EXTENSION

Oklahoma Agriculture's Role in Reducing Greenhouse Gas Emissions

January 2023

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As alarms about dangers from climate change become more intense many are looking to agriculture to play a role in reducing greenhouse gas emissions (GHG). For almost a century Oklahoma farmers have implemented conservation practices that reduce soil erosion and protect natural resources and fortunately these practices also tend to reduce GHG concentrations in the atmosphere, largely by sequestering carbon in the soil and plant biomass.

This presents an opportunity for farmers. Carbon makets have been developed, whereby people can earn money by reducing GHG emissions. Over 50,000 Oklahoma acres have already participated in the Oklahoma Carbon Initiative, providing farmers financial rewards for reducing GHG emissions and Oklahoma legislation has already passed to make other initiatives easier to establish.

The purpose of this fact sheet is to describe the amount of carbon reductions that can be achieved in Oklahoma using standard conservation practices and the income it can generate under different carbon prices.

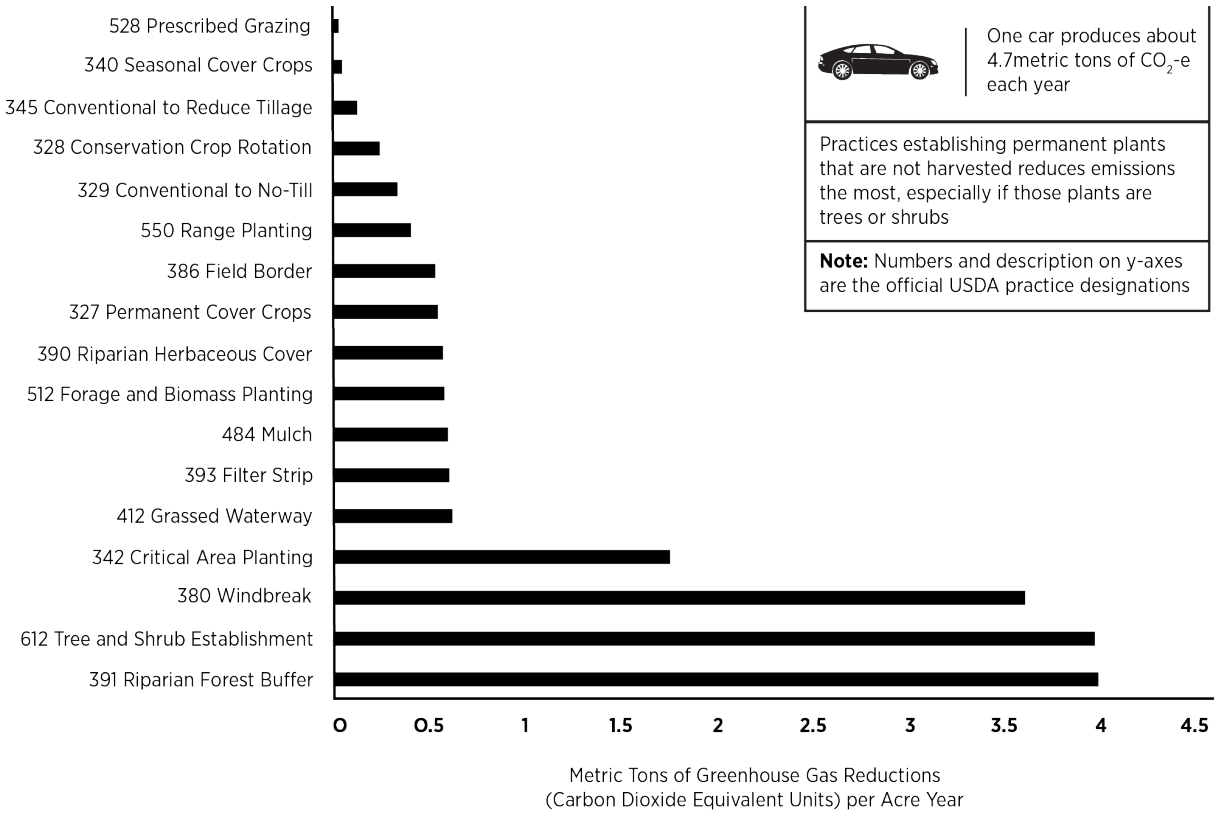

Figure 1: How conservation practices in Oklahoma can reduce greenhouse gas emissions

**The emission factors reported above are a weighted average of the factors from the Comet-Planner model for each county, weighted by acres enrolled in the conservation practice and estimates of the manner in which the practice is executed.*

Estimating Emission Reductions

Measuring the carbon sequestered on agricultural land is notoriously difficult, but sufficient research has been conducted to make reasonable estimations possible. This fact sheet uses the Comet-Planner model developed by the USDA, which relies upon a vast literature review to estimate the amount of GHG emission reductions associated with a large number of conservation practices at the county level for the US.

The actual emission reductions depend on the rainfall, temperature and farming practices used; the Comet-Planner model is designed to accommodate a variety of different environments.

Figure 1 shows GHG emission reductions for a variety of conservation practices in Oklahoma. Those involving the establishment of permanent cover crops sequester the most GHGs, especially if they are trees or shrubs. One acre of trees or shrubs can sequester up to four metric tons (tonnes) of GHGs, which is almost as much as the typical passenger car emits each year! This is why climate scientists are so keen on planting new trees and preventing forest destruction.

Of course, establishing trees and shrubs entail taking land out of production, so farmers may seek ways to sequester carbon while continuing to produce agricultural products. For decades Oklahoma farmers have reduced tillage and experimented with cover crop strategies. As the previous figure shows, switching from conventional to no-till reduces GHG emissions by about 0.33 tonnes of CO_2-equivalent GHGs per acre.

The actual carbon sequestration a farm experiences will differ across regions. For example converting cropland to a permanent cover crop in the southeast Oklahoma can sequester 50% more carbon than in the Panhandle. This is largely due to rainfall. The more plant biomass a region can grow the more carbon it can extract from the atmosphere.

The Price of Carbon

Climate scientists estimate the price of carbon needs to be around $100 per tonne to achieve the goals set by the Paris Agreement. If US policy was designed to actually achieve these goals, this means a farmer could receive $100 for every tonne of carbon they sequester.

At this price an Oklahoma farmer could be paid around $400 each year for each acre of trees and shrubs they plant. Such revenues would exceed the average per acre revenue from wheat production. At this same price a farm switching from conventional to no-till production could earn $33 per acre of revenues in addition to the profits from the crop itself. Of course, the price of carbon in the US isn't $100 per ton. A price of $15 per tonne is more common and the Biden Administration claims the social cost of carbon is $51 per tonne.

Whether it would be feasible to implement a conservation strategy in a carbon trading scheme hinges critically on that carbon price. A buffer strip planted in herbaceous plants sequesters about 0.57 tonnes of GHGs per acre each year and costs about $100 per acre per year to install and maintain. If the price of carbon is $100 per tonne this would pay for half of the cost of the strip, which might still be worth it for some in order to limit soil erosion and reduce water pollution. At a carbon price of only $51, however, the strip seems much less desirable.

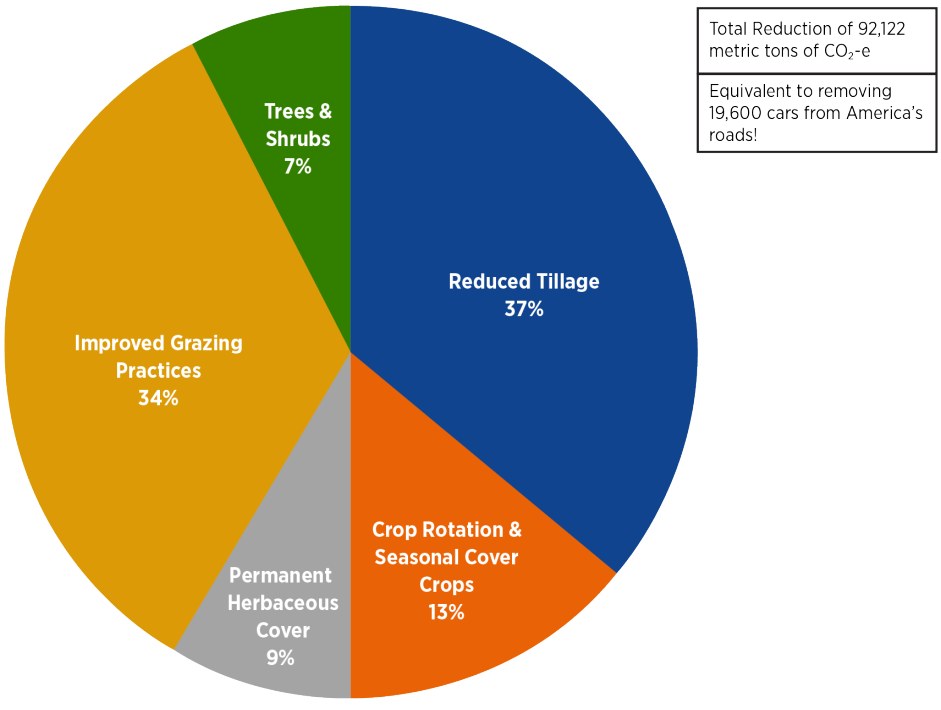

Figure 2: Greenhouse gases sequestered in 2020 due to Oklahoma participation in USDA conservation programs

**Note: numbers do not account for the fact that conservation practices involve some GHG emissions. For example, planting a seasonal cover crop requires tractor fuel which has its own carbon footprint.*

USDA Conservation Programs

The USDA has been funding conservation practices long before the idea of a carbon market existed. Through programs like the Conservation Reserve Program and the Conservation Stewardship program farmers are being compensated for establishing the practices shown previously in Figure 1. Such practices have numerous benefits: improving soil health, reducing soil erosion, reducing water pollution and providing habitat for pollinators are some examples. Yet they also sequester carbon in the soil and plant biomass, and depending on the price of carbon, this sequestration alone provides considerable social benefits.

Consider that in 2020, changes in land management due to Oklahoman's participation in conservation programs sequestered a total of 92,122 tonnes of carbon, which is the equivalent to the emissions from 19,600 cars. Now, total GHGs are not reduced by this amount because it still takes inputs like fuel to install these practices and those inputs have carbon footprints of their own.

Still, this is a considerable amount of carbon removed from the atmosphere. If the social cost of carbon was really $100 per tonne as climate economists suggest, then this sequestration provides $9.2 million in social benefits. When you then consider that the USDA paid farmers a total of $8.4 million to implement these practices and when you also consider the practices provide other benefits in addition to GHG sequestration, a full cost-benefit analysis might easily find these programs pay for themselves.

Oklahoma Agriculture's Contribution to Climate Solutions

It is possible that farmers will one day pay attention to the price of carbon in the same way they track commodity and input prices. They currently do not because the carbon price is low. Carbon markets already exist and in two general forms. There are compliance markets, where GHGs from certain industries are limited by law. In California large emitters are required to either buy a carbon permit or a carbon offset to emit any GHG. Because the state limits the total amount of carbon permits available the price of carbon is substantial. On June 1, 2022 the price was $31 per tonne.

Then there are voluntary markets, where buyers can choose to pay people to reduce their GHG emissions. Such markets exist and farmers can earn money by participating. Here, because the total amount emitted is not limited by law, the price of carbon is lower. On June 1, 2022 the price of carbon in voluntary markets was $2.80 - $11 per tonne.

Even though these prices are below the $51 per tonne social cost assumed by the Biden Administration and the $100 per tonne cost needed to meet our climate obligations, Oklahoma farmers are playing a role in reducing GHGs. Sometimes they receive federal funding to reduce tillage, install climate friendly grazing practices and planting trees and shrubs between their fields and surface waters. Sometimes they do this on their own. For instance, between 2012 and 2017 the amount of Oklahoma land in intensive tillage has decreased by 29% and though the major motivation is to improve soil health, that change has sequestered a considerable amount of carbon as well.

While farmers have and will continue to engage in conservation practices to preserve that thin layer of the earth's crust responsible for all terrestrial life, these practices can also reduce climate change, but this depends critically on the price of carbon.

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President for Agricultural Programs and has been prepared and distributed at a cost of 20 cents per copy. January 2023 AM.