Study puts a price on help nature provides agriculture

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Root nodules on hairy vetch store nitrogen captured from the air with help from *Rhizobium* bacteria. The stored nitrogen is released into the soil when the plant dies and decomposes in place. Credit: Sylvia Kantor/WSU

A team of international scientists has shown that assigning a dollar value to the benefits nature provides agriculture improves the bottom line for farmers while protecting the environment. The study confirms that organic farming systems do a better job of capitalizing on nature's services.

Scientists from Australia, Denmark, New Zealand, the United Kingdom and the United States describe the research they conducted on organic and conventional farms to arrive at dollar values for natural processes that aid farming and that can substitute for costly fossil fuel-based inputs. The study appears in the journal *PeerJ*.

"By accounting for ecosystem services in agricultural systems and getting people to support the products from these systems around the world, we move stewardship of lands in a more sustainable direction, protecting future generations," said Washington State University soil scientist John Reganold, one of the study's authors.

Tests in organic and conventional fields

Earthworms turning the soil, bees pollinating crops, plants pulling nitrogen out of the air into the soil and insects preying on pests like aphids - these are a few of nature's services that benefit people but aren't often factored in to the price we pay at the grocery store.

The value of ecosystem service benefits provided to people by nature is rarely quantified experimentally in agricultural studies and is generally not taken into account in the real world of economic markets.

The research team led by Harpinder Sandhu at Flinders University in Adelaide, South Australia quantified the economic value of two ecosystem services - biological control of pests and the release of nitrogen from soil organic matter into plant-accessible forms - in 10

organic and 10 conventional fields on New Zealand grain farms.

Farmers rely on pollination services provided by bees for many crops including apples. Credit: Sylvia Kantor/WSU

Values greater for organic systems

The values of the two ecosystem services were greater for the organic systems, averaging $146 per acre each year compared to $64 per acre each year in their conventional counterparts.

The combined economic value, including the market value of the crops

and the non-market value of the two ecosystem services, was also higher in the organic systems, averaging $1,165 per acre each year compared with $826 per acre each year in conventional fields.

The study showed that the value of the two ecosystem services on the organic farms exceeded the combined cost of traditional pesticide and fertilizer inputs on the conventional farms. The scientists calculated that the potential value of these two services could exceed the global costs of pesticides and fertilizers for growing similar crops, even if the two services were used in just 10 percent of the world's cropland.

Farmers use cover crops like hairy vetch mixed with triticale or rye grass to supply organic matter to soil and make nitrogen available to plants. Credit: Sylvia Kantor/WSU

Economic incentives necessary

The study indicates that widespread conversion to organic agriculture is not required to reap the benefits of nature. The value of ecosystem services can be realized by conventional and other farming systems by adopting farming practices like diverse crop rotations and cover crops.

Reganold said that government payments or market rewards for ecosystem services are likely required to ensure the widespread utilization of ecosystem strategies to enhance agricultural sustainability.

"Many people think it's the responsibility of farmers to enhance the benefits that nature provides," Reganold said. "But it's not always economically feasible because the current market system doesn't recognize the value of these services."

More information: Significance and value of non-traded ecosystem services on farmland. *PeerJ* 3:e762; DOI: 10.7717/peerj.762.

Provided by Washington State University

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