Isolating the Economic Values of Prairie Reconstruction, Restoration, and Management in Iowa

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Introduction

There is interest among many in Iowa in maintaining, restoring, and reconstructing native prairies. This work is being done by individuals, by organizations, and by state and federal governments. Major institutions include the Iowa Departments of Transportation and of Natural Resources, the Farm Service Agency, the various county conservation boards in Iowa, the Nature Conservancy, and the Neil Smith National Wildlife Refuge. This study estimates some of the overall economic values associated with prairie reconstruction in Iowa.

There are several dimensions to prairie reconstruction and restoration. A large portion of the effort in Iowa involves low to medium quality reconstructions – reconstruction that only involves a limited diversity of plant types. To date, approximately 57,000 acres fit into this category. The Iowa Department of Transportation, the Department of Natural Resources, and the county conservation boards account for slightly more than half of these acres, with the remainder divided between individuals and the Native Roadside Vegetation Center at UNI and its activities.

High quality, high diversity reconstruction is currently evident on about 7,100 acres in Iowa. This kind of reconstruction may include as many 150 species. Most of this higher value reconstruction, 56 percent or more, is found on private land, but a large and growing fraction is located in the Neil Smith National Wildlife Refuge. In addition to these acres, there are currently 22,000 acres in the state that have been restored to prairie condition or are virgin prairies that are managed and maintained.

This short report attempts to quantify the economic values of these activities so that the overall worth of prairie reconstruction and restoration in Iowa can be identified. The mechanism for this assessment is an input-output model of the Iowa economy. The model, which is maintained at Iowa State University, allows us to estimate inter-industry

transactions based on an accounting of the amount and kind of purchases and sales that Iowa industries make.

Step 1: Background Data and Output Estimates

A necessary first step in input-output analysis is to gather as much data as possible about the activity that we are attempting to measure. It is often disturbing to groups when an activity that they care passionately about is reduced to sets of commodity purchases, but unless we account for the kinds and costs of inputs, we cannot isolate linkages to the rest of the economy.

The initial and most important question we faced was how to value an acre of low/medium reconstruction and an acre of high quality reconstruction. To do that we had to consider several factors, among which were the costs of

- Land
- Seed
- Herbicides and other chemicals
- Machinery and equipment
- Labor

We also needed to know the extent of reconstruction and restoration in the state to get an idea of the total economic value of prairie reconstruction in the state. Data provided by Jim Netwig demonstrated that there is a range of listed costs per acre (excluding land) across individuals. At the lower end costs were reported at $30 per acre, and at the high end was a claim of $2,000 per acre annually. The number of species represented ranged from 15 to 360. As the seed costs (and other costs) varied so widely across respondents and the extent of species diversity also ranged greatly, average seed costs for a low to mid quality reconstruction and for a high quality reconstruction were determined. Costs per acre for the lower quality reconstruction were set at $400 per acre, while those for the high quality reconstruction were placed at $1,500.

Separate calculations were made for the state's 22,000 restored or managed prairies. These acres, too, have value, both aesthetically and economically. The owners of these acres make annual investments in the health of these tracts requiring labor, time, herbicides, cutting, and burning. Most of this land is maintained primarily for its "prairie" value and has use primarily to the owners as a discretionary purchase. Still, we can measure the value of this land-owner spending choice annually.

To arrive at prairie reconstruction and restoration production costs, we relied on an ISU Cooperative Extension bulletin, "Estimated Costs of Pasture and Hay Production (November 2000)," for estimates of average machinery, land, chemical, and labor costs. The input values per acre were determined considering all initial costs per acre as well as all annual costs per acre.* Adjustments were made in machinery and labor values to reflect the need for more intensive management of reconstructed prairie lands than would be the case for, say, pasture land or hay production.

Table 1. Major Input Costs* Per Reconstructed Acre

	Hi Quality	Low Quality
Machinery	35.97	18.02
Burn	8.00	-
Seed	91.96	26.45
Labor	36.91	12.98
Herbicide	0.77	0.83
Land	40.00	20.00
Total	213.60	78.27

* Portions of these costs reflect the amortized values of initial costs

Now that we have isolated input values, we apply them to the number of acres currently managed. Those values are found in Table 2. The 7,100 acres of high quality reconstructed acres in Iowa have an annual output value of $1.517 million. The 56,700 acres of low quality reconstructed acres have an output value of $4.438 million. The total current output value of the reconstructed acres is almost $6 million.

In Table 2 we have also compiled an estimate of the current output value of the restored and managed prairies. We estimated that the likely annual value per acre of maintaining these acres is $27.26. Most of the value of this maintenance is the amortized value of the land (the opportunity cost), plus labor, herbicides, chemicals, and machinery. That value times 22,000 acres yields an output value for this activity of $599,720 annually. The sum of the reconstructed and the restored and managed land estimated output is $6.55 million.

* The value of the initial costs have been amortized and added to the annual costs.

Table 2. Estimated Output Values for Reconstructed, Restored, and Managed Acres

	Acres	Annual Output
Hi Quality Reconstructed	7,100	$ 1,516,583
Low Quality Reconstsructed	56,700	$ 4,438,156
Total Reconstructed	63,800	$ 5,954,739
Restored and Managed Prairie*	22,000	$ 599,720
Reconstructed, Restored, and Managed Total	85,800	$ 6,554,459

* Based on a per acre annual cost of $27.90

Normally when we measure industrial output we are measuring a tangible good for sale or the value of a distinct public good. Much of the reconstructed prairie, along with the restored and managed land, in Iowa is simply held and managed by private landowners for their own purposes – it is not, therefore, transacted or otherwise consumed in the market. Some of the reconstructed prairie is managed for the production of seed for the express purpose of generating income. Still other reconstructed land is maintained by public institutions for roadways, parks, and natural spaces and represent a choice of a public good. Consequently, the "output" value of this activity is the sum of the annualized costs paid by landowners, the public, and those who produce seeds and maintain prairies for profit.[*]

Step 2: Estimating Total Economic Effects of Prairie Reconstruction, Restoration, and of Prairie Management

When we compiled our estimation of the costs of production of reconstructed and restored prairies in Iowa we are also acknowledging linkages to the remainder of the Iowa economy. There are machinery inputs, land and land management inputs, labor inputs, and agri-chemicals. There are additional linkages to seed producers from Iowa and from outside of the state. We also know that all of these linkages might involve financing and insurance inputs, so linkages to banks and to insurance firms need to be assumed. We know, too, that machines require fuels and lubricants, so appropriate linkages to those sectors are assumed.

These data sources are the backbone of input-output modeling, the kind of estimation applied to this situation. Input-output modeling (I-O) is an intricate and data intensive system of linking the production relationships that industries have with each other. The models that we create are an inter-industrial accounting of the goods, commodities, and

[*] Recalling our economics, we remember that a normal return on investment counts as a production cost.

services that all industries in Iowa produce and the goods, commodities, and services that they require to produce their products. As production in one sector requires inputs from another, we identify a linkage. The strength of that linkage helps us to understand the potential importance of that set of transactions to the whole economy. We use the term "multiplier" as an indexed measure of the relationship of the whole economy to the economic activity that we are studying.

There are three kinds of effects that we scrutinize: the indirect, the induced, and the total effects. The first measures the total demand that the industry that we are studying places on goods and service producing industries in our study area (in this instance the state of Iowa). The second assumes that the productivity in the direct sector (prairie reconstruction) and the indirect sectors (those supplying goods and services to the prairie reconstruction activities) induce spending by workers. The sum, therefore, of the direct, indirect, and the induced worker spending gives us the total economic effects.

These measures of economic effects are often used to imply causality, but we are careful to distinguish between production designed for local or regional consumption and production designed to produce export sales. When a landowner reconstructs or restores a parcel of land for no other purpose than personal enjoyment, then those costs become discretionary household spending, which may or may not enhance the value of his or her property, ultimately. When a public entity restores or reconstructs roadways to a more natural prairie setting, these costs fit into the category of discretionary public costs. They represent the purchase of one kind of public good or amenity versus all other uses for which the money could have been used. The point is that there is not new economic activity being stimulated statewide; rather, private and public spending preferences are being articulated and subsumed within the existing economic structure. When production of reconstructed prairies is intended for either seed production or for the purpose of stimulating cultural, environmental, or recreational uses then we can isolate *potential* new economic activity to a region. Those activities could create spending that otherwise might not have occurred in the region; consequently, they import dollars from outside of the region.

We modified the original model to contain a "prairie" sector containing the production inputs that we summarized in compiling Tables 1, and we "shocked" that model by the values contained in Table 2 so see what kinds of economic effects accrued for the restored prairies. We added another scenario considering the 22,000 acres or restored and managed land and added them to the findings for the reconstructed acreds. The findings are reported in Table 3, within which we report four kinds of economic information:

- *Industrial output*, or just output, measures the value of the product or good that we are measuring. In the private sector it is measured by sales. In the public sector it is measured by the amount of public spending required to produce the good.
- *Labor income* is the earnings that accrue through salaries and wages to workers. It also includes normal returns to sole proprietors.
- *Value added* includes labor income above, along with payments made to investors (dividends, interest payments, and rents) and payments made for indirect tax payments to state and local governments (usually sales and excise taxes).
- *Jobs* are the last measure. They represent the number of positions in an industry. Some industries produce full-time, full-year jobs, primarily. Others rely on part-time and seasonal employment. The kind of job, therefore, varies by industry.

Table 3. Prairie Reconstruction, Restoration, and Managment Economic Values

	Direct	Indirect	Induced	Total	Total Multiplier
Output	6,554,457	2,103,070	962,109	9,619,635	1.47
Labor Income	1,076,617	613,990	349,640	2,040,247	1.90
Value Added	1,348,648	894,571	399,468	2,642,687	1.96
Jobs	296.2	19.6	15.4	331.0	1.12

We have estimated that all of the prairie reconstruction, restoration, and management that has been undertaken yields a combined public and private sector annual output value of $6.55 million, requires $1.08 million in labor income, is responsible for $1.35 million in total value added, and requires the equivalent of 296 jobs annually. When we factor in indirect and induced outcomes we find that $9.62 million in statewide private and public industrial output, $2.04 million in labor incomes, $2.64 million in value added (of which labor income is already a component), and 331 jobs in Iowa are attributable to the reconstruction, restoration, and maintenance of native prairies.

We have also listed total multipliers in Table 3. A multiplier is a measure of the relationship of the total economy to the economic activity that we are studying. It measures how much of the total economy is influenced by a unit change in the activity that we are scrutinizing. The output multiplier of 1.47 means that for every dollar's worth of output in prairie reconstruction, an additional $.47 in output was supported or required in the rest of the state economy. The labor income multiplier of 1.9 means that for every dollars worth of labor income generated directly in the prairie reconstruction sector, $.90 is supported in the rest of the economy. And the jobs multiplier of 1.12 means that for every job equivalent in the prairie sector, $12/100^{ths}$ of an additional job is sustained elsewhere in the economy. The jobs multiplier is low because the estimate of jobs in prairie reconstruction, the direct value, is very high.

Step 4: Estimating Total Economic Effects of Nature Enterprises

There is also interest in Iowa in developing what we are terming "nature enterprises" in the state. A prime example is the Neil Smith National Wildlife Refuge located in central Iowa, which will eventually contain 8,654 acres of prairie, savanna, and wetland. This center had nearly 200,000 visitors in fiscal 2001 and had an annual operating budget of $1.1 million. The center has many elements and many attractions, the natural prairie counting as one of them.

The Neil Smith National Wildlife Refuge represents just one kind of nature enterprise. There are many other possibilities in the state, most of which would be of a much lesser scale in size, funding, and diversity. Nevertheless, these types of enterprises are important components of local economies. As Iowa is not a destination state for its natural resources and amenities, the potential for statewide economic impacts due to out-of-state visitorship are very small. The potential for localized benefits are, however, very real.

Table 4 was constructed considering the annual budgets of several public nature enterprises in Iowa to help to give us an idea of their average expected economic effects. The data have been indexed to a per-$1,000,000 in output level so that they can be scaled up or down depending on the size of the enterprise. For example, if the Neil Smith National Wildlife Refuge 2001 annual budget of $1.1 million were used we would multiply all of the values in Table 4 by 1.1. If another enterprise had an annual operating budget of $.3 million, we would multiply all of the economic values in Table 4 by .3, and so on.

Table 4. Nature Enterprises Economic Values Per Million Dollars of Output

	Direct	Indirect	Induced	Total	Total Multiplier
Output	1,000,000	190,187	282,892	1,473,079	1.47
Labor Income	427,697	69,520	102,928	600,145	1.40
Value Added	700,279	107,666	174,458	982,403	1.40
Jobs	23.3	2.8	4.5	30.7	1.32

Given the operational cost configuration of nature enterprises in Iowa, we would expect total local economic output per million dollars in direct output in the enterprise to be $1.473 million. In producing that $1.473 million in output, $.6 million in labor incomes would be sustained, $.98 million in value added (which already contains labor income), and nearly 31 jobs would be supported.

Step 5: Visitor Effects

When any public or private enterprise entices visitorship to an area that otherwise would not have occurred, we can compile the economic impact of those visitors. The kinds of visitors and the kinds of spending that they do depend on the destination, the activities involved, and the types of people doing the visiting. Visitors to a metropolitan area have different spending opportunities than visitors to a nature enterprise. Over the years we have compiled expected visitor spending indices based on the kind of event visited. These indices are informed by trade studies and by on-site surveys.

Table 5 gives us an idea of the potential visitor economic impacts that would accrue to a county, for example, due to the presence of a nature enterprise that attracted new visitors to the area. These values are indexed to a per 10,000 visitors level to allow for scaling depending on the enterprise. If visitorship to the Neil Smith National Wildlife Refuge in fiscal 2001, for example, was 150,000, then we would multiply all of the economic values in the table by 15 to estimate the expected visitor economic impacts to the area. If another area averaged 25,000 out-of-county visitors annually, then we would multiply these values by 2.5, and so on.

Table 5. Expected Localized Visitor Economic Impacts Per 10,000 Out-of-County Visitors

	Direct	Indirect	Induced	Total	Total Multiplier
Output	79,418	18,497	27,811	125,726	1.58
Labor Income	33,610	6,752	10,572	50,934	1.52
Value Added	50,967	11,045	18,037	80,049	1.57
Jobs	2.8	0.2	0.4	3.5	1.24

Per 10,000 out-of-county visitors, we expect just under $80,000 in direct output (purchases) as the visitors consume necessary goods and services while in the area. These might be fuel, food, and other retail and service goods. Those purchases would support $33,610 in total labor incomes and nearly 3 jobs. When we account for inputs purchases (the indirect effects) and household consumption (the induced effects) we find that per 10,000 visitors, a region can expect $126,000 in total industrial output (sales), nearly $51,000 in labor income locally, and 3.5 jobs.

Conclusions and Observations

The preceding analyses help us to understand some of the economic dimensions to prairie reconstruction in Iowa and the promotion of visitorship and special areas for enjoying these prairies. Precious little of this activity, however, fits into the category of “economic impact” where discernible net growth in regional economic activity is attributable to prairie

reconstruction. The values measured, in the main, are termed economic effects as we cannot determine the amount of net gains in regional or statewide industrial output that are directly caused by prairie reconstruction, restoration, and management considering all other uses to which land, labor, and capital could be put. In addition, much of the reconstruction occurring in Iowa is being done on public lands, which simply represents a policy choice in the allocation of public resources as opposed to all other uses to which those resources could be put.

Taking a broader, long term view, all of this effort over time enhances the state's natural heritage and resource base, which counts as an amenity that adds value perceived and real to the state's economy and its public resources.

There are elements of prairie reconstruction, restoration, and management requiring specialized inputs. Quality seed production is a growing component of this industry, as also I suspect is the specialized labor required to maintain and manage reconstructed prairies. The actual output of the prairie seed industry in the state is, however, unknown and has been subsumed and assumed within the values listed in Table 3. It might be interesting in the future to conduct a more thorough study of that particular industry to better understand its production characteristics and the value of its output.