Well-managed perennial pasture: Setting the gold standard for ecosystem services

The goal of ecosystem service markets is to incentivize agricultural practices that purify air and water, build soils, retain nutrients, support pollinators, recycle wastes, build soils, recharge groundwater, mitigate droughts and floods, and help stabilize climate. One significant shortcoming is that most current markets pay for changes in farming practices, while the technology needed to measure outcomes is in formative stages and many of these markets do not verify results.

The rapidly evolving market for carbon credits is an example of these ecosystem service markets, with farmers and landowners receiving payments for practices aimed at stabilizing climate by accumulating and storing carbon in soil. The effectiveness of various agricultural practices in delivering this and other ecosystem services is currently the focus of intense research and discussion, as is the appropriate monetary value of the services delivered. The single most effective agricultural practice for delivering an array of ecosystem services while returning a sustainable income to farmers is managed grazing of perennial pastures (see box next page).

Well-managed pastures provide superior ecosystem services

Ecosystem services provided by well-managed pastures include clean water, flood reduction, biodiversity, soil retention, and soil carbon storage resulting from continuous living vegetation cover and improved soil health (refs. 2, 8, 10, 16, 29, 31). **Table 1** compares estimates of multiple ecosystem services provided by managed grazing and annual cropping systems with and without cover crops for a typical farm in central Wisconsin.

Table 1. Estimated ecosystem service values provided by three agricultural systems typical of Wisconsin.

Ecosystem process (ecosystem service)	**Units**	**Corn-Soy (tilled, no cover crop)**	**Corn-Soy (no-till & cover crop)**	**Pasture (managed grazing)**	**References**
Soil carbon stored (climate stabilization)	tons CO_{2eq}/ac/yr	-1.03[a]	.74[b] + 0.25[c] = 0.99	5.3[d]	18[b], 28[c] 27[a], 30[d]
Soil erosion (water quality)	lb soil/ac/yr	4200	3000	0	26
Phosphorus runoff (water quality)	lb P/ac/yr	2.0	1.5	0.2	26
Nitrate loss (water quality)	lb N/ac/yr	28.6[a]	18.0[b]	8.9[c]	5[b], 14[a], 16[c]
Storm runoff (flood reduction)	in. H_2O from a 5-in rain in 24 h	3.3	2.8	2.1	6
Grassland bird habitat (biodiversity)	nesting pairs/ac	0.04[a]	0.2[a]	2.6[b]	1[a], 32[b]
Pollinator habitat (biodiversity)	0 (poor) to 10 (best)	1.5	1.5 – 2.5	5.0 – 6.0	7, 9, 17, 20, 21, 22, 25, 34

Profitability of livestock systems incorporating managed grazing

Livestock raised on well-managed pastures not only deliver superior ecosystem services, but also can be more profitable. Economic data in **Table 2** were collected on a per-acre basis for crop systems and on a per-cow basis for livestock systems (33). A typical dairy farm in the region averages 138 cows and 453 acres or approximately 3.3 acres per cow (24). Per-acre income estimates for livestock systems were calculated by dividing per-cow annual income estimates for managed grazing ($510) and confinement ($355) by average acres per cow. Income was higher with both dairy systems compared to annual corn-soy production. Federal payments and crop insurance subsidies deter both crop and livestock farmers from taking land out of corn and soybean production by significantly reducing the financial risk associated with producing these crops.

Table 2. Average income (2016-2020) of annual cropping systems and dairy operations in Wisconsin, Illinois, and Minnesota. Data compiled from the University of Minnesota's Center for Farm Financial Management farm financials database (FINPACK, ref. 33).

Income Source	Corn-Soy, conventional	Corn-Soy, no-till w/cover crops	Managed grazing dairy	Confinement dairy
Net income from farm operations (w/o federal payments or crop insurance)	$40.27/ac/yr	$45.50/ac/yr	$155.16/ac/yr	$107.93/ac/yr
Federal payments and crop insurance	$34.79/ac/yr (corn) $27.82/ac/yr (s0y)	$48.53/ac/yr (corn) $26.47/ac/yr (soy)	$34.03/ac/yr (all crops)	$42.79/ac/yr (all crops)

Ecosystem services valuation

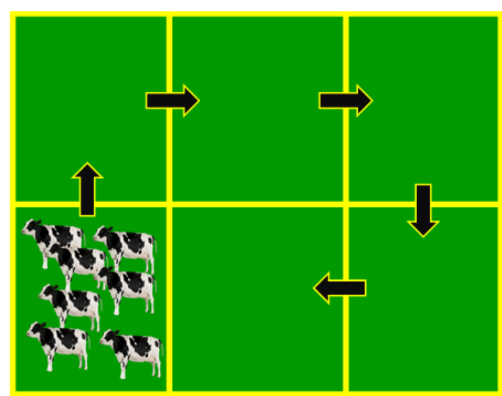
A variety of means are used to establish the economic value of each ecosystem service (3, 12, 19, 23). The value to society is different from what the market is willing to pay or currently paying (**Table 3**). National carbon markets are being established by private companies, governments, and non-profits and are currently highly variable. Local and regional markets for phosphorus, water quality trading, and wetland mitigation have been in existence since the 1980s. Markets for biodiversity, flood control and other ecosystem services are yet to be established. Current payment ranges are listed in the table below and are subject to change. For several of these ecosystem services, neither valuations nor markets are established.

Table 3. Estimated value and current payment rates for ecosystem services.

Ecosystem process	Estimated value to society	Current payment	Refs.
Soil carbon storage	\$52/ton $CO_{2\ eq}$	$10-$30/ac	15
Soil retention	$3.78/ton soil	none	13
Phosphorus retention	$29/lb P	$30-$90/lb	35
Nitrate retention	$0.36/lb N	none	11
Storm runoff & flood reduction	?	none	
Grassland bird habitat (biodiversity)	?	none	
Pollinator habitat	?	none	

What is managed grazing?

- On a typical grazing farm, 100 acres of annual crops are replaced with diverse perennial pasture.
- Well-managed pastures provide livestock with nutritious, low cost feed, equivalent to grain and silage.
- The herd is moved through a series of subsections or paddocks, allowing each paddock to rest and recover for several weeks between grazings.
- The animals harvest their own feed and spread their own manure, reducing cost of production and labor, and increasing livestock health.
- Milk production or rate of gain may be reduced, but production costs are reduced significantly more, resulting in higher net income.
- A flexible production tool that can be scaled to fit any farming system and any size operation.



Investing in ecosystem services? Choose managed grazing

Because society places value on clean water and healthy soil, new ecosystem service markets can reward farmers who balance production and environmental protection. They can also encourage farmers to make changes toward more regenerative practices by reducing the financial risk associated with making changes to their farm businesses. The most effective means of generating multiple ecosystem services in agriculture is through well-managed grazing of perennial pastures. Investing in managed grazing systems is a win-win-win for the environment, the farmer, and the community.

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Ecosystem services markets are evolving. This document will be updated as new information becomes available. If references are not attached to this version, a complete list of references is available at grasslandag.org.

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