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Cover Crop Adoption Decelerates and No-till Area Stagnates in the I-States

Alejandro Plastina, Wendiam Sawadgo, and Emmanuel Okonkwo
plastina@iastate.edu; wendiam@auburn.edu; eko0013@auburn.edu

USING COUNTY-LEVEL data from the 2022, 2017, and 2012 US Census of Agriculture (USDA 2014; 2019; 2024a), this article sheds light on the patterns of adoption and disadoption of cover crops and no-till in Illinois, Indiana, and Iowa, which jointly accounted for 19% of the value of crop production in the United States from 2017 to 2022 (USDA 2024b). Over that period, cover crop adoption decelerated substantially with respect to the previous five years, and no-till area stagnated in the I-states.

Deceleration in cover crop adoption

In 2022, cover crops were planted in 3,152,118 acres in the I-states, equivalent to 5.1% of their total cropland area (table 1), with high variability in the intensity of adoption across counties, ranging from 0.5% in Menard County, Illinois, to 42.1% in Brown County, Indiana (figure 1). Iowa planted 1,282,608 acres, Indiana 988,282 acres, and Illinois 881,228 acres. The region more than doubled its area under cover crops between 2012 and 2017, with most of the increase taking place in Iowa (593,498 acres), followed by Indiana (389,521 acres), and Illinois (343,179 acres). However, regional growth in cover-cropped area between 2017 and 2022 only amounted to 535,084 acres, or 40.6% of the growth during 2012–2017. The net increase in cover crop area during 2017–2022 occurred mostly in Iowa (309,496 acres), followed by Illinois (173,424 acres), and Indiana (52,164 acres).

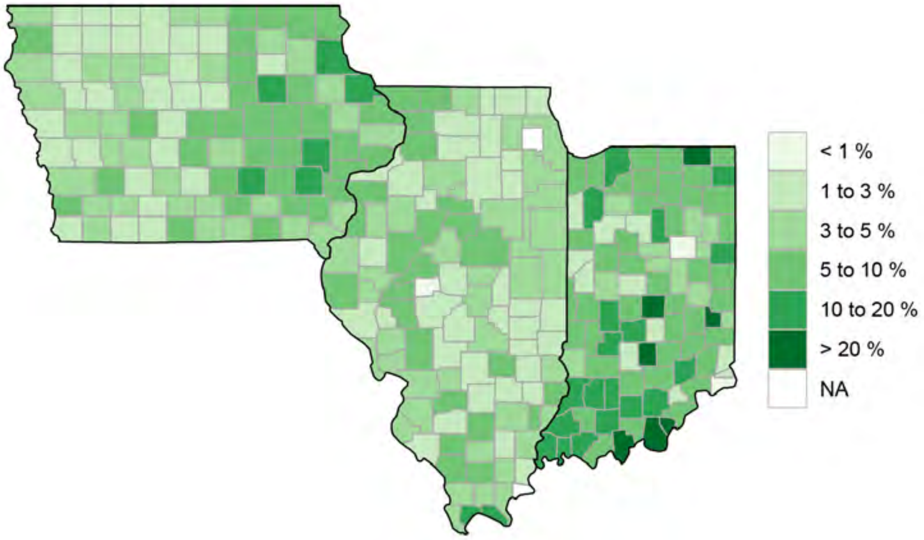

Figure 1. Rate of adoption of cover crops by county in 2022.

The rate of adoption of cover crops, calculated as the ratio of cover crop area to total 2022 cropland acres (to eliminate the effect of changes in cropland acres through time from the comparison), increased between 2017 and 2022 from 3.8% to 5.0% in Iowa, from 3.1% to 3.8% in Illinois, and from 7.5% to 7.9% in Indiana. Total cropland acres are calculated as the sum of planted (e.g., harvested, pastured, and failed) and not planted (e.g., summer fallow and idle) acres.

An analysis of changes in adoption rates by county indicates that 94

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Table 1. Adoption and Disadoption of Cover Crops and No-Till in the I-States

Conservation Practice & State	Adoption Rate[a]	Disadoption 2017–2022			Net Change in Area			
					2017–2022		2012–2022	
		No. of Counties	Percent[b] of Counties	Change in Acres	Acres	Percent of Cropland[a]	Acres	Percent of Cropland[a]
Cover Crops								
Illinois	3.8%	32	32.0%	-57,248	173,424	0.8%	560,924	2.4%
Indiana	7.9%	41	44.6%	-160,561	52,164	0.4%	389,229	3.1%
Iowa	5.0%	21	21.2%	-36,676	309,496	1.2%	902,994	3.5%
Total I-States	5.1%	94	32.3%	-254,485	535,084	0.9%	1,853,147	3.0%
No-Till								
Illinois	28.1%	54	52.9%	-611,025	-32,152	-0.1%	386,944	1.7%
Indiana	37.7%	56	60.9%	-553,854	-176,814	-1.4%	-226,031	-1.8%
Iowa	32.7%	43	43.4%	-379,509	256,262	1.0%	1,501,625	5.8%
Total I-States	32.0%	153	52.2%	-1,544,388	47,296	0.1%	1,662,538	2.7%

[a] Adoption rate and percentage of cropland calculated as area under conservation practice divided by total cropland area. Total cropland includes cropland harvested, crop failure, cultivated summer fallow, cropland used only for pasture, and idle cropland.

[b] Percent of counties calculated with respect to all counties in the state or region with data.

Source: Authors' calculations based on Census of Agriculture (USDA 2014; 2019; 2024a).

counties out of the 291 counties in the I-states for which data are available (32.3%) experienced declines in their rates of adoption, or disadoption, totaling 254,485 acres between 2017 and 2022 (table 1 and figure 2). The biggest gain in cover cropped area (17,109 acres) occurred in Mahaska County, Iowa, and the largest drop (-21,274 acres) was observed in Kosciusko County, Indiana.

Between 2017 and 2022, 41 counties in Indiana experienced a total net attrition in cover crop area of 160,561 acres, equivalent to 47.6% of the state cover crop area expansion during the previous five years (table 1). In Illinois, 32 counties reduced their cover cropped area by 57,248 acres, equivalent to 14.8% of the area gains in that state over 2012–2017. In Iowa, 21 counties experienced a total decline of 36,676 acres, equivalent to 6.2% of the area gains over the previous five years.

No-till area stagnates

In 2022, no-tillage systems were implemented on 19,618,394 acres in the I-states, or 32.0% of their total cropland area and only 47,297 more acres than in 2017. Not only the intensity of adoption varied widely across counties (ranging from 4.2% in Winnebago County, Iowa, to 75.7% in Washington County, Indiana), but also total net adoption differed substantially across states (figure 3). Iowa increased no-till usage by 256,262 acres between 2017 and 2022, bringing its total no-till area to 8,452,461 acres, equivalent to 32.7% of its cropland area (table 1). Indiana and Illinois experienced a drop in their no-till areas of 176,814 and 32,152 acres, respectively, reducing their adoption rates from 39.1% and 28.2% in 2017 to 37.7% and 28.1% in 2022. Between 2012 and 2022, Indiana saw its no-till area decline by 226,031 acres, with 78.2% of the decline occurring over the second half of the decade.

An analysis of changes in adoption

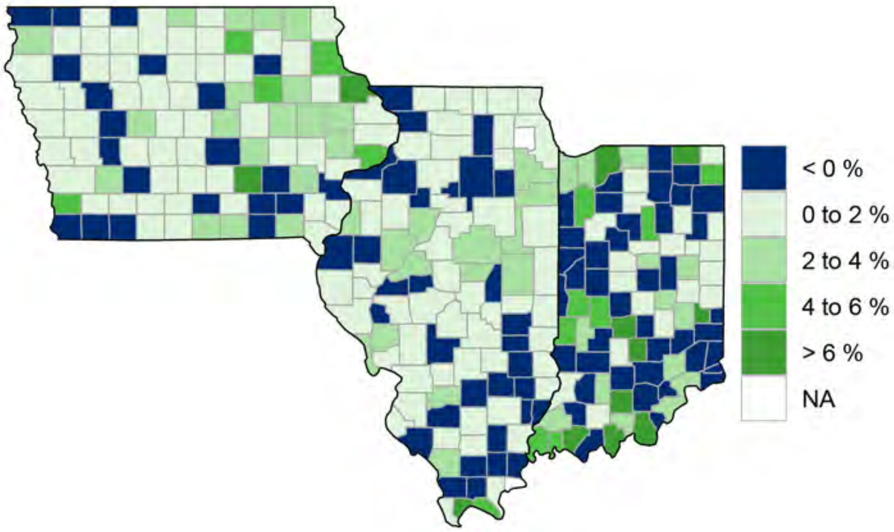

Figure 2. Change in rate of adoption of cover crops by county between 2017 and 2022.

rates by county indicates that 153 counties out of the 293 counties in the I-states for which there is complete data (52.2%) experienced disadoption (figure 4). The biggest gain in no-till area (40,066 acres) occurred in Jasper County, Indiana, and the largest drop (-38,325 acres) was observed in Hancock County, Illinois.

In Indiana, 56 counties experienced a total reduction in no-till area of 553,854 acres between 2017 and 2022, equivalent to 11.3% of the total state area in no-till in 2017. In Illinois, 54 counties reduced their no-till area by 611,025 acres, equivalent to 9.4% of the state's no-till area in 2017. In Iowa, 43 counties experienced a total decline of 379,509 acres, equivalent to 4.6% of the state's no-till area in 2017.

Concluding remarks

In light of the imminent discussion of the next Farm Bill and the ongoing efforts by USDA to design and implement climate-smart agriculture and forestry policies, this article highlights the deceleration in cover crop adoption and the stagnation of no-till area in the I-states between 2017 and 2022, and sheds light on the *non-permanence* of those practices. Policymakers, researchers, extension professionals, and other stakeholders in the private sector interested in increasing the net adoption of conservation practices should consider these trends in designing their future plans.

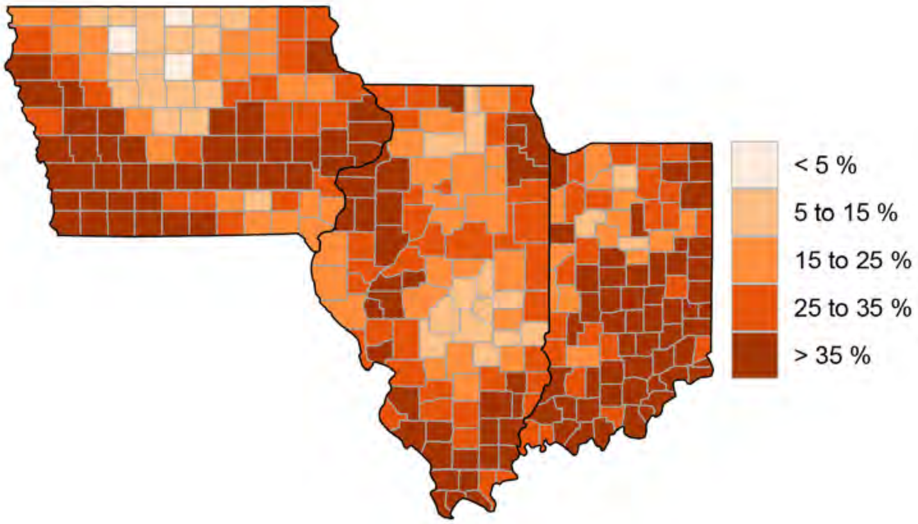

Figure 3. Rate of adoption of no-till by county in 2022.

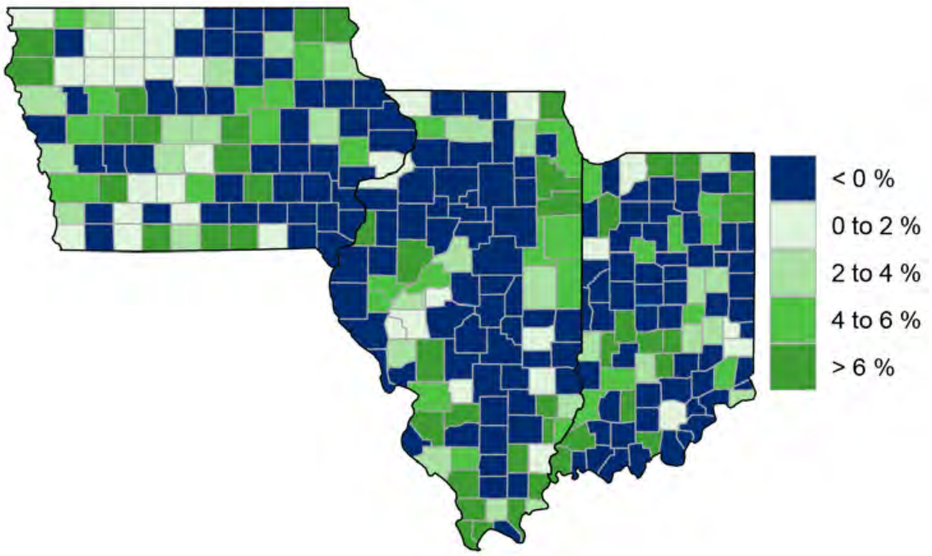

Figure 4. Change in rate of adoption of no-till by county between 2017 and 2022.

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Iowa Farmers' Perspectives on Precision Agriculture

J. Arbuckle, Joe Hollis, and Katie Dentzman

arbuckle@iastate.edu; hollisj@iastate.edu; dentzman@iastate.edu

USDA'S ECONOMIC Research Service defines precision agriculture (PA) as "a suite of technologies that may reduce input costs by providing the farm operator with detailed spatial information that can be used to optimize field management practices." Marketing of PA technologies generally focuses on potential benefits such as increased productivity and profitability, optimization of input use, and overall improved sustainability of farming practices. But what do farmers, the typical PA end users, think about these technologies? A recent Iowa Farm and Rural Life Poll survey examines use of key PA technologies and farmers' perspectives regarding the potential benefits and concerns related to use of these technologies.[1] This article summarizes the findings.

Are farmers using PA?

The first question set asked farmers if they were using any items on a list of common PA technologies. Use rates ranged from 66% for global positioning system (GPS) yield monitors and/or maps to 12% for on-farm sensors for soil, air, or plant tissue data collection (table 1). Theories of behavioral change posit that openness to adoption and then formation of an intention to adopt generally precede adoption of innovations. Our survey results show that many farmers who were not using the practices were either open to trying them or have plans to use them in the next three years.

Table 1. Precision Agriculture Technologies: Adoption, Intent to Adopt, and Openness to Adoption

	I used it in 2021	Not used in 2021, but intend to use within 3 years	Not planning to use within 3 years, but open to idea of future use	Not used in 2021; no plans to use it
GPS yield monitors and/or maps	66%	8%	10%	17%
GPS soil maps	60%	11%	13%	16%
GPS guidance systems (steering assistance, auto steer, etc.)	56%	7%	13%	24%
Variable rate equipment (sprayers, fertilizer applicators, etc.)	56%	13%	14%	17%
Satellite imagery	30%	16%	25%	29%
Data from online decision tools to guide crop management	27%	21%	25%	28%
Drones or aircraft-based imagery	21%	18%	29%	32%
On-farm sensors to collect data (soil, air, plant tissue, etc.).	12%	19%	32%	37%

Table 2. Farmer Perspectives on Potential Benefits of Precision Agriculture Technologies

Use of precision agriculture technologies can...	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
increase efficiency of input application	1%	1%	11%	62%	26%
increase yield for individual crops	1%	3%	19%	62%	16%
improve confidence in management decisions	1%	2%	23%	61%	14%
increase profitability of the farm operation as a whole	1%	3%	22%	55%	18%
identify subfield areas needing nutrient loss management	1%	2%	25%	58%	15%
identify subfield areas needing soil health management	1%	3%	27%	58%	12%
confirm the effectiveness of prior management decisions	1%	3%	27%	60%	10%

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[1] This article is a condensed version of the 2023 report, *Iowa Farmers' Perspectives on Precision Agriculture*, available at https://store.extension.iastate.edu/product/16630.

Farmers' perceptions of potential benefits

PA technologies are posited to result in numerous benefits to farmers and farm enterprises. One question set asked farmers to rate their agreement with a series of benefit-related statements on a five-point agreement scale. The statements were preceded by the introductory text, "Using precision agriculture technologies can…" The highest rated statement, with 87% agreement, was "increase efficiency of input application" (table 2). Most farmers also agreed that PA technologies can increase crop yield (78%), improve confidence in management decisions (75%), and increase farm operation profitability (74%). Another benefit that received high levels of endorsement was facilitation of subfield-level management: most farmers agreed that PA technologies can help with subfield management of nutrient loss (73% agreement) and soil health (70%).

Do farmers believe claims about PA?

Many claims are made about the ways in which PA might change agriculture. Typically, these claims focus on potential benefits for farmers and the environment, but there are also critiques and counter-claims. We posed several statements expressing such claims and critiques and asked farmers to rate the degree to which they agreed with them. We preceded the statements with the introductory text, "In the next 10 years, advances in precision farming technology may lead to changes in Iowa's agriculture. Please rate your agreement/disagreement with statements about potential impacts." The phrase "Precision technologies in agriculture will likely lead to…" immediately preceded the statements.

Table 2. Farmer Perspectives on Potential Benefits of Precision Agriculture Technologies (Cont.)

Use of precision agriculture technologies can…	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
increase profitability by optimizing crop types and rotation	1%	3%	30%	53%	12%
identify subfield areas needing soil erosion management	1%	5%	28%	54%	11%
identify opportunities to change field layouts (share and size of fields) to improve overall economic performance	1%	7%	40%	45%	8%
identify areas that could be shifted from row crops to perennial crops or conservation plantings	2%	10%	40%	39%	9%

Table 3. Farmer Perspectives on Potential Impacts of Precision Agriculture over the Next 10 Years

Precision technologies in agriculture will likely lead to…	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
increased profits for machinery and technology companies	0%	2%	20%	60%	18%
fewer and larger farms	1%	5%	24%	51%	20%
more effective pest control methods (e.g., weeds, insects)	1%	3%	30%	61%	5%
reduced need for farm labor	1%	9%	31%	53%	6%
less nutrient runoff into waterways	1%	6%	33%	52%	7%
improved soil health	1%	5%	36%	53%	6%
increased profits for input suppliers	0%	5%	44%	41%	9%
increased profits for farmers	1%	5%	44%	45%	5%
increases in farmers' decision-making independence	1%	13%	44%	39%	3%
decreased need for fertilizers	2%	27%	40%	28%	2%
decreased need for agri-chemicals (e.g., herbicides, insecticides)	3%	22%	45%	28%	3%
reduced greenhouse gas emissions	5%	16%	56%	22%	2%
decreased farmer dependence on purchased inputs	2%	27%	49%	21%	2%

The statement about potential impacts that elicited the most agreement was "increased profits for machinery and technology companies," with 78% agreement, followed by […will likely lead to] fewer and larger farms (71%) (table 3). Other statements about potential impacts that substantial majorities of farmers agreed with were more effective pest control (66%), reduced labor needs (59%), reduced nutrient runoff (59%), and improved soil health (58%). About half (51%) agreed that PA technologies would lead to increased profits for input suppliers, and 50% agreed that they would lead to increased profits for farmers. Less than one-third of farmers agreed that PA technologies would lead to decreased reliance on fertilizers (31%), less need for agrichemicals (30%), reduced greenhouse gas emissions (24%) or decreased farmer dependence on purchased inputs (23%). For these latter items, a plurality of respondents selected the uncertain category.

Potential concerns

The last question set examined potential concerns or challenges associated with PA technologies, and we again asked respondents to express their agreement or disagreement on a five-point scale. The highest rated item focused on cost, with 74% of farmers agreeing that the cost of new PA hardware is too high (table 4). At the same time, however, just 23% agreed that the cost of PA technologies exceeds the benefits, although this item also garnered the highest level of uncertainty, at 48%. Other notable results include 73% agreement that keeping up with PA technologies is like a never-ending treadmill and concern that data could be used for regulatory purposes (52% agreement).

Table 4. Potential Concerns or Challenges Related to Precision Agriculture Technologies

	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
Economics					
The cost of new precision farming hardware is too high	1%	6%	20%	53%	20%
Precision farming technologies are more beneficial for big farms	2%	20%	24%	38%	16%
The cost of maintaining precision farming hardware is too high	1%	12%	40%	39%	9%
The cost of precision farming technologies exceeds benefits	3%	25%	48%	18%	5%
Data					
Data from precision technologies could be used for regulatory purposes	3%	5%	40%	43%	9%
I am concerned that corporations could use farmers' planting and harvest data to manipulate markets	2%	10%	37%	37%	15%
I'm not sure I am using the data I collect as effectively as possible	1%	9%	41%	43%	6%
Corporations will use data primarily for their benefit, not farmers	2%	18%	40%	29%	12%
Knowledge and capacity					
Keeping up with precision technologies is like a never-ending treadmill	1%	8%	19%	58%	15%
Precision farming technologies are difficult to learn	3%	29%	32%	33%	3%
Precision farming technologies take too much time to learn	3%	37%	42%	17%	2%

Conclusion

Overall, survey results indicate that most survey participants view PA technologies as beneficial and promising for increasing input-use efficiency, yields, profitability, and overall sustainability. More than 70% of farmers reported using at least one of the eight technologies listed, and most farmers who were not currently using a given practice reported that they either intend to adopt it within the next three years or were open to future use. However, while respondents are generally positive towards PA, results also indicate concerns about potential negative aspects and impacts. While most farmers believed PA technologies could have positive impacts on their farms, management processes, and environmental issues, there was some worry that PA technologies are difficult to learn, keeping up with them can feel like a never-ending treadmill, and that many of the benefits will accrue to PA technology firms and larger-scale farms.

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Pest Susceptibility Commons in Agriculture

David A. Hennessy and Yanan Jia
hennessy@iastate.edu; jiayanan@ruc.edu.cn

PEST RESISTANCE to control technologies are causing costly management problems in crop and animal agriculture. Pest resistance often arises from heavy use of a particular control technology, a choice that makes sense to each individual farmer but may leave all farmers worse off. Viewing pest susceptibility to control as a commons, or common good, admits an understanding of policy responses intended to protect against excessive use of pest control technology. Common goods are characterized by two criteria—the good is rivalrous so that use by one person takes from use by another; and, it is also non-excludable so that those who do not pay can use the good. Excessive use for the social good, a reduction in resource availability, and a decline in resource quality generally ensue. Better management of the good requires mechanisms to both limit consumption and direct goods to those who value them most. These possibilities are not available for non-excludable goods. The extent to which either definition criterion is met varies greatly; and yet there is consensus that the underlying concept captures the essence of many resource use problems. We discuss some classical agricultural common good (ACG) issues as well as topical examples with emphasis on pest susceptibility to applied chemicals.

Historical examples

The classic commons problem, livestock on commonage grazing, is remarkably clear in illustrating the criteria, some limitations, and also the robustness of the underlying concept. Grass is a rivalrous good while common grazing ground is non-excludable in that many owners can place stock upon the land. Exclusion may be unprofitable absent any other consideration and may also be difficult due to property laws and the social mores or politics underlying these laws.

Soil erosion, and in particular the US Great Plains Dust Bowl event of the 1930s, illustrates a more involved ACG problem. For land under drought and inappropriate management, strong wind will blow small soil particles far away and larger particles nearby. The originating land declines in subsequent productivity but the farmer may accept future yield losses when practices causing the losses, primarily continuous cropping and intensive cultivation, enhance the near-term profits that small farm operators needed in the 1930s. The problem is one of displaced soil as much as lost soil. Large particle soil is, once settled on neighboring land, unproductive. Rivalry here regards near-term profit on one's own land at the expense of profit on nearby land. Non-excludability is more subtle. The 'good' is now a bad. Rather than preventing entry without payment, the challenge is to prevent other farmers from taking actions that cause the bad to exit and rest at the wind's whim. Policy remedies at the time included compulsory fallowing as well as mandated and incentivized changes in land management practices. Hansen and Libecap (2004) argue that the presence of larger farms was the most effective solution then and later. Large farm operators were generally not in dire need of cash, and also, being their own neighbors, internalized much of the

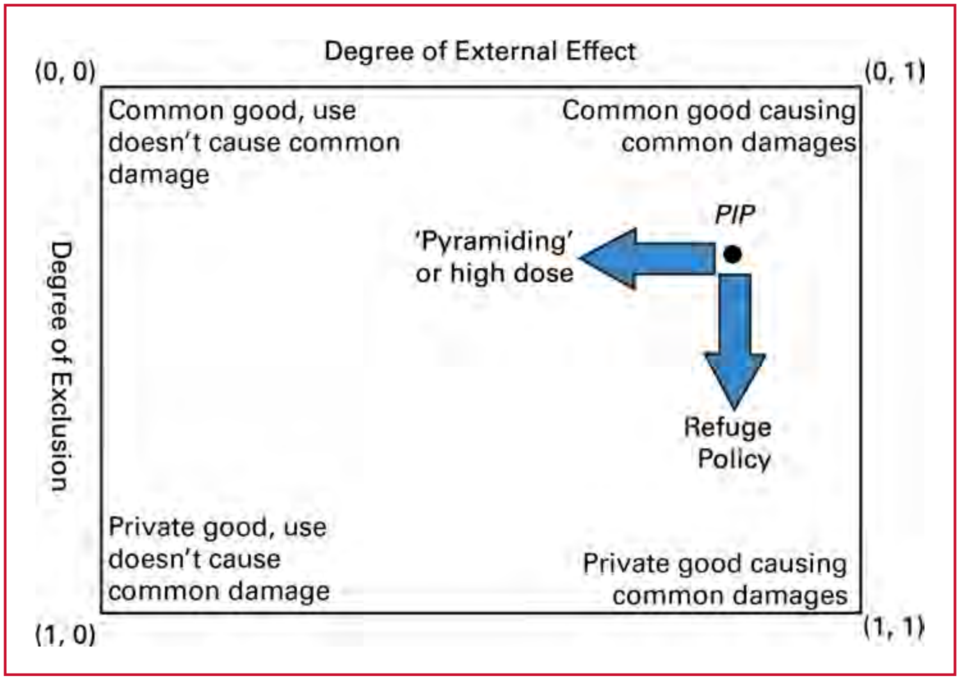

Figure 1. PIP policies to alter excludability and external damage attributes in the insect susceptibility commons.

externality.

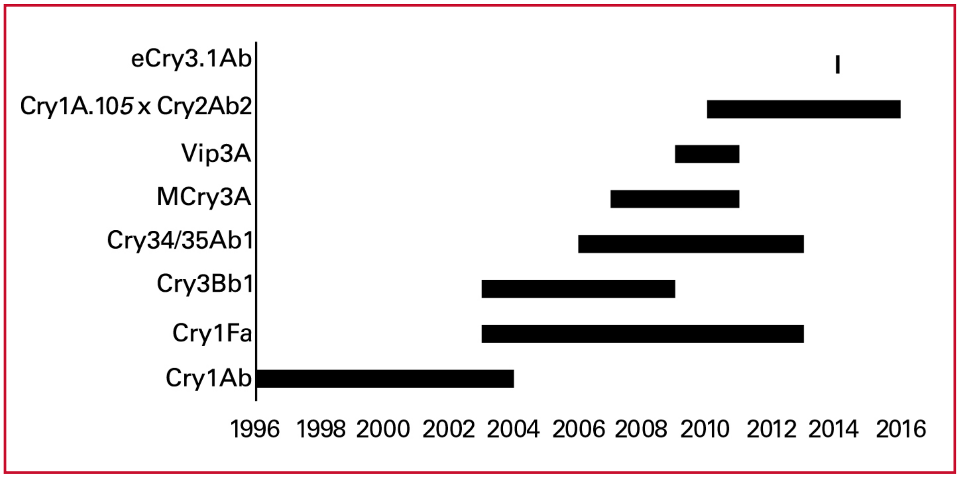

Figure 2. *Bt* resistance development in *Bt* corn in the United States.

Notes: 1. Each bar indicates when the corresponding *Bt* toxin was first commercialized and when field-evolve resistance was first documented. Data were extracted from Yang et al. (2013) and Tabashnik and Carrière (2017).

2. Cross resistance is suspected or known to contribute to Cry1A.105 x Cry2Ab2, mCry3A, eCry3.1Ab toxin resistance (Tabashnik and Carrière 2017). Field-evolved resistance to eCry3.1Ab was documented in the year it was first commercialized.

Pest susceptibility commons

We explain the perspective that a pest's susceptibility to a treatment is rival, is non-excludable, and declines over time with reference to three examples—weeds, insects, and microbes.

Weeds: Inclusion of herbicide resistance traits into soybean, corn, cotton, and some other crops since about 1996 has created a weed susceptibility commons (SC). At the price of the trait premium, farmers can spray over their crop with an all-purpose herbicide, killing weeds but not their crop. When the seed is commercially available without restriction, only price limits exclusion from using the SC. Rivalry arises because, through genetic selection, each weed species eventually becomes resistant to herbicide exposure. This cost for individual use is deferred and can be at least partly incident on other farmers. Management can involve enforcing non-market approaches to exclusion from using the technology. However for herbicide-resistant crop such use restrictions have generally not been imposed. A prevailing belief is that the cost of weed resistance is mostly internalized into farmers' private decisions because weeds and seeds generally have low mobility, and so policy intervention is likely ineffective for the weed SC. Whether this logic is valid is unclear, but weed resistance to glyphosate is now widespread in the United States (Landau et al. 2023).

Insects: Plant-incorporated pesticides (PIPs) are insect toxins built into the seed and thus expressed throughout the plant material. These toxins are proteins synthesized from the *Bacillus thuringiensis* (*Bt*) bacterium where different proteins have proven effective against different insects. There is an insect SC—when producers use toxins in excess then resistance will come to dominate susceptibility in the insect's gene pool. Rivalry is again with others who seek to use the SC and also with one's future self. In this case, however, the mix decidedly tilts toward rivalry with others because winged-phase insects are far more mobile than weeds.

Figure 1 adapts the standard schematic for characterizing a common good. The vertical dimension represents degree of exclusion with 0 at top and 1 at bottom. Rather than placing a rivalry index, as is standard, on the other axis we focus more generally on the externality effect. The standard common good problem focuses on a private benefit that people can access for free. Leaving aside the trait price, the insect SC problem is that the damage done is diffuse and extends beyond someone else's animal not having the opportunity to consume the grass. We focus on all external effects and not just removing someone else's opportunity to consume a specific good. Here 0 is at left and 1 is rightmost on the horizontal axis. A common good is in the upper right corner and the desirable location is across the box diagonal, a private good that does not cause commonly shared damage. Management approaches can seek to exclude through technology use restrictions, to reduce the magnitude of external spillover or do both.

The US Environmental Protection Agency saw early the need to intervene through a means of exclusion, the refuge requirement whereby farmers had to sow a specific fraction of a crop with toxin-omitted seed. PIP with refuge relocates the PIP seed in the figure further along the exclusion axis to render it more like a private good, albeit one that can cause commonly shared damage. An alternative approach is referred to as 'pyramiding' whereby multiple distinct PIP toxins are bundled in each seed so that the insect faces multiple distinct barriers to adaptation. This approach seeks to reduce the external effect by reducing the rate at which susceptibility declines. A third approach, although similar to pyramiding, is to incorporate one toxin at a high dose rate so that even mildly susceptible insects will die so that their genes disappear from the gene pool. Again, this approach amounts to reducing the external effect. We characterize both of these alternatives as shifting the good's location leftward and so again closer to the desirable lower left corner.

Figure 2 shows a timeline of documented *Bt* resistance development for different toxins in commercial corn. If there is a trend then time from first commercialization of a *Bt* toxin to first documented field-evolved resistance to the toxin declined over time. Cross-resistance mechanisms, in which species resistance to one toxin facilitates resistance to other *Bt* toxins, may have contributed to more rapid field-evolved resistance (Tabashnik and Carrière 2017), showing the importance of early and deliberated management.

Microbes: Most antibiotics consumed in the United States are by non-human species, mainly animals for food. For many antibiotics, microbe susceptibility has declined over time. A distinction relative to the weed and PIP SC is that the social welfare goal in resource management extends beyond the agricultural and food sectors. Resistant bacteria genetics originating from other species may make their way to those that harm humans, resulting in many human fatalities. In the United States, recent policies to manage antibiotics include the Veterinary Feed Directive (VFD), with implementation by the Food and Drug Administration completed in 2017, and Prescription Regulation (PR), implemented in 2023. VFD places veterinarians as the authority on whether antibiotic administration through feed or water are appropriate in a specific setting. PR requires that medical professionals prescribe all antibiotic uses. VFD and PR are intended to enforce exclusion through non-market means. Figure 3 presents recent US-level antibiotic use trends in food-producing animals. The long-run upward trend was reversed in 2016. Between 2015 and 2017, use of medically important antibiotics in agriculture declined by 43% and accounted for most of the 30% overall decline in antibiotic usage in agriculture. While likely a prudent and overdue policy stance, a formal economic analysis of costs and benefits would be challenging because the underlying biology of resistance-trait transfer is poorly understood.

Discussion

If producers can deplete a pest management tool's susceptibility status with confidence that an acceptable alternative will emerge then its obsolescence should be of little concern. Both pesticides and antibiotics markets witnessed a long hiatus in product development during recent decades. Consistent with the induced innovation hypothesis, however, the past decade saw commercial developments to address the decline in effectiveness of older pesticide (Umetsu and Shirai 2020) and antibiotic (Chin et al. 2023) products. We might count ourselves fortunate because SC has an unique, pernicious feature—need for a product when combined with sound management of the existing resource may not translate into profit for an innovator whose product encompasses the SC property (Årdal et al. 2020). Consumers should rarely use new products in order to protect against the emergence of resistance, so that the revenue stream to compensate for a likely expensive and risky investment may not suffice to induce innovation.

The essence of the SC problem is physical and biological openness. Sharing air, water, infrastructure, genetic, and other resources can reduce production costs, increase product benefits, and facilitate trade gains. But there are also costs, one being the erosion of susceptibility. The crucial question is how to manage the rate of erosion. This is a hard question as the response depends on technological details, including genetic trait attributes as well as the prospects for finding a commercially viable replacement. Institutions, as with property and patent law details, and quality of research infrastructure matter. So too do social preferences, as with balancing gains and losses across sectors, valuing animal welfare, and addressing the ethics of gene drives. Furthermore, the economic and intellectual climates are relevant. A dynamic society may at once be more exposed to decline in pest susceptibility

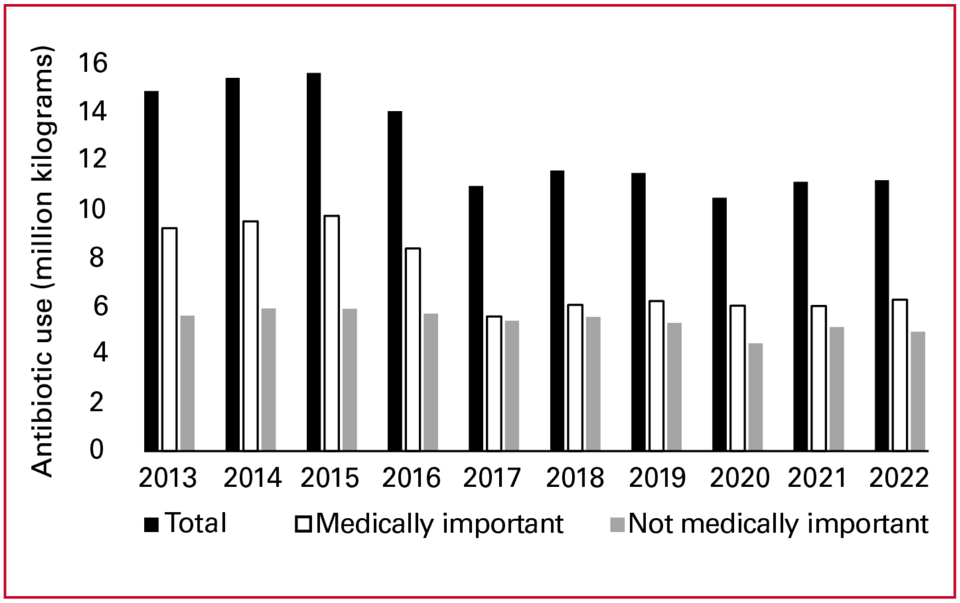

Figure 3. Antibiotic sold or distributed for use in food-producing animals.
Data source: US FDA (2023).

and better prepared to find replacements for an eroded resource.

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The Contribution of Agricultural, Forestry, and Fisheries Production to the US and Iowa Economies

John M. Crespi

jcrespi@iastate.edu

IN A recent report, USDA's Economic Research Service summarizes the prevalence of agricultural and food sectors in the United States economy (USDA ERS 2024a). USDA finds that the $1.4 trillion spent in all agricultural, food, forestry, and related industries was about 5.5% of US gross domestic product (GDP). In their analysis, USDA includes all agricultural and forestry production, food and beverage manufacturing and processing, food retailing, food service, and fishing, as well as textiles, apparel, and leather production. According to the report, US households spent approximately 13% of their 2022 consumption on food—only transportation and housing expenditures ranked higher. USDA reports that the agricultural, food, forestry, and related industries contributed about 1% to 2022's US GDP and directly created about 3.6 million jobs.

In this article, I focus only on the initial production portions of the "agricultural, food, forestry, and related industries" in the supply chain in order to ask what the impact is on the US economy from not just the direct spending but also indirect and induced effects that impact other industries. First, I need to define what I mean by the initial production portions of that industry.

The 2-digit, North American Industrial Classification System (NAICS 2022) categorizes US economic activities into 20 major sectors. Using the 2022 coding, I will examine the impact from NAICS Industry 11: Agriculture, Forestry, Fishing, and Hunting. This is a large sector, which I shall refer to as an "industry" although obviously it is aggregated over many different industries. Importantly, Industry 11 does not include food or beverage manufacturing and processing, so it is only the production portion of the supply chain for farming, livestock production, timber harvesting, and the harvesting of animals from farms, ranches, or natural habitats and sold for food or sold to other industries for further processing.

Table 1 shows the value-added contribution of Industry 11 to both Iowa and the United States from 2019 to 2022 (the latest year for which data are available). Value added is the addition to GDP for the state and the United States (state GDP is more often called Gross State Product). Value added is the difference between an industry's sales revenue (its gross output) and the cost of that industry's intermediate inputs. Table 1 shows that in 2022, Industry 11 directly added $18.6 billion and $270.8 billion to the Iowa and US economies, respectively. Or, one could say that of the $270.82 billion added to US GDP from Industry 11, Iowa contributed about 7%. However, this is only part of the direct contribution, as dollars generated in Industry 11 also had impacts across the economy when they were spent.

There are approximately two million farms in the United States with 86,000 of those in Iowa. Forestry acreage is about two-thirds the size of farmland acreage in the United States and in Iowa it is about 10% the size of Iowa's farm acreage. Table 2 presents a simple breakdown, and table 3 then compares the cash receipts for the top 5 agricultural commodities in both Iowa and the United States.

In some states, fisheries and forestry are larger than agricultural production. In Iowa, on the other hand, fisheries and forestry are much smaller than agriculture as a whole.[1]

I use an economic impact model, often called an input-output (IO) model, developed by IMPLAN.[2] In this model, think of all industries in the economy as feeding inputs into each other to produce outputs that are then sold to consumers or sold to another industry

Table 1. Iowa and US Agriculture, Forestry, Fishing and Hunting Value Added ($billions)

	2019	2020	2021	2022
Iowa	$6.65	$5.40	$12.62	$18.64
United States	$162.04	$160.78	$225.67	$270.82

Source: US BEA (2024) (various tables).

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[1] The north-central United States had 117 billion cubic feet of forest growing stock in 2017, which is only 12% of the growing stock of the entire United States. The north-central United States has little fresh, frozen, or canned fishery products relative to the 1.65 billion pounds of fish production for the rest of the United States in 2017 (USDA NASS 2021).

[2] IMPLAN Group, LLC. Huntersville, NC.

along the supply chain. IO models make adjustments for imports and exports as well as government services while also accounting for employment and taxes to the various industrial sectors. IO models determine the linkages between and among different industries in the production of goods and services in the economy and can measure how dollars spent in one industry impact another.

Relying on data collected by a variety of agencies in federal and state governments, an IO model determines the production linkages of all of an economy's industries. IMPLAN uses what is called a Leontief production function (named for Wasily Leontief, 1906–1999, who won the Nobel Prize in Economics for his work on IO models, see Leontief 1986) that assumes inputs are used in each industry in some measurable fixed proportions by value. Once these proportions are measured, the interactions of the inputs to production across the economic system and along its supply chains can be related to the collected government agency data, which creates an economic snapshot of an economy's linkages. With the model in hand, changes to underlying values or assumptions in the model produce counterfactual results. Economists recognize that assuming fixed proportions technologies for production functions is a big assumption; however, economic development studies regularly use IO models such as IMPLAN because they allow hypothesizing changes to an industry's employment or revenue to measure the impacts on the rest of the productive inputs in the economic model.[3] For this study, I will use IMPLAN's Industry Contribution Analysis (ICA) software.[4] ICA can be used to gauge the aggregate economic importance of a particular industry, in this case, NAICS Industry 11 on the rest of the economy.

For this analysis, I take a conservative approach whereby I remove the effects along the supply chain for Industry 11 where the industry is interacting with itself, so as to focus only on the impacts of this industry on the rest of the economy. In other words, I remove "buybacks" and other intra-industry sales within Industry 11, such as, when a hog producer buys feeder pigs, or when corn is purchased for livestock production, since both purchases are within Industry 11 and we want to avoid double counting.[5] Under industry contribution analysis, IMPLAN measures three types of effects as shown in table 4.

Table 5 shows the economic impact of Industry 11 on the rest of the economy where "Jobs" is IMPLAN's estimate of the number of jobs created in the economy due to Industry 11 ("Jobs" in IMPLAN can be both full and part time and do not directly match full-time employment (FTE) often used in other studies). "Labor Income" is the income transferred to people working in those jobs. Directly, labor income adds $8 billion in Iowa and $146 billion in the United States, but with its indirect and induced impacts throughout the economy, labor income is an additional $4.7 billion and $190 billion in Iowa and the United States, respectively. "Output" is IMPLAN's estimate of revenue—its direct effect impact is the value of the final production from Industry 11. As a check on IMPLAN's results, we see that IMPLAN's estimate of the direct impacts of output in table 5 for Industry

Table 2. Iowa and US Agricultural and Forestry Characteristics

	Farms (number)	Farmland (acres)	Farmland Share of Total Acreage (%)	Forestry (acres)
Iowa	86,104	30,563,878	85.5	2,968,000
United States	2,042,220	900,217,576	39.8	631,682,000

Source: USDA NASS (2021), USDA ERS (2024b; 2024c) based on US Census of Agriculture.

Table 3. Top 5 Agricultural Commodities in Iowa and the United States, 2022

Top 5 Iowa	Cash Receipts ($1000s)	Iowa Cash Receipts as % of US	Top 5 United States	Cash Receipts ($1000s)
1. Corn	$15,398,193	17.7%	1. Corn	$87,115,067
2. Hogs	$10,862,106	35.5%	2. Cattle & Calves	$86,055,031
3. Soybeans	$8,707,609	14.2%	3. Soybeans	$61,398,768
4. Cattle & Calves	$5,299,680	6.2%	4. Dairy products, Milk	$57,252,795
5. Eggs	$1,968,823	10.2%	5. Broilers	$50,445,885
All Iowa Commodities	$44,781,637	8.3%	All US Commodities	$536,645,076

Source: USDA ERS (2024b; 2024c) based on US Census of Agriculture.

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3. CARD researchers recently used IMPLAN to examine the economic importance of the Iowa beef industry (Schulz et al. 2017), the hog industry (Cook and Schulz 2022), the impact of African Swine Fever in Iowa and the United States (Carriquiry et al. 2020), and the economic impact of Iowa State University's veterinary diagnostic lab on the Iowa economy (Schulz et al. 2018).

4. For a fuller discussion on contribution analysis, see Lucas (2019) and Miller and Blair (2022, pp. 310–316).

5. As another example where buybacks in sectors are removed, see Cook and Schulz (2022).

11 in Iowa (which has little forestry or fisheries) is comparable to the cash receipts reported by USDA in table 3 for all agriculture (differing mostly by inflation between 2022 and 2024). Likewise, notice the direct effects on value added for Iowa and the United States ($19 billion and $274 billion, respectively) are similar to the values generated by the Bureau of Economic Analysis and shown in table 1 for 2022.

Table 4. Measured Economic Impacts

Impact	Definition
Direct Effect	Direct effects are the change in an economy's final demand in terms of revenues, employment, labor income, and taxes due to the existence of Industry 11.
Indirect Effect	Indirect effects occur through industry-to-industry (business-to-business) purchases within and across supply chains. When one industry spends money buying inputs from other industries and paying taxes then that spending indirectly impacts the rest of the economy. In the ICA analysis used in this study, I remove indirect effects along the supply chain in Industry 11. Essentially, we are not allowing Industry 11 to "buy back" any of its production, in order to examine this industry's contribution to the rest of the economy (net of its contribution to itself).
Induced Effect	When employees are added to an industry, they spend their wages on goods produced in other industries, and, in turn, those industries produce more and hire employees who also spend and pay taxes, etc. These are the induced effects from the economic impact of the industry under consideration. In the ICA analysis used in this study, I remove induced effects along the supply chain in Industry 11 for the same reason as for the indirect effects.

What table 5 shows on the "Output" results is that the direct, indirect, and induced economic impacts of the agricultural, forestry, and fishing industries adds $68 billion to Iowa sales revenue with about 30% of this being from indirect and induced effects. For the United States as a whole, the indirect and induced economic impacts of the agricultural, forestry, and fishing industries is about 52% of the total output generated by this sector ($1.3 trillion). "Value Added" shows a similar story where the direct impacts are only part of the story as the indirect and induced effects multiply through the rest of the economy. Furthermore, table 5 shows that without Industry 11, combined federal and state taxes from Iowa would be about $4 billion less and about $111 billion less nationally.

There are drawbacks of the present study, of course. The first is the base year of the data used. Because all government agencies have lags in their reporting of data, sometimes by a year or two, IMPLAN is guessing as to the 2024 impacts based upon data collected in 2022 and earlier and then adjusting for inflation and other effects determined by IMPLAN's developers (see IMPLAN 2017a; IMPLAN 2017b). Secondly, IMPLAN is based on very large, aggregated building blocks of data about US industries and, as such, this limits what economists would call a general equilibrium approach to the study of impacts. In short, IMPLAN does not examine linked market changes in supply and demand and does not directly model one market's linkages through the economy to other markets in production-function, IO analysis. Third, the production function utilized by IMPLAN is restrictive. IMPLAN enforces a Leontief production function on all of its industries whereby it assumes proportions of inputs to production used in the recent past remain the same when changes are made to an industry. While such fixed proportions arguably make sense for some industries like agriculture and forestry (e.g., producers may use roughly fixed proportions of seed, land, labor, and fertilizer to produce a crop in one year, which IMPLAN assumes might be the same the next year), we

Table 5. Economic Impact of Agriculture, Forestry, and Fishing Production in the United States and Iowa (2024 dollars)

Industry 11's Impact on Iowa (1000s)						
Impact	Jobs	Labor Income	Value Added	Output	State Taxes	Federal Taxes
Direct	112	$7,962,302	$19,029,721	$48,216,549	$321,423	$1,753,199
Indirect	41	$2,585,378	$6,789,544	$12,595,232	$397,742	$691,852
Induced	43	$2,194,868	$4,094,431	$7,218,519	$219,120	$522,038
Total	197	$12,742,548	$29,913,697	$68,030,301	$938,284	$2,967,089
Industry 11's Impact on the United States (1000s)						
Direct	3,555	$145,905,610.23	$274,291,460.07	$605,164,621.69	$6,633,127.84	$34,220,765.87
Indirect	999	$83,391,846.38	$170,508,050.79	$348,050,222.08	$10,685,825.68	$21,781,092.69
Induced	1,597	$106,366,562.35	$187,171,526.02	$332,126,796.60	$10,636,793.54	$26,605,156.98
Total	6,151	$335,664,018.96	$631,971,036.87	$1,285,341,640.37	$27,955,747.06	$82,607,015.54

still must question the usage of fixed proportions for industries like trucking, construction, financial, or service industries that can more easily alter their input combinations when the output from another industry changes. Fourth, I do not study any environmental or other negative costs (externalities) that affect an economy. For example, I do not consider the impact of pollution from Industry 11, although there are methods to try and take such costs into the calculations.

Nevertheless, as a back-of-the-envelope analysis assuming every input flowed proportionally through an industry as it did during data collection, this analysis does provide a rational guess as to the impacts of a dollar spent in one industry on the spending of another industry. In every economic model, one is always trading off one set of modeling assumptions for another. In this short paper, by restricting the model to large aggregations of many industries in order to examine "agriculture, forestry, and fishing production" I have also aggregated away many of the supply and demand linkages, and, by restricting linkages to a single year of the analysis, have taken a short-run snapshot where fixed proportions make more sense. Likewise, by restricting the analysis to remove indirect and induced linkages within the "agriculture, forestry, and fishing" sector, I make the analysis more conservative in its estimates. Future studies should consider less aggregated sectors such as crops, livestock, and food processing to follow the indirect and induced effects throughout the economies of Iowa and the United States for these sectors. What the analysis is showing is that the production portion of the agricultural, forestry, and fisheries sector has much larger impacts than just its direct ones. The industry contributes to 197,000 jobs in Iowa, 6 million jobs in the United States, $68 billion throughout the Iowa economy, and $1.3 trillion throughout the United States because of the presence of direct, indirect, and induced impacts.

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Profitability of Winter Cereal Rye in Integrated Crop-Livestock Systems

Alejandro Plastina
plastina@iastate.edu

DESPITE THE numerous environmental benefits associated with cover crop use, such as reducing erosion, improving infiltration, mitigating nutrient loading in surface waters, and improving soil health, many farmers in the Midwestern United States are still reluctant to include cover crops in their production practices. The Iowa Farm and Rural Life Poll (Arbuckle 2016) reports potential economic impacts had moderate-to-very strong influence on changes in 74% of producers' management practices, and 57% of them agreed with the statement "pressure to make profit margins makes it difficult to invest in conservation practices." The peer-reviewed literature based on survey methods (Plastina et al. 2018a, b, c), field experiments (Thompson et al. 2020), and simulations from physical models (Marcillo et al. 2019), conclude net returns to cover crops in the US Midwest were predominantly negative, even after accounting for cost-share payments.

In integrated crop-livestock systems, cover crop biomass in early spring can reduce dependence on stored feed, and thus reduce feed costs (Lundy, Loy, and Bruene 2018; Phillips et al. 2019). Malone et al. (2022) suggest harvesting cereal rye for forage between mid-May and early June before planting soybeans in the north-central United States could be economically viable, particularly if producers did not observe soybean yield losses from the double-cropping alternative (Gesch, Archer, and Berti 2014; Nafziger et al. 2016).

Using experimental agronomic data from six location-years in Iowa and a partial budget framework, Plastina et al. (2023) evaluate the annual private net returns to cereal rye as a winter cover crop in the no-till corn phase of an integrated corn-soybean and cow-calf system in Iowa. They calculate the annual net returns to cereal rye in an integrated crop-livestock operation as the direct sum of the net returns in the crop system and the simulated net cost savings in the cow-calf enterprise, by planting date and method, seeding rate, and termination date. Net returns in the absence of grazing average -\$50.08/acre and are negative for 82.2% of the treatments, while net returns under grazing average -\$6.17/acre and are negative for 54.8% of the treatments. Early-broadcast cereal rye produces higher biomass and larger net cost savings in the livestock enterprise than late-drilled cereal rye, but it also results in higher corn yield penalties. In the no-grazing scenario, net losses for early-broadcast cereal rye are \$67.16/acre larger, on average, than for late-drilled cereal rye.

The findings from Plastina et al. (2023) have multiple implications for farm management:

- First, the statistical relationship between higher cereal rye biomass in the spring and lower subsequent corn yields showcases the trade-off faced by farmers between producing higher environmental services and incurring economic losses. Private net returns to cereal rye in the no-grazing scenario are negative for 82.2% of the treatments and average -\$70.77/acre for those treatments. In the absence of large financial incentives (subsidies, cost-share payments, or payments for ecosystem services) their findings suggest cover crops will not be adopted at large scale in Iowa.
- Second, average net returns are significantly less negative in late-drilled plots than in early-broadcast plots in the no-grazing scenario, as higher rye biomass negatively affects corn yields relatively more in the latter than in the former plots. This suggests Iowa farmers would be more likely to break even if the planting date-method combination could be adjusted to achieve their environmental goals while minimizing corn yield losses. Late-broadcasting cereal rye (which was not explored in the study), could produce similar or even higher net returns than late-drilling, given the lower expenses associated with the former planting method.
- Third, since seeding rates and target termination dates are not statistically significant factors affecting net returns to cereal rye in the no-grazing scenario, farmers could benefit from further research exploring the use of lower seeding rates and flexible termination dates to minimize costs subject to achieving their environmental goals. Marcillo et al. (2019) report less negative private net returns to cereal rye at lower seeding rates.
- Fourth, the finding that 45.2% of

the plots under grazing obtained average net returns of $43.32/acre suggests that cereal rye could be profitable to a sizable share of the integrated row-crop and cow-calf production systems in Iowa when using rye biomass as forage. Figure 1 illustrates the relationship between net returns to cereal rye in the grazing scenario and total biomass produced by termination date (both grazed and left in the field). It seems to suggest that in order to be profitable while providing ground cover and its associated environmental benefits, cereal rye has to produce a total biomass of at least two tons (2,000 lbs) per acre by termination date. However, this is a testable hypothesis that should be further explored with a larger sample size.

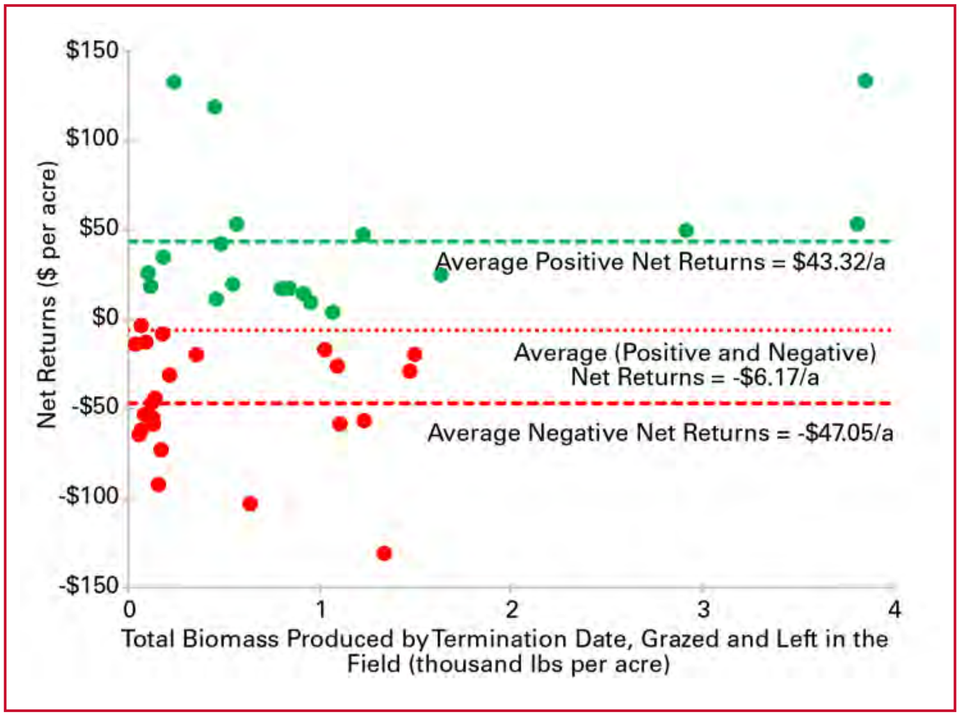

Figure 1. Net returns to grazing versus total biomass produced by termination date (grazed and left in the field).

The findings from Plastina et al. (2023) also have multiple implications for policy analysis. Since USDA considers grazing livestock on cereal rye a good farming practice in Iowa, implementing this practice does not impact farmers' ability to receive government payments or subsidies or their amounts. If the average incentive of $33.83/acre from the USDA Environmental Quality Incentives Program (EQIP) to plant cereal rye in Iowa (Sawadgo and Plastina 2018; Myers, Weber, and Tellatin 2019) had been applied to all treated farms in the Plastina et al. (2023) analysis, the percent of plots that would have generated positive net returns in the no-grazing scenario would have increased from 17.8% to 42.2%. While this seems like a substantial achievement, it is relevant to highlight that even under such a generous incentive, 57.8% of the treatments would have incurred annual net losses. Even after doubling the cost-share incentive to $67.66/acre, 37.8% of the treatments would have not broken-even in the no-grazing scenario. In the grazing scenario, cost-share incentives to plant cereal rye of $33.83 and $66.67/acre would have brought the share of profitable farms to 69.0% and 90.5%, respectively.

Additionally, it is important to consider the differential impact of the same EQIP incentive across low- versus high-biomass producing practices, conceptually represented in the study through late-drilled versus early-broadcast plots, respectively. In the no-grazing scenario, 66.7% of the plots with low-biomass and 14.3% of the plots with high-biomass would have obtained positive net returns after receiving EQIP payments. This comparison should inform policy discussions on the cost-effectiveness of public programs to achieve environmental goals and induce research on the social net returns to alternative cover cropping methods targeting high-biomass production.

Under grazing, the differential impact of a $33.83/acre EQIP payment on private net returns across low- vs. high-biomass plots would have been much smaller: 66.7% of the low-biomass plots and 71.4% of the high-biomass plots would have obtained positive private net returns. However, further research is still needed to understand the social net returns to cereal rye planted for forage.

Conclusions

Recent evidence from cover crop experiments should raise awareness about the low probability of obtaining positive annual private net returns to cereal rye in Iowa in the absence of sizable targeted financial incentives, and inform the policy discussion on the cost-effectiveness of government-sponsored conservation programs.

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How Will Changes in Net Incomes Affect Iowa's Land Market?

Rabail Chandio
rchandio@iastate.edu

This is the first in a series of three articles evaluating the relationship between farm income, interest rates, and other factors and land values.

THE IOWA land market has experienced significant fluctuations over the past century, marked by three golden eras—in the 1920s, 1980s, and early 2010s—with each characterized by a significant surge in farm incomes and land values. The first two golden eras ended with marked crashes in land value, while the last ended with a less drastic market adjustment. Recently, the COVID-19 pandemic triggered another such surge, inevitably drawing comparisons to these golden eras and raising questions about the potential for a subsequent decline. In 2023, however, the rate of increase slowed noticeably, with a nominal growth of 3.7% and an inflation-adjusted increase of 0.5%. This plateau indicates a less sustained rise in land values, highlighting a difference from previous golden eras, and has prompted questions about the future direction of the land market and the broader agricultural economy.

To begin with, this slower pace of growth, while unexpected to some, aligns with the predictions of approximately half the respondents to the 2022 Iowa State University Land Value Survey. These respondents expected land values to change modestly, ranging between a decrease of 5% and an increase of 5% from November 1, 2022, to November 1, 2023. The data corroborates these expectations, with most areas in Iowa witnessing increases or decreases within this margin, except for some southern counties where the land values rose by 10%, supported by recreational demand that is not directly affected by the changes in the agricultural economy.

Moving forward, the sentiment for 2024, as captured by the 2023 survey, suggests a cautious outlook. Over two-thirds of the respondents (70%) consider the current land values to be either "too high" or "way too high," and approximately half of the respondents anticipate a market adjustment in the near future, with declines in land values in 2024 by up to 10%. Some of that movement seems to have begun already—the February 2024 edition of Chicago Fed's AgLetter reports a 2% decrease in Iowa's farmland values over the last quarter of 2023 and a 1% reduction over the entire year (Oppedahl and Kepner 2024).

Overall, land market dynamics are guided by a single valuation principle: the value of land today is the present value of all expected benefits it will provide in the future. Therefore, we can define land value as net income divided by interest rate. This equation simplifies the movements of the land market to two pivotal factors: net farm income and interest rates. Through this lens, the recent hikes in land values can be explained by record-high farm incomes and historically low interest rates. Similarly, we also need to look towards the outlooks for both of these factors to form expectations about the future of the land market. We will begin with a closer look at net income projections for 2024 and beyond.

USDA's World Agricultural Supply

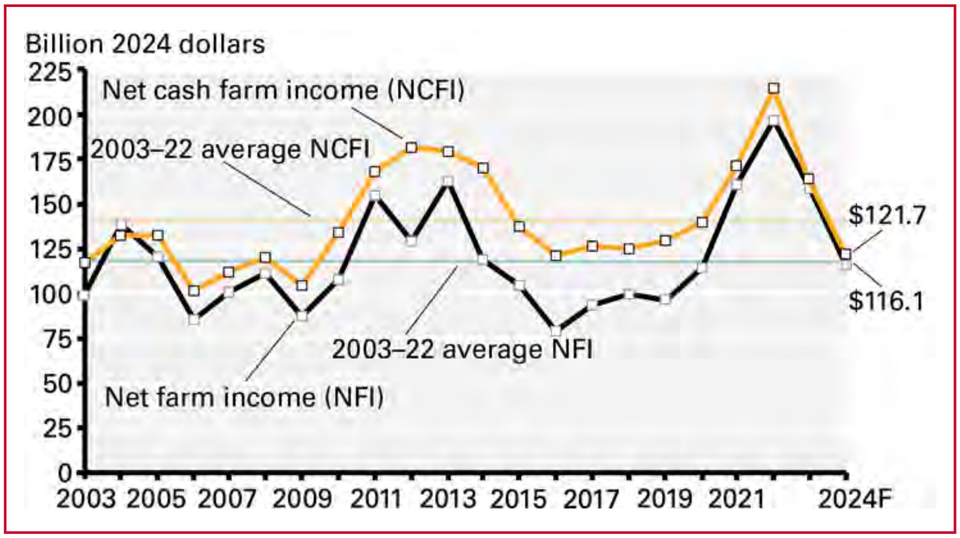

Figure 1. US net farm income and net cash farm income, inflation adjusted, 2003–24.

Note: F=forecast; data for 2023 and 2024 are forecasts. Values are adjusted for inflation using the US Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product Price Index (BEA API series code: A191RG) rebased to 2024 by USDA Economic Research Service.

Source: USDA ERS (2023).

and Demand Estimates (WASDE) provides short-term forecasts for agricultural markets over the next year. The February 2024 WASDE forecasts indicate a tightening in the farm economy, exerting negative pressure on net farm income. For instance, livestock markets expect mixed outcomes, with a decline in beef production but increases for pork, broilers, and turkeys. This variability in production and prices, alongside projected increases in corn production and downward adjustments in crop prices, suggests a potential decline in overall agricultural prices and, by extension, farm incomes in 2024 (Schulz and Hart 2024).

Figure 1 shows that the February 2024 forecast pegs net farm income at $116.1 billion in 2024, which is a fall of 25.5% from 2023, continuing a trend from the previous year's 16% decrease. Despite this, net farm income until 2023 remained above the 20-year average, mitigating immediate downward pressure on land values. While realized net farm income has dramatically increased and is now in decline, it is interesting to note that the longer-term projections for net farm income have also shifted significantly. Figure 2 illustrates how the 10-year USDA baseline projections for net farm income have changed over the pandemic. Note that the net farm income projections set in 2023 and 2024 begin at a much higher estimate for net incomes, which are expected to fall for the next 3–4 years until stability and an upward trajectory are regained. Throughout the 10-year horizon, however, projected income is at a higher level than that expected in 2022 or earlier. Moreover, while the 2024 projection for 2030 net farm income is lower than it was in the 2023 projections, it is still roughly $30 billion higher than the 2022 projection. This positive movement in projected net farm income helps maintain higher land values, even with the lowering of those projections in the most recent set.

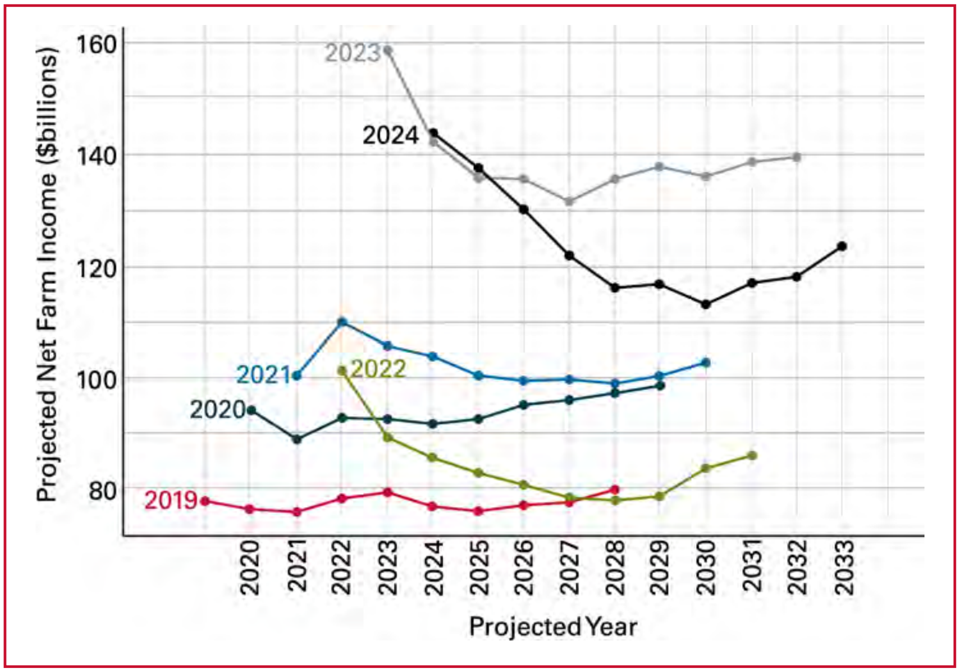

Figure 2. Net farm income baseline projections.

Note: Each line shows the projections made in the report year mentioned at the start of the line and provides projections for 10 years into the future.

Source: USDA ERS (2023).

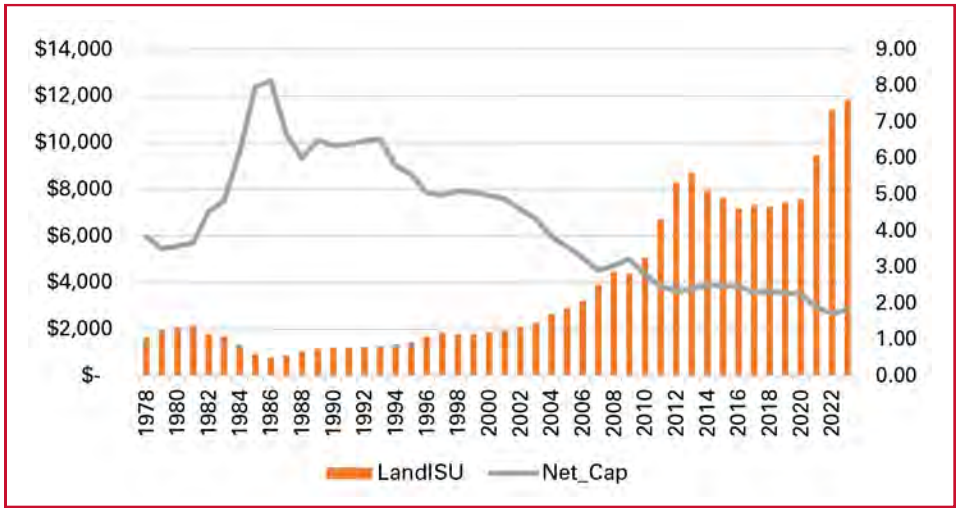

Figure 3. Land Values and Net Capitalization Rate for Iowa.

Source: Iowa State Land Value Survey and Iowa State Cash Rental Rate Survey.

Why does the expectation of higher farm incomes matter for land values today? Because the prospects for higher incomes, as well as appreciation in land value, are bid into purchase prices. When farmers, investors, and landowners anticipate higher farm incomes in the future, they are generally more willing to pay higher prices for land today, barring cash or credit constraints. Over time, buyers in the land market have been willing to accept lower percentage returns, further supporting higher land prices. Figure 3 depicts the net capitalization rate for Iowa farmland since 1978. Since the peak of about 8% in 1985–86, the capitalization rate has been on an overall decline. As land values have continued to rise, the net capitalization rate has fallen to less than 2% in 2023. So, expectations about stable or less-drastically falling farm incomes should have a more pronounced role in supporting land values than they did before. That said, net incomes still exert a positive influence in the land markets, not a negative one, despite their falling trends.

In summary, the Iowa land market is navigating through a period of uncertainty stemming from the uncertainty in the current agricultural market dynamics and future income expectations. While recent trends show a slowing in the pace of land value increases, the underlying fundamentals – net farm income and interest rates – determine the future of land values together. What we can say for certain is that the expectation of higher farm incomes in the future, despite current downturns, maintains a positive influence on land values.

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