Agricultural Drainage and Wetlands: Can They Co-exist?

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The Iowa Policy Project

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EXECUTIVE SUMMARY

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Reducing the environmental impact of agriculture is a goal of states across the Mississippi River Basin, as nutrients leaving farm fields have negative effects on communities locally and downstream, most notably contributing to the so-called "Dead Zone" in the Gulf of Mexico. To reduce nitrate pollution by 45 percent, as the EPA has called for, states across the region are looking at potential solutions.

As the Iowa Department of Agriculture and Land Stewardship (IDALS) develops a comprehensive plan, one tool it is evaluating is building nutrient-removal wetlands at the outlets of subsurface drainage mains, or tile, in its "Drainage and Wetland Landscape Systems Initiative." Over time, Iowa farmers are likely to make large investments in replacing aging drainage infrastructure with larger tiles. Unfortunately this, by itself, would actually increase nitrate delivery to rivers and streams. The use of wetlands in conjunction with tile systems, however, could provide both economic benefits for farmers by virtue of increased yields, and environmental benefits of reduced surface runoff and nutrient losses.

That's the theory, however, and it is largely untested. Several pilot studies are under way to determine whether farmers and the environment really will benefit or whether there will be unforeseen consequences of the marriage of increased drainage capacity and constructed wetlands. Given the significance of this study, it needs to be done right. Monitoring needs to be comprehensive and transparent, as there have been concerns expressed about the transparency of the project to date. Given the floods of recent years, there are concerns amongst some about the impacts on Iowa's hydrology from re-plumbing the landscape. Others have concerns about whether the wetlands really will remove the nitrates as touted. Some worry about the potential broader implementation beyond the pilot projects and the public costs of doing so.

Still other people are confident that combining drainage and wetlands is the key to economic and environmental concerns, but there is no proof either way yet. The many unanswered questions cannot be answered without on-the-ground trials, such as those that IDALS has proposed. With these pilots, enough time, and adequate monitoring, scientists may start to understand the costs and benefits of such an approach. Iowa must not develop any programs linking enhanced drainage and wetlands until there are credible answers to the many questions.

The amount of infrastructure under Iowa's cropland is enormous and growers will not take lightly the decision to invest in expensive upgrades. IDALS, the Legislature and others must not take lightly the decision to support or oppose these investments without carefully considering the environmental consequences. If these pilot studies achieve the results that many proponents expect, there will be a tremendous opportunity to use private dollars for economic and environmentally beneficial steps that would bolster farmers' bottom lines and significantly advance toward the goal of reducing nutrients headed down the Mississippi. To know if those economic and environmental benefits materialize, the pilot projects should be constructed and given enough time to determine what the results, expected or unexpected, are and what impact broader implementation across much of Iowa would have on farmers, fish, fields and flows. In the meantime, existing programs that are already working should receive full funding, and comprehensive, holistic nutrient reduction strategies need to be developed and implemented in the state.

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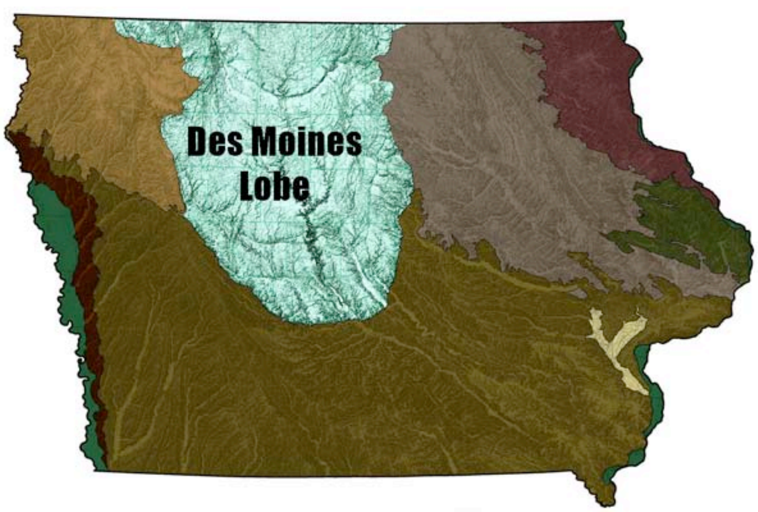
Introduction

In October 2010, the Iowa Department of Agriculture and Land Stewardship (IDALS) announced plans to develop a statewide nutrient reduction strategy.[1] This plan would likely include the use of cover crops, reduced tillage, improved timing of nutrient applications and nutrient-removal wetlands among other strategies developed to help achieve a Mississippi River Basin-wide goal of reducing nitrogen and phosphorus loads to the Gulf of Mexico by 45 percent.

One of these strategies — the nutrient-removal wetlands — deserves further examination because of the way IDALS has linked it to enhanced subsurface drainage, or tiling. Farmers throughout Iowa and particularly on the so-called Des Moines Lobe of north central Iowa (see Figure 1) commonly use subsurface drainage, or tiling, to drain wet spots and whole fields to increase crop yields and make field work easier. IDALS has proposed a pilot project — the "Iowa Drainage and Wetland Landscape Systems Initiative" (and referred to here as the Initiative, but known to many as the "Iowa Plan") — to test whether enhanced subsurface drainage main capacity in combination with wetlands will both help farmers and improve water quality in the Des Moines Lobe and downstream. While everyone recognizes the importance of agriculture to Iowa's economy and proclaims support for cleaning Iowa's water, many have questioned whether the marriage of enhanced subsurface drainage and wetlands will ultimately be good for Iowa's water quality. This report explores this idea.

Figure 1. Des Moines Lobe is Focus of Pilot Project



IDALS' Initiative is one that has received significant attention in the press, and rightly so. There are regional and national implications of the results of this pilot study and the EPA will be watching the results closely as it starts to focus more and more on improving the effectiveness of its nonpoint programs. The pilot projects offer a tremendous opportunity to learn whether the concept linking enhanced drainage capacity to wetlands creation can benefit both water quality and crop yields or whether there will be negative unintended consequences that make full scale implementation across Iowa a bad idea. The few Initiative pilot projects currently built, under construction or under contract negotiations need to, upon completion, be given adequate time to be comprehensively monitored in an open, transparent way so that supporters and critics will have access to the data that demonstrate whether the Initiative lives up to proponents' lofty expectations.

Background

Nutrient-laden runoff from farms is the biggest contributor to the Gulf of Mexico's "Dead Zone," where low oxygen levels occur during the summer annually and devastate fisheries and economies along the Louisiana coast.[2] Nitrogen and phosphorus applied to crops do increase yields, but if significant loads make it into waterways they are significant pollutants that harm water quality. The chemical characteristics of the various forms of nitrogen and phosphorus differ and thus the routes they take into Iowa waterways are different. So, too, are the management strategies to control them. Phosphorus attaches to soil and generally enters waterways through sediment carried by runoff whereas nitrogen (as nitrate) is more likely to enter waterways through subsurface pathways. This frequently means that a management technique that reduces one nutrient will not work for the other.

Agricultural drainage tile began to be installed in Iowa in the late 1800s at enormous cost. Some tout the total investment by Iowans into draining the landscape as almost equaling the cost of building the Panama Canal.[3] The economic gains from tiling are enormous. While there are many variables, many reported increases in corn yield from tiling exceed 20 percent, sometimes greatly.[4] Drainage tile works by rapidly moving soil water to streams or drainage ditches and results in lowering the water table. This, in turn, allows more water to infiltrate and flow through the soil, thus keeping soil from becoming waterlogged and improving plant growth. Because tiling increases subsurface drainage there is less water remaining on the surface of farm fields that would have been stored in temporary wetlands, evaporated, or flowed over land to rivers and streams before tiling. Overland flow would only occur when these closed depressions are filled with water and overflowed. The reduction in overland flow as a result of tiling can mean less soil and phosphorus entering streams. Total reductions in surface runoff can range from 30-60 percent while peak surface runoff can be reduced by 15-30 percent and sediment transport by up to 65 percent.[5] Tiling also works best in flatter landscapes and thus encourages row crop production in flatter, wetter areas such as the Des Moines Lobe, where many environmental impacts are smaller compared to the impacts often seen on steeper slopes.

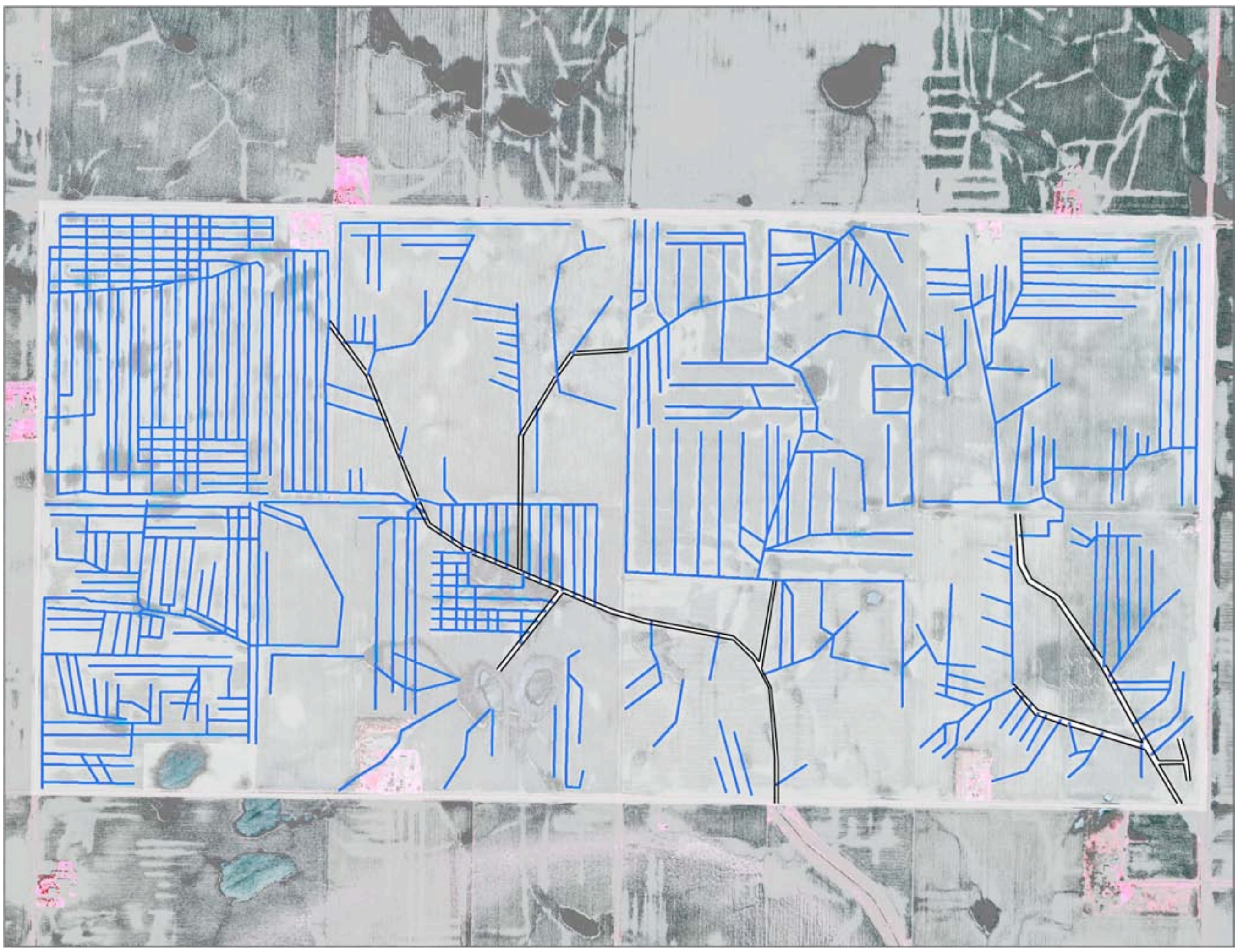
Tiling has its downsides as well. Over 100 years ago when farmers tiled and artificially drained their fields some 90 percent of Iowa's native wetlands were drained for agriculture and development.[6] The removal of Iowa's wetlands increased flooding, as wetlands were once able to store, absorb and slow the runoff from major storms. As tiling expanded across north central Iowa in the early 20th century, wetlands no longer stored water, and instead rainfall rapidly flowed to rivers and streams, and newly created drainage ditches.

Iowa's massive subsurface drainage infrastructure has been implicated in recent floods[7], but there is little evidence to support a linkage. Studies have shown that there is more streamflow now than there was in the 1950s and that this increase is mostly, but not entirely, a result of increased precipitation. Land use changes may be playing a supporting role.[8] There also is not statistical evidence that extreme flows in Iowa's rivers have increased despite the major flood events of the past few years.[9] Further, anecdotally there has been little expansion in the extent of subsurface drainage in Iowa since the middle part of the 20th century, meaning that tiling has had minimal impact on whatever streamflow changes that have occurred in past decades.

Wetlands also provided valuable habitat for a diversity of plants and animals and naturally treated water that flowed through them, removing excess nutrients and pollutants. Perhaps most notably tile lines provide a direct route for nitrate to enter waterways and thus tiling has been implicated as a prime contributor to nitrate pollution in the Gulf.[10] Because nitrate is water soluble it can move as a part of the water through the soil into tile lines, groundwater and ultimately, streams and rivers bound for the Gulf. The impacts of nitrogen pollution are not only felt in the Gulf. Removing nitrate from drinking water is costly for cities, such as Des Moines and the surrounding metropolitan area, but necessary as excess nitrate can cause health problems.[11]

The total amount of subsurface drainage in Iowa is poorly understood as there are no comprehensive records. The Iowa Drainage District Association estimates that more than 9 million acres, or almost 30 percent of Iowa farmland, are drained.[12] Figure 2, below, shows that almost 60 miles of drainage tile are estimated to underlie two square miles of Hamilton County, which is representative of much of the tile-drained parts of Iowa.

Figure 2. Almost 60 Miles of Drainage Tile Estimated in Two Sections of Hamilton County



A two-square-mile area in Hamilton County (T89N R26W, Sects 8,9) showing the hypothesized locations of public and private drainage tile.[13] Approximately 59 miles of tile are estimated to exist in the two sections.

The destruction of natural wetlands, increase in artificial drainage, and increase in nitrogen application to fields that now almost exclusively grow corn and soybeans all have combined to increase the amount of nitrogen in our water. Nitrogen fertilizer usage has leveled off, but Iowa rivers and streams still suffer from significant nutrient pollution. IDALS is pursuing a pilot project to increase artificial drainage capacity and then mitigate the expected increase in nitrate pollution by using constructed wetlands, which could remove nitrogen, at the outlets of the drainage tiles.

The Initiative

The IDALS Initiative was developed in cooperation with the ISU College of Agriculture, Iowa Drainage District Association and the Iowa Farm Bureau Federation. Its stated aims are to establish "at least" five new pilot sites with re-engineered "high drainage coefficient" systems and nitrate-removal wetlands.[14] These high drainage coefficient systems have a drainage capacity of at least 0.5 inches of water per day, significantly higher than the majority of existing drainage systems built before the mid-20th century, which generally have coefficients of less than 0.25 inches per day. The older, lower coefficient systems are believed to be inadequately sized to handle the needs of today's growers (who are now growing commodities such as corn and soybeans almost exclusively) and undersized for the type of heavy rain events that are becoming increasingly common as predicted under climate change modeling.[15]

Under the Initiative the increased drainage will be captured and treated at tile main outlets by treatment wetlands similar to those being built in central Iowa through the federal Conservation Reserve Enhancement Program (CREP) and monitored by researchers from various state and federal agencies. Each of these wetlands will capture and treat water coming from drainage areas of 500-2,000 acres. Although not yet tested in combination with expanded drainage, some data show that these treatment wetlands can significantly reduce nitrate loading to streams and rivers through the bacterial-driven process known as "denitrification."[16]

According to IDALS, the Initiative will achieve the following:

- A 40-70 percent reduction in nitrate transport to streams and rivers,
- A 50 percent reduction in phosphorus transport,
- A 50 percent reduction in surface runoff that contributes to flooding,
- A decrease in nitrous oxide greenhouse gas emissions,
- A 7-20 percent increase in crop yields, and
- Enhancements of wetland function, habitat and recreational opportunities.[17]

According to the draft work plan, up to 25 pilot sites will be established and compared to existing low drainage coefficient systems that already have wetlands associated with them. This will allow for studying the effectiveness of the increased drainage and wetlands and will help to answer questions related to hydrology, water quality, habitat, soils, greenhouse gases and crop yield.

Since the tile infrastructure in Iowa is, like much of our nation's infrastructure, many decades old and is perceived by many in the agriculture industry as inadequate for current needs, much of it will likely be replaced at great expense in coming years and decades, and the IDALS plan aims to capitalize upon that reality and redesign drainage systems to reduce nutrient loads and address other environmental goals. While little data about Iowa's drainage infrastructure exists, anecdotal evidence suggests systems are already starting to be rebuilt to higher-drainage coefficients. Current record-high crop prices and high land values mean that growers may now have the money to make expensive infrastructure investments.

The Initiative has been around in some form for several years and has been presented to the EPA's Hypoxia Task Force among other groups. One pilot site in Pocahontas County is complete and was dedicated by Secretary of Agriculture Bill Northey in late October 2010. It currently is being monitored by ISU researchers. Six more pilots are under construction and are anticipated to be completed in 2011. A total of $15 million of public and private dollars have been committed to these pilot projects.[18] At this point it appears that the initial proposal of up to 25 pilot sites will be scaled back to the current seven.

The Initiative's draft work plan includes a great deal of discussion about the monitoring, with detailed plans described for monitoring the changes in hydrology and water quality; the impacts on wildlife habitat, soil quality and quantity and crop yield; and how greenhouse gases would be affected. These various elements were developed and prioritized based on input from stakeholders with scientific expertise in a variety of fields and representing various agencies and organizations.

Analysis

This Initiative can serve as one starting point for addressing the water quality concerns that are largely due to what happens on (and under) Iowa farm fields. Clearly there is a need to take significant steps to keep excess nutrients out of Iowa's waters and a significant amount of data show that wetlands can do just that. But, is the pairing of increased drainage with the construction of engineered nutrient-removal wetlands the right approach? The idea has merit, but IDALS' approach poses significant concerns.

The positives

Much of Iowa's drainage infrastructure is old. If industrial row crop agriculture is going to continue to dominate in Iowa, then from a purely financial standpoint it makes sense for drainage infrastructure that maximizes production to be updated and upgraded. This drainage clearly has had an environmental impact so if there is some way to mitigate that ongoing (and potentially increased) damage through the development of treatment wetlands then that would be beneficial. This Initiative offers some potential for mitigation to occur. However, the question of who will bear the costs of the improved drainage is an important and unresolved policy question. Right now upgrades to larger subsurface drainage mains that would impact wetlands do require mitigation, and this mitigation is paid for through the drainage districts themselves, via assessments levied on district growers. In Iowa there are over 3,000 drainage districts. These quasi-governmental entities have the power to raise money in each district via assessments on growers, who would be the ones to benefit from enhanced drainage.

The initial pilot demonstration projects are being paid for through a variety of federal, state, local and private dollars. Assuming the pilots are successful and the program were to move beyond "pilot" status the marriage of drainage updates to treatment wetlands could theoretically be done without any public dollars; the profits resulting from the increasing yields enabled by investment in increased drainage capacity could be used to pay for the costs of constructing and maintaining the treatment wetlands through the taxes paid by farmers within individual drainage

Table 1. Roughly 16-Year Payback for Drainage Capacity Investment*

Acreage		1,000
Yield increase from increased drainage (%)		7.7
Base corn yield, w/o improved drainage (bu/ac)		160
Base soybean yield w/o improved drainage (bu/ac)		50
Corn price	$	3.10
Soybean price	$	7.41
Percent acreage in corn		65
Percent acreage in soybeans		35
Corn yield with improved drainage (bu/ac)		172.32
Soybean yield with improved drainage (bu/ac)		53.85
Annual increase in income	**$**	**34,809.78**
Cost per acre to upgrade drainage tile	$	550.00
Drainage maintenance costs ($/ac)	$	5.00
Years to reach simple payback		**15.94**

** Sample calculation for increase in income and simple payback for a hypothetical 1,000-acre farm from investing in increased drainage main capacity.*

districts. The details of such a process would need to be worked out as the upfront costs of building a wetland and updating drainage systems are substantial and the simple payback may not occur for over a decade depending upon yields, crop prices and maintenance costs. The cost of updating drainage lines is estimated at $550 per acre and the first-year costs of building CREP wetlands can range from $59,500 to $280,500.[19] Table 1 shows a sample calculation for the simple payback period for investing in increased drainage capacity.[20] It does not include the costs of constructing a treatment wetland, nor the potential environmental costs of accelerating drainage.

It must be noted that the above payback is relative to the status quo. If existing drainage is not functioning correctly then yield increases are likely to be much greater. Also, if farmers choose to replace existing drainage with tile of the same size then the cost would be smaller but there would be no yield benefit, unless the existing drainage was not functioning at full capacity. The payback period for upgrading to a new, larger drainage main capacity versus replacing existing drainage mains with undersized tile of the same size would be only two to three years on average, meaning that farmers who do make the sizable investment in new drainage systems will most likely choose to go with a higher drainage coefficient system.

The simple payback period is greatly affected by the yield increase from increased drainage. Systems that are functioning poorly and severely undersized may see much greater yield increases and much shorter payback periods. Commodity prices, too, play a significant role. At current commodity prices (especially corn at over $7/bushel) the simple payback may be less than eight years, half the time it would take based on a the average prices from the first decade of the 21st century.

Studies have shown that increasing subsurface drainage does reduce surface runoff.[21] One recent report shows the erosion caused by surface runoff in parts of the state is much worse than what had been previously reported.[22] While the tile-drained landscape of north-central Iowa is fairly flat with less risk of soil loss compared to more hilly parts of the state, there can still be erosion and nutrient loss associated with soil transport. As such, it is anticipated that this Initiative may reduce the amount of phosphorus, sediment and other contaminants that are transported into streams by runoff. On the other hand, converting some surface runoff to subsurface flow will increase the amount of nitrate flowing through drainage systems, which would have to be addressed, in this case through constructed wetlands.

Table 2. Greater Nitrate Reduction With Larger Wetlands — Hypothetical Example

	Subsurface flow (m/yr)	Surface runoff (m/yr)	Total flow (m/yr)	Nitrate export (kg/ha/yr)	Phosphorus export (kg/ha/yr)	Change in N export from low coefficient condition	Change in P export from low coefficient condition
Low coefficient system	0.213	0.038	0.25	31.9	0.625		
High coefficient system	0.231	0.019	0.25	34.7	0.312	8.8% increase	50% decrease
With 0.5% wetland	0.231	0.019	0.25	24.1	<0.312	24.3% decrease	>50% decrease
With 1.0% wetland	0.231	0.019	0.25	17.3	<0.312	45.8% decrease	>50% decrease
With 2.0% wetland	0.231	0.019	0.25	11	<0.312	65.6% decrease	>50% decrease

Table 2 above shows the theoretical changes that come about as a result of going from a small existing drainage main like those that exist across much of Iowa today to a larger size, neither of which drain into a wetland, and then simple calculations suggesting what would happen with constructed wetlands of three different sizes: 0.5, 1, and 2 percent of the drained area.[23] Surface runoff and the resulting phosphorus transport are decreased with enhanced drainage capacity but nitrate in the drainage tile is increased. Wetlands address the nitrate, and the larger the wetland the more nitrate is removed.

Finally, there are a lot of unanswered scientific questions surrounding wetlands and enhanced drainage. Among these are questions about the impacts on nitrogen and phosphorus delivery, habitat, hydrology, greenhouse gases, and crop yields. Through the data generated from the monitoring of the pilot projects, it is possible that scientists will have a better understanding of whether or not treatment wetlands really can do what many say they can.

The negatives

The fundamental concern with the Initiative is the enhancement of drainage. While subsurface drainage allows for the intensive cropping practices common to Iowa, it has eliminated huge amounts of wetlands and undoubtedly contributed to increases in treatment costs for drinking water locally, and increased the flux of nitrogen that reaches the Gulf of Mexico. As a result, any proposal to increase drainage may be viewed negatively by many who have felt these negative impacts. Tiling is not cheap; it is an enormous investment by growers and drainage districts and it lasts a long time. Investing in enhanced drainage would likely further cement the continuation of industrial row-crop agriculture in Iowa long into the future, when other forms of agriculture are believed to be much less environmentally destructive and more sustainable.[24] This Initiative may not necessarily drain more land or expand the acreage of corn and soybeans but it would allow tiled land to drain faster and more efficiently.

A second oft-raised concern is the potential changes in hydrology that this Initiative creates particularly with regard to flooding. Enhanced drainage allows more water to flow through the subsurface tiles which decreases the surface runoff volume and peak runoff rate, but has minimal impact on the total amount of water reaching rivers and streams.[25] As climate patterns change and the state sees more precipitation, especially in the form of larger and more severe storms earlier in the year as many models predict, anything that might add more water to a river or stream is clearly undesirable. The few pilot projects themselves are very unlikely to contribute to large scale flooding. Even full-scale implementation across Iowa is not likely to increase the occurrence of flooding, as most researchers agree that the severe large-scale flooding that occurred in 1993, 2008 and again in 2010 in parts of Iowa occurred when the ground became completely saturated following extreme rainfall events, and tiling would have had negligible impact as the tiles are flowing at capacity already at those times. Still, at watershed scales, floods are complex phenomena and changes on (and under) the land can and do impact hydrology. For example, there is evidence that the intensification of agriculture, which is partly enabled by subsurface drainage, in Iowa since the middle 20th century has contributed to an increase in baseflow to some Iowa rivers.[26] Any attempts to re-plumb parts of Iowa with bigger pipes need to be done with caution, and should be backed up with modeling results or monitoring data that demonstrate that increased drainage capacity will not impact communities downstream.

A third issue is the degree to which the treatment wetlands actually remove nitrogen from the drainage. On average the greatest volume of water flowing through drainage tiles occurs during the months of April, May and June, when snowmelt combines with spring rains.[27] This is when the greatest nitrate load enters surface waters. This means, too, that wetland water levels are at their highest. But at this time the biological activity that removes the nitrogen is not at its peak, which is reached during July and August when temperatures are at their maximum.[28] There is clear scientific evidence of substantial denitrification in wetlands, but the extent to which it occurs is highly variable. If these nutrient-removal wetlands were constructed to increase the length of time the water spent in the wetland (retention time), and if the nitrates predominantly entered the wetlands in July and August the denitrification that occurs within these wetlands would be further increased. Still, despite the timing of the nutrient loading and the minimal retention time, measured denitrification rates show that these type of wetlands do remove nitrate at the same rate in the months of April, May and June as they do for the year as a whole.[29]

Another issue is with the constructed wetlands themselves. These wetlands are designed and built to meet the same specifications as those built for Iowa's Conservation Reserve Enhancement Program (CREP). Like the CREP wetlands the IDALS Initiative wetlands would be newly constructed rather than restored (though the question about what a "restored" wetland is can get murky) and are located at the outlet of existing drainage mains.[30] It is unknown at this time just what the ecological benefits of the constructed CREP-type wetlands are and how those are different from the in-field, seasonal wetlands that still exist in place across Iowa. Research is under way to answer these questions.

The CREP wetlands are expensive; engineering, construction and easement costs can total more than $280,000.[31] Furthermore there is not a good understanding of the ecological value of either the CREP-style constructed wetlands or the farmed wetlands that appear intermittently during wet periods and are believed to serve an important role for migrating waterfowl. These in-field wetlands could become even less common as drainage capacity increased. Without a firm understanding of the habitat and ecological value of either type of wetland, favoring one at the expense of the other seems premature.

There are many government and private programs to help protect soil and water on agricultural lands. Wetlands are just one of the tools in the toolbox and it remains to be seen what a broader implementation of enhanced drainage and wetlands would mean for some programs like the popular Wetlands Reserve Program. Furthermore, moving toward a reliance on nutrient removal wetlands continues the current scattershot approach to conservation programs. Improvement projects are largely done in isolation (e.g. buffers here, conservation tillage there, wetlands over here and cover crops over there) as funding and programs permit and growers choose to participate. Voluntary programs are not necessarily bad, but by their nature only those farmers who want to participate do participate. As such, certain watersheds or sub-watersheds that are more critical from a water quality perspective may not get the protection they need because the landowners there opt not to participate.

Another source of frustration expressed by staff of organizations and agencies such as Des Moines Water Works is the lack of detail in IDALS' Initiative and the fact that little about the plan has been put in writing aside from the "Draft Work Plan" that was released for public comment during the summer of 2010. It is difficult to evaluate something when details are limited, and in many cases are only disseminated in oral presentations, rather than in writing. In many early documents IDALS referred to an "initial" set of "up to" 25 pilot studies. This wording worried many, who felt 25 pilots far exceeded "pilot" status and that "initial" implied that more were going to be built regardless of the results. At this point IDALS seems to have settled on far fewer pilots based on funding limitations and landowner interest. It is also interesting to note that over time the word drainage has become less prominent in IDALS material and in some cases now the agency refers to it as the Iowa Wetland Landscape Systems Initiative instead of the Iowa Drainage and Wetland Landscape Systems Initiative. It seems IDALS has deemphasized the drainage component over time.

At this point it appears that funding for monitoring will be limited and that a variety of entities including the USGS, EPA, university researchers and others will have to coordinate the collection and sharing of monitoring data. It is very unfortunate that monitoring will be limited and that direct monitoring of conditions before the enhanced drainage and wetlands are installed is not being done as the ability to determine how effective this Initiative truly is will be severely compromised without knowing the antecedent conditions at each site, and there would be an enormous opportunity to learn a great deal about the role of wetlands. Plus, this Initiative is being touted as a way to remove excess nutrients in tile-drained areas across the Corn Belt and there are high hopes for the Initiative. Still, with proper coordination, sharing and transparency, the monitoring that does occur with the limited funding will provide some information about the effectiveness of the Initiative. Without a robust, transparent monitoring plan we will not know whether the concept works or not. We will also not know what unintended consequences, positive or negative, there may be.

There is not a consensus that the concept behind IDALS' Initiative is a good one. Staff in various agencies and at a variety of non-governmental organizations expressed serious concerns with the approach. One group — Des Moines Water Works, which provides drinking water to 500,000 customers in the Des Moines metropolitan area, and has had to make expensive infrastructure investments to remove nitrates — has been the most vocal opposition to it, especially to the concept of broad, landscape-scale implementation.

Discussion

It is necessary to differentiate between the pilot studies that occur as a part of this Initiative and the potential implementation across the tile-drained landscapes of the Corn Belt. It would be foolish to move toward full implementation across Iowa and elsewhere in the Midwest until the scientific questions are resolved about how effective the marriage of increased drainage capacity to nutrient removal wetlands really is. Those who hear about the "Iowa Plan" and envision full implementation across the state justifiably have concerns about it. At this point, however, it is simply a pilot study of a few sites in Iowa.

As stated earlier there are lots of unanswered scientific questions. To get at those answers the pilot projects need to be transparently and comprehensively monitored. One pilot is built and more are expected to be completed in 2011. It may take five years or more before there are sufficient data. Given the unknowns, no more taxpayer dollars should be spent facilitating an increase in drainage and no more pilots constructed until the pilots that are already built or under contract to be constructed have been thoroughly studied. It is very unfortunate that no antecedent monitoring was done at the pilot sites to determine baseline conditions. Without that, it becomes more difficult to know what the effects of the increased drainage and wetlands actually are. Modeling and data that compare other sites can supply some of those answers, but the variability inherent in any natural system makes analyzing results difficult. Furthermore, no clear definitions exist for what would make the pilots "successes" or "failures," or indicate when more data are needed. A project that increased yields, decreased nutrient and sediment losses and provided habitat all while not adding to flooding problems clearly would be a success, but it becomes much less obvious if yields are increased but so, too, are nitrate loads. IDALS should use its claims for the Initiative (listed on page 4) and develop an a priori set of determinants of success. While IDALS may not be the final arbiter of the success of the pilot projects, it would be useful to have a set of numeric criteria by which to evaluate the data and to guide decision-makers who are deciding whether to push for a landscape-scale implementation down the road.

Maybe five years of monitoring will demonstrate definitively that enhanced drainage combined with treatment wetlands increases yields and reduces water contaminants reaching Iowa waterways, but it may not be that simple and there may have to be a weighing of the benefits and consequences before determining whether to move forward with further projects. Also, with the very limited monitoring that seems likely to occur, scientists may not be able to get at the answers and may not know with any degree of certainty just how effective the construction of nutrient-removal wetlands across the Des Moines Lobe is for improving water quality. It would be a terrible waste of taxpayer dollars if these wetlands were to be constructed and provided little data upon which to judge any future expansion of this type of program.

Given all the question marks surrounding IDALS' Initiative, the agency should slow down and allow the remaining pilots to be completed but not start any more. These pilots need to be given adequate time for monitoring and for rigorous scientific conclusions to be drawn. IDALS, along with cooperating scientists from other agencies, should determine what results would have to be achieved to justify the expansion of the Initiative beyond the pilots and what results would indicate that the Initiative should be scrapped. This will, of course, ultimately be a political decision, but the team of scientists working together on monitoring should develop the metrics for success and failure.

In the meantime, the CREP wetlands should receive increased funding as they have been shown, in the absence of enhanced drainage, to remove significant amounts of nitrogen. Other conservation programs need to continue to receive funding as well, as many have waiting lists that indicate significant interest on the part of farmers. The 2010 passage of the Iowa Water and Land Legacy Amendment with 63 percent of the vote also indicates that Iowans want action that improves our soil and water.

Iowans are unlikely to support a program that spends public dollars with small positive or perhaps negative environmental effects. Iowans should also not allow private investment in drainage that does not also include effective mitigation of the downstream impacts, especially as concern over Gulf of Mexico hypoxia becomes an increasingly important driver in guiding national nonpoint source strategies. Iowa's CREP has proven effective, but marrying increased drainage capacity to CREP wetlands is thus far untested. At this point the onus is on IDALS to prove that increased capacity across north central Iowa will not negatively impact (or will benefit) water quality, water quantity, wildlife habitat or other environmental indicators. Such a demonstration could take years and would require significant investments in monitoring at the pilot sites. IDALS also should add significant detail and update its plans to be better understood by outside agencies, organizations and individuals. This could be done perhaps through a series of FAQ sheets available on a public Initiative website that also includes updates on performance criteria and the spending of public monies. In the meantime, IDALS must continue to focus on other ways of reducing the environmental impacts of Iowa's agriculture industry.

It seems there are two ends to the spectrum on this debate. Many environmental advocates would love to see no increase in drainage projects but also greater conservation practices, including wetlands, all across the landscape to improve water quality. Many growers would love to see the capacity of their drainage increased and not have to sacrifice any acres currently under production in order to build wetlands. Right now farmers can invest in increasing their capacity, and with current crop prices and farmland values they might start making those expensive investments. Creating a mechanism that expressly marries increased drainage capacity and wetlands might be a necessary compromise. At this point nobody really knows if enhanced drainage and water-quality improvements really can coexist, but with adequate monitoring the answer might present itself in a few years. Until then, there will be significant skepticism about IDALS' Initiative and its benefits for Iowans.

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[2] http://water.usgs.gov/nawqa/sparrow/gulf_findings/primary_sources.html and http://www.gulfhypoxia.net/Overview/

[3] http://query.nytimes.com/mem/archive-free/pdf?res=F2071EFF345D16738DDDAA0A94D1405B808DF1D3

[4] http://farmindustrynews.com/subsurface-drainage-pays-big-dividends

[5] NRCS. 2001. National Engineering Handbook. Engineering Field Handbook. Part 650. Chapter 14 – Water Management. Available http://www.bae.ncsu.edu/www3/pe/references/EFH/EFH-Ch14%20Drainage.pdf

[6] http://www.ia.nrcs.usda.gov/news/brochures/RestoringWetlands.html

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[11] http://www.extension.iastate.edu/publications/edc232c.pdf

[12] http://www.iowadrainage.org/Facts.html

[13] Courtesy of Andy Asell, Iowa DNR. The aerial image was taken in April 2007.
[14] Iowa Drainage & Wetland Landscape Systems Initiative Draft Work Plan
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[18] In IDALS' March comments to NRCS regarding proposed wetland mitigation ratios. According to this landowners would pay $7.11 million and public cost share dollars would total $7.89 million. http://www.epa.gov/ocempage/frrcc/pdf/2010_iowa_funded_conservation_programs_and_initiatives.pdf
[19] Drainage cost estimate from Dr. Matt Helmers (ISU), personal communication. Wetland cost estimate from "Economics of CREP/CRP Treatment Wetlands for the Tile Drained Cropland in the Cornbelt" Available http://www.fsa.usda.gov/Internet/FSA_File/hyberg_iowa_wetlands.pdf
[20] The 7.7 percent increase in yield is based on an average from a variety of research and is the figure used in IDALS presentations. Crop prices are based on the data from the National Agricultural Statistics Service (NASS) from 2001-2010. At current commodity prices as of the release of this report the payback period drops below eight years.
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[22] http://www.ewg.org/losingground/
[23] Calculations and modeling were done by Iowa State University researcher Bill Crumpton. Assumptions that go into the calculations include 1) 25cm of annual runoff, 2) 15 percent of runoff is surface and 85 percent subsurface, 3) 15 mg of NO3-N in tile flow and 4) high coefficient drainage reduce surface runoff by 50 percent.
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[29] Data to be published in IDALS' 2010 annual report on Agricultural Drainage Research. Data was obtained from Bill Crumpton, ISU.
[30] Some argue that the CREP wetlands (and the IDALS Initiative wetlands are "restored" since they are build on hydric soils, which are formed by wetlands. Other scientists are resistant to calling these wetlands restored.
[31] Wetland cost estimate from "Economics of CREP/CRP Treatment Wetlands for the Tile Drained Cropland in the Cornbelt" Available http://www.fsa.usda.gov/Internet/FSA_File/hyberg_iowa_wetlands.pdf