BENEFITS OF VILICUS FARMS

ESTIMATED VALUE OF ECOSYSTEM BENEFITS FROM SUSTAINABLE AGRICULTURE PRACTICES

VILICUS FARMS | HILL COUNTY, MONTANA

$16M

in soil carbon stored on croplands

(excluding emissions)

$10,000

per year in pollinator habitat benefits

$9,000

per year in reduced erosion

Vilicus Farms is a nationally recognized first generation, organic, dryland crop farm in Northern Hill County, Montana. The cropping systems here model a vision where organic practices are considered the norm, seeking to advance land stewardship practices at scale that promote healthy ecosystems.

Sustainably managing the land can play a major role in protecting the environmental benefits we receive from natural areas, often called ecosystem services. This case study looks at a few of the ecosystem services enhanced by activities on Vilicus Farms.

Learn more at Vilicusfarms.com.

Credit: Vilicus Farms

ECOSYSTEM SERVICES AND THEIR BENEFITS

Ecosystem services are the benefits nature provides to people, free of charge. While ecosystem services are difficult to value, they are vital both to our quality of life and to economic production. In fact, nature contributes substantial economic value to local, regional, even global economies. They provide essential goods for people's use, they protect infrastructure, and provide habitat people care about, among many others.

While many consider nature to be truly priceless, and putting a dollar value on nature makes some people uncomfortable, decisions are made and policies developed using the language of budgets, costs, and returns on investment, often never considering these additional benefits. Not taking these values into account means they are considered having a value of zero, and policies and decisions that move forward will reflect that. The value of nature means many things to many people, but we know an economic approach can be important when it comes to considering nature in the decision-making process.

THE BENEFITS OF SOIL CARBON

As climate change and greenhouse gas emissions moved to the forefront of sustainability concerns in recent years, so has valuation of offsetting carbon dioxide (CO_2) emissions. Although agriculture can be seen as major greenhouse gas emitters, there's also significant value in cropland's ability to sequester and store CO_2 in the form of soil carbon. Soil carbon is often measured in standard soil tests either directly as soil organic carbon (SOC) or indirectly as soil organic matter (SOM). Although Vilicus Farms has faced increasing drought frequency, likely due to climate change, their dedication to sustainable practices (e.g., diverse 5- to 7-year crop rotations, cover cropping and green manure) may have contributed to retention of soil carbon.

SOIL CARBON ON VILICUS FARMS

Using the average of the most recent soil tests provided by Vilicus Farms for each of their fields as of 2020, the estimated soil carbon in their cropland alone is 85,539 metric tons. The U.S. government values the *Social Cost of Carbon* (SCC)[1] at $51 per metric ton of CO_2 in 2020. The CO_2 offset by Vilicus Farms' soil carbon stock in their cropland has an estimated value of $15,995,703 as of 2020. This value does not include their lands used as pollinator habitat, pasture, or rangeland, nor does it account for emissions produced by the farm.

85,500
metric tons of soil carbon stored in croplands on Vilicus Farms.

$16 million
in CO_2 offset value by Vilicus Farms' cropland soil carbon stock.

Credit: Vilicus Farms

ASSUMPTIONS

- The social cost of carbon is a nation-wide value that reflects all economic damage that would occur as a result of emitting one ton of carbon dioxide into the atmosphere. It includes damages such as flood damage to infrastructure, agricultural losses, and more.
- The value of soil carbon is not an annual value, but instead changes with percent organic carbon within the first 8 inches of soil below the surface.
- Soil organic matter values were acquired from the most recent soil tests for each strip within every field (that had available data) before averaging across the field. SOM was converted to SOC, assuming SOC is 58 percent of SOM, before using SOC percent, bulk density, and soil depth to estimate SOC stock in tons per acre.
- Bulk density for each field was assumed from the weighted average of the dominant components within the first 8 inches of soil retrieved from the NRCS Web Soil Survey.[2]

[1] Interagency Working Group on the Social Cost of Carbon. 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990.

[2] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Found at: http://websoilsurvey.sc.egov.usda.gov/, retrieved 04/20/21.

THE BENEFITS OF POLLINATOR HABITAT

Pollinators are essential to the development of fruits, vegetables, and seeds grown on agricultural land, enhancing production of 75 percent of globally important crops.[3] ***World-wide, crop production pollinated by animals is valued at over $235 billion each year.[4]***

POLLINATOR HABITAT ON VILICUS FARMS

One focus of Vilicus Farm's cropping practices is on pollinator-friendly conservation tactics. Twenty-six percent of managed land on the Farm is dedicated to permanent pollinator-friendly conservation. Vilicus Farms is also 'Bee Better'[5] certified, meaning their practices are designed to protect bees and other pollinators from threats and provide critical habitat for pollinators.

Besides their contribution to market value, pollinators also contribute to human wellbeing in other ways. Consumers also care that pollinators are in decline, benefitting by simply knowing that pollinator habitat exists. Many are even willing to pay to increase habitat areas suitable for pollinators to stem this decline. One study found that households were willing to pay up to 81 cents per pollinator habitat area per household in a 10-county region to increase pollinator habitat areas.[6] If the same results are applied to the pollinator habitat areas at Vilicus Farms, the population in Hill County, Montana values the habitat areas here at about $10,000 per year.

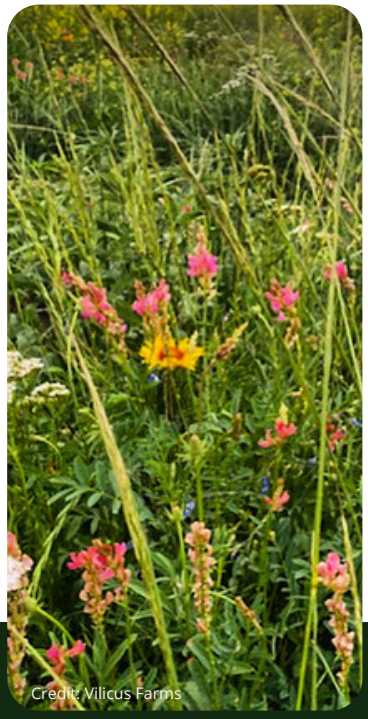
26%
of managed land on Vilicus Farms is permanently conserved pollinator habitat.

$0.81
per pollinator habitat area value to each household.

$10,000
per year in pollinator habitat benefits on Vilicus Farms.

ASSUMPTIONS

- Each pollinator strip operated by Vilicus Farms equals one "pollinator area". Size of pollinator areas was not defined in Johnson (2017), although the survey used ranged from 50 to 200 areas. We counted roughly 150 pollinator areas on Vilicus Farms.
- Although Johnson (2017) was conducted on the east coast, income levels are not drastically different in Hill County. Average income in the study region in Johnson (2017) was, "within the $50,000 to $74,999 range in accordance with U.S. Census income levels." The average income of Hill County is $49,321.[7] The average income in Montana is slightly higher, at $54,970.
- Because of the distance between the original study and Hill County, we chose to apply results only to households within Hill County. However, households throughout Montana and even beyond may value these pollinator habitat areas. The value calculated here is likely an underestimate.



Credit: Vilicus Farms

[3] Breeze, T. D., Gallai, N., Garibaldi, L. A., & Li, X. S. 2016. Economic measures of pollination services: shortcomings and future directions. Trends in Ecology & Evolution, 31(12): 927-939.

[4] IPBES. 2016. The Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production. Edited by S. G. Potts, V. L. Imperatriz-Fonseca, and H. T. Ngo. 552 pp. Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

[5] See https://beebettercertified.org/ for more information.

[6] Johnson, W. 2017. Understanding willingness to pay for pollination and sense of place connections on the Eastern Shore. M.S. thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA.

[7] https://www.census.gov/quickfacts/hillcountymontana, retrieved 05/05/2021.

THE BENEFITS OF EROSION CONTROL

With fields divided into strips separated by 20- to 30-foot conservation buffers, a rotation of cover crops, and minimum-disturbance tillage, Vilicus Farm's cropping practices are designed to reduce soil erosion on the land. Erosion reduction creates benefits both on- and off-site, benefitting not only Vilicus Farms, but also others in Hill County and beyond.

REDUCING EROSION MEANS . . .

- Less soil nutrients are lost, meaning the farmer doesn't have to pay to put those nutrients back in the soil.
- Less runoff reaches surface water, improving water quality. This leads to increased benefits for water-based ecosystem services, such as recreational activities like fishing and swimming, as well as supply of drinking water.
- Protecting infrastructure by decreasing maintenance costs and flood risk from off-site soil buildup.
- Improving air quality by reducing the amount of dust and particulate matter. This leads to better health outcomes for people.


Credit: Vilicus Farms

EROSION CONTROL ON VILICUS FARMS

Compared to modeled results of a typical conventional spring wheat-fallow operation in Hill County, a common rotation of spring wheat-cover-rye-cover at Vilicus Farms reduces total erosion by almost 60% each year over a 4-year period. This leads to economic benefits like the ones described above of about $1,000 each year from reduced water erosion and $8,000 each year from reduced wind erosion. These benefits accrue to both Vilicus Farms and the population of Hill County.

60%
erosion reduction compared to a conventional rotation.

$9,000
per year in reduced erosion benefits on Vilicus Farms

ASSUMPTIONS

- Only one type of crop rotation present at Vilicus Farms was analyzed at this time and compared to a conventional rotation of 1 year spring wheat followed by 1 year of fallow using no-tillage.
- Crop rotations were input into the WEPS and RUSLE2 models to calculate erosion rates.
- Dollar values per ton of eroded soil were derived for Hill County from Hansen and Ribaudo (2008).[8]
- Locations and soil types of 1 field from each property owned by Vilicus were used as model and results averaged over all properties.

[8] Hansen, L., Ribaudo, M. 2008. Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment. Technical Bulletin No. (TB-1922), 32 pp.

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