tillage and BMP’s used. Perennial hay and pasture improve water quality and support livestock grazing. Stream corridors protected and enhanced through 60 meter wide buffers and detention pond systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perception:</strong> The landscape is perceived as having public value for its pastoral appearance of agriculture. The landscape looks healthy, desirable and inhabited. People enjoy recreation there.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Landscape Scenario III - Agriculture policy is redirected to emphasize biodiversity as a primary objective of profitable agricultural production.

| **Risk:** Global market risk is ameliorated by incentives for ecological farming systems. Strategically targeted land is purchased for watershed bio-reserves. Ecological farming systems emphasize grain production and support ecological connectivity. |
| **Conservation:** 120 meter wide stream buffers and 640 acre bio-reserves are broadly distributed and linked. Innovative production practices perform ecological functions. |
| **Perception:** High amenity value for observed biodiversity of landscape wins broad public approval. People want to live in agricultural landscapes. Perceived outdoor recreation value associated with corridors and bio-reserves. The landscape looks healthy, desirable and inhabited. |

Landscape Image in 2025

Landscape Pattern in 2025

Landcover - Green connotes land providing biodiversity benefits including lands in production agriculture. Dark green identifies bio-reserves and networks.
**A Look at Possible Futures For Agricultural Landscapes**

In summer 1999, we interviewed 43 national agricultural policy stakeholders about their views of agricultural policy for the future (see Risk, Conservation and Public Perception - Discussing and Understanding the Challenges). We wanted to know how our ongoing research about future scenarios for Corn Belt agricultural watersheds could provide information to policy makers. This webpage summarizes results of those interviews. Responding to issues raised by the interviews, it also describes our alternative landscape scenarios, policy assumptions, and ecological hypotheses for two typical Corn Belt watersheds in central Iowa.

These pictures show the way part of central Iowa looked in 1994 and could look 25 years from now at fall harvest.

(Click on image for larger picture)

<table>
<thead>
<tr>
<th>Existing Landscape (1994)</th>
<th>Landscape Scenario I</th>
<th>Landscape Scenario II</th>
<th>Landscape Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landcover patterns resulting from agricultural policy to support prices, limit production, control erosion and improve wildlife habitat.</td>
<td>Landcover patterns respond to high world demand for Corn Belt grain crops with high use of production inputs.</td>
<td>Landcover patterns and agricultural enterprises have changed to the degree necessary for farmers to efficiently achieve acceptable water quality.</td>
<td>Landcover patterns have changed to increase habitat with innovative, profitable agricultural production methods.</td>
</tr>
<tr>
<td>• Farm size averages 350 acres;</td>
<td>• Farm size averages 640 acres and field size increases to maximum 320 acres;</td>
<td>• Farm size averages 500 acres;</td>
<td>• Farm size averages 640 acres and field size increases to maximum 320 acres;</td>
</tr>
<tr>
<td>• Some woodlands remain;</td>
<td>• Woodlands largely converted to cultivation;</td>
<td>• Woodlands maintained and grazed;</td>
<td>• Some land purchased by public for permanent habitat reserves increases biodiversity;</td>
</tr>
<tr>
<td>• Riparian areas narrowly buffered with grasses;</td>
<td>• Riparian areas narrowly buffered with grasses;</td>
<td>• Wider riparian buffers increase biodiversity;</td>
<td>• Woodlands increase;</td>
</tr>
<tr>
<td>• Livestock trending toward confinement feeding and geographic concentration;</td>
<td>• Livestock raised in confinement feeding and geographically concentrated;</td>
<td>• Livestock grazing widely adopted;</td>
<td>• Widest riparian areas increase biodiversity;</td>
</tr>
<tr>
<td>• Conservation tillage, limited crop rotation used by some;</td>
<td>• Conservation tillage widely adopted, limited crop rotations, Best Management Practices (BMP's) used;</td>
<td>• Conservation tillage, alfalfa crop rotations, innovative BMP's used;</td>
<td>• Livestock raised in confinement feeding and geographically concentrated;</td>
</tr>
<tr>
<td>• 1994 rural population decreasing;</td>
<td>• 50% fewer rural residents than in 1994; those remaining are farmers;</td>
<td>• 75% of rural population remains in farming;</td>
<td>• Innovative farming practices used; native herbaceous strip intercropping, agroforestry and BMP's;</td>
</tr>
<tr>
<td>• Few people visit the Midwest farm landscape for recreation.</td>
<td>• Few people visit the farm landscape for recreation.</td>
<td>• People admire the beauty of rural landscape and visit for recreation.</td>
<td>• Population stable at 1994 levels, 50% non-farm residents, 50% farmers;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• People attracted to, visit, and live in the beautiful rural landscape.</td>
</tr>
</tbody>
</table>
Existing landscape assumes that landcover patterns have been shaped by 1994 agricultural policy. Public investments support crop price, limit production, control erosion, and improve wildlife habitat.

**Existing Landscape (1994)**
Landcover patterns resulting from agricultural policy to support prices, limit production, control erosion and improve wildlife habitat.

- Farm size averages 350 acres;
- Woodlands remain;
- Riparian areas narrowly buffered with grasses;
- Livestock trending toward confinement feeding and geographic concentration;
- Conservation tillage, limited crop rotation used by some;
- 1994 rural population decreasing;
- Few people visit the Midwest farm landscape for recreation.

BACK TO COMPARING FUTURE SCENARIOS

BACK TO MAIN PAGE
Landscape Scenario I assumes that profitable agricultural production is the dominant objective of federal policy, and that profit is perceived as short term economic return.

**Landscape Scenario I (2025)**
Landcover patterns respond to high world demand for Corn Belt grain crops with high use of production inputs.

- Farm size averages 640 acres and field size increases to maximum 320 acres;
- Woodlands largely converted to cultivation;
- Riparian areas narrowly buffered with grasses;
- Livestock raised in confinement feeding and geographically concentrated;
- Conservation tillage widely adopted, limited crop rotations, Best Management Practices (BMP’s) used;
- 50% fewer rural residents than in 1994; most remaining are farmers;
- Few people visit the farm landscape for recreation.

This scenario assumes high demand for Corn Belt grain crops by world food markets, and high use of fossil fuel, chemical, and technological inputs in 2025. Agricultural operations and technology continue to increase in scale, favoring the success of large-scale, industrial farms. Water quality and biodiversity are protected in this scenario using practices that were typical under the US 1996 Federal Agriculture Improvement and Reform Act. Scenario I also assumes that public trust in the quality of food produced by industrial agriculture is high, that the public perceives the landscapes resulting from industrial agriculture to be environmentally acceptable, that the fossil fuel necessary to industrial agriculture remains economical or that alternative fuels emerge, and that the public remains willing to support industrial agriculture (through research, crop insurance, etc.).

Farmers have widely adopted conservation tillage and precision-farming with resulting water quality gains. However, woodlands have continued to disappear as more land is converted to cultivation. The Corn Belt landscape has been depopulated by nearly 50% compared with 1994, many farmsteads have been demolished and groves cut down, and most farmers do not live on their farms through the winter months. Farm size and field size has increased to a maximum 320 acres per field. Crops are corn and soybeans. Livestock are raised almost exclusively in confinement feeding operations in a few counties in each state, so there is almost no pasture or alfalfa. Few people visit the rural landscape for recreation.
Landscape Scenario II assumes that landcover patterns have evolved in response to federal policy that has enforced clear, measurable water quality performance standards for non-point source pollution of surface and groundwater, on a farm by farm basis. Landcover patterns and agricultural enterprises have changed to the degree necessary for farmers to achieve reductions in surface and groundwater pollution in the most efficient way.

Landscape Scenario II (2025)
Landcover patterns and agriculture enterprises have changed to the degree necessary for farmers to efficiently achieve acceptable water quality.

- Farm size averages 500 acres;
- Woodlands maintained and grazed;
- Wider riparian buffers increase biodiversity;
- Animal grazing widely adopted;
- Alfalfa crop rotations, innovative BMP’s used;
- 75% of rural population remains in farming;
- People admire the beauty of rural landscape and visit for recreation.

Under this scenario, public environmental perceptions and concerns are assumed to be focused on improved water quality and quantity. Public support of agriculture targets practices that efficiently reduce soil erosion, reduce sediment delivery to streams, reduce the movement of excess nutrients to streams and aquifers, reduce the energy and flashiness of storm events downstream, reduce flood damage, and improve aquatic habitat.

Federal policy and profits from world markets for beef and pork are fueling Corn Belt interest in livestock enterprises, and hay fields or extensive animal grazing has been widely adopted as a means of meeting water quality performance standards on rolling or erodible land. Farmers are using alfalfa and hay rotations to meet water quality standards. Woodlands have been widely maintained as grazed woodlands, but they have not been extended or replanted.

Farm size increases over 1994, but more farmers stay on the land because of the management required for profitable extensive livestock operations. About 75% of the farms present in 1994 remain in 2025. The public appreciates the pastoral appearance of agricultural landscapes. Farm vacations and countryside second homes bring urban people into the rural landscape in a regular but temporary way.
Landscape Scenario III assumes that landcover patterns have been dramatically changed by policy interventions to increase indigenous biodiversity. Public investments are used to maintain and restore native habitat within a landscape that continues to support profitable agricultural production.

Landscape Scenario III (2025)

Landcover patterns have changed to increase habitat with innovative, profitable agricultural production methods. • Farm size averages 640 acres and field size increases to maximum 320 acres; • Some land purchased by public for permanent habitat reserves increases biodiversity; • Woodlands increase; • Widest riparian areas increase biodiversity; • Livestock raised in confinement feeding and geographically concentrated; • Innovative farming practices used; native herbaceous strip intercropping, agroforestry and BMP’s; • Population stable at 1994 levels, 50% non-farm residents, some on farmsteads; • People are attracted to, visit and live in the beautiful rural landscape.

Agriculture continues as the dominant Corn Belt land use in 2025, and public ecological perceptions and concerns drive public investment. Federal agricultural policy is redirected to support enhanced biodiversity within agricultural landscapes. Targeted land purchases to create habitat reserves, and cost-sharing to encourage the adoption of new technologies, increase biodiversity.

Under this scenario the world grain market is robust but continues to produce a comfortable surplus. World market demands for grain are similar to 1994. Livestock enterprises have continued to trend toward confinement feeding operations.

Early in the 21st century, US agricultural policy has been substantially influenced by public environmental perceptions and concerns. Federal land purchase programs, funded by federal sales tax on agrochemicals and value-added agricultural products, have established at least one indigenous ecosystem core reserve of at least 640 acres in each Iowa agricultural watershed. New technologies have been turned to ecological purposes. Federal subsidies for innovative, ecologically-sound farming practices (e.g., perennial strip intercropping and agroforestry) have been targeted to landscapes that connect and buffer the new reserves and riparian corridors. Long-term economic returns and stewardship in agriculture, and biodiversity within the agricultural landscape are aims of agricultural policy. The substantial public investment in core habitat reserves and habitat corridors allows public involvement in and enjoyment of the rural landscape.

While the number of farms in 2025 decreases to about 50% of the number present in 1994, nearly all farmsteads present in 1994 remain inhabited, some by non-farmers or intensive gardeners who enjoy the amenity value of biodiversity in the rural landscape. The public admires and enjoys the healthy rural landscape. Trail systems connect the watershed corridor system and visitor education sites located at the periphery of each reserve.