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SHOULD I SELL CARBON CREDITS?

A Decision Guide for Ranchers

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INTRODUCTION

Increasing public attention to climate issues has amplified pressure on many industries to develop 'climate neutral' systems. A central goal of most 'climate neutral' strategies is for an entity to achieve 'net zero' carbon emissions by reducing direct emissions of greenhouse gases (GHG) where possible, and seeking sources of carbon dioxide (CO_2) emissions offsets (often called 'carbon credits' or 'carbon offsets') to balance emissions that cannot be eliminated. These 'offsets' or 'credits' represent CO_2 being removed from the atmosphere and stored. Land-based carbon accumulation has long been considered an essential element of climate mitigation strategies, and is increasingly viewed as a potential source of purchasable credits for those seeking to offset emissions. Ranch owners and managers need a framework to make the most effective decisions about if, and how, entering into a carbon credit contract fits their business operations.

This article describes the foundational concepts of carbon trading, key considerations for managing the development of credits, risks associated with entering a carbon credit contract, and economic and market considerations. Our goal is to inform ranchers so the best decisions can be made in an emerging and uncertain enterprise.

CARBON CREDITS AND CARBON TRADING

WHAT IS A 'CARBON CREDIT'?

A carbon credit represents one metric ton (1,000 kg) of CO_2 or CO_2 equivalents removed from the atmosphere. From an accounting perspective, if the atmosphere is the 'account', then a release of CO_2 into the atmosphere is a 'debit' to that account, and removal of CO_2 from the atmosphere is a 'credit'. For a corporate entity, debits (CO_2 emissions) occur through: 1) direct use of fuels in manufacturing or distribution processes (Scope 1 emissions); 2) the use of fossil fuels to generate electricity off site that is then consumed by the company (Scope 2 emissions); and for some 3) emissions embedded in their raw materials inputs, or use of their products by consumers (Scope 3 emissions).

A given company may seek to reduce its emissions through efficiency gains or other means, but may not be able to completely eliminate all emissions. If they wish to achieve 'net zero' emissions, then they will seek 'credits' to their atmospheric account that offset any remaining 'debit' amounts to balance the account. In markets like the European Union and California, governmental regulation requires that companies offset all or a portion of their emissions (often under 'cap and trade' systems), while in many other markets (most of the United States) these corporate actions are voluntary. A company may have incentive to do this as a component of their corporate social responsibility (CSR) or environmental, social, and governance (ESG) policies and reporting requirements, or to improve their competitive position with customers. These factors affect the demand for purchasable 'carbon credits' and may result in differences in demand (and therefore prices for credits) among markets.

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The demand for carbon credits is met through supply – the generation of credits. Primary sources of carbon credits are through engineered or nature-based systems. Engineered systems include direct CO_2 capture from the atmosphere or CO_2 removal from exhaust sources, coupled with long-term underground storage of captured carbon. These systems are collectively referred to as 'CCUS' for 'carbon capture and underground storage'. 'Nature-based' solutions include those associated with forestry or the accumulation of carbon containing compounds in soil through natural processes that begin with photosynthesis of plants. These are the focal point of this decision guide, as they are the most directly accessible for ranchers.

CREATING A CARBON CREDIT

Plants effectively capture CO_2 from the atmosphere, and combine it with water (hydration) through photosynthesis to assemble it into more complex carbon containing molecules (carbohydrates). Some of these carbohydrates are translocated to the root of the plant, and may be excreted or assimilated into the soil as organic matter that contains 'soil carbon'. This is the fundamental mechanism of transferring atmospheric carbon into soil carbon and is the basis of land-based carbon credit generation (Figure 1).

Generating a tradeable carbon credit requires measuring, verifying, certifying, recording, and tracking the amount of carbon accumulated and retained in the soil, and creation of tools to exchange these carbon credits. Much like an exchange traded contract for a commodity, several entities have created 'Standards' for the generation of carbon credits.

CONTRACT STANDARDS

The standards define the credit units (e.g., 1 tonne of CO_2) and the methods for quantifying, measuring, and assessing the data required to assure the soil accumulation and storage of credited CO_2 equivalents. It is important to note that soil measurements are usually expressed in terms of carbon, not CO_2. However, credits are issued in terms of CO_2. Each tonne of soil carbon is equivalent to 3.67 tonnes of CO_2. The standards may also describe the required components of any contractual 'project' intended to generate tradeable credits, the types of projects allowable under the standard, and other policies and procedures governing accumulation and maintenance of soil carbon. In this sense, the standard

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defines the rules governing the carbon credit contract. Because there are multiple entities that facilitate the trade of carbon credits, more than one standard exists. While the various standards share many similarities, they may also have key differences in definitions of allowable credit generation activities (e.g., grazing practices), acceptable methods of measurement and verification, and duration of performance. Standards also differ in their definitions of 'additionality' and 'permanence' of storage.

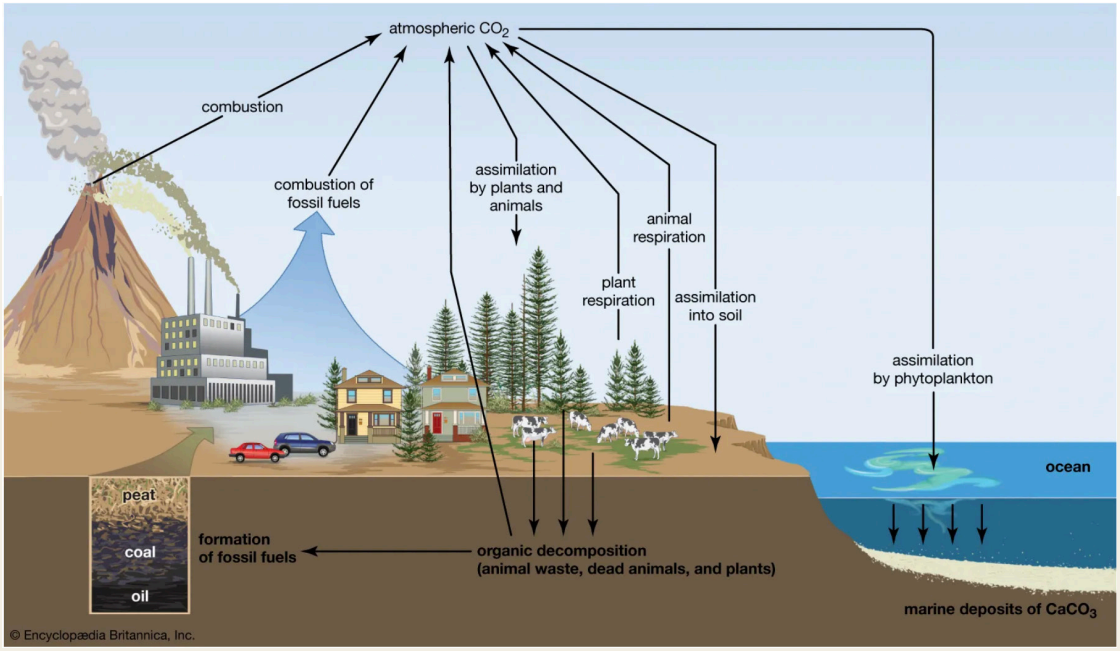


Figure 1. *Schematic of the global carbon cycle. Carbon dioxide from the atmosphere is taken up through photosynthesis and accumulated in biomass and some portion becomes assimilated into the soil or deep ocean. Much of the carbon used in photosynthesis is subsequently consumed and respired back to the atmosphere. Human activities can release additional carbon to the atmosphere, and this results in an imbalance in the cycle. Increasing net accumulation in soil could offset some or all of this imbalance. Photo courtesy of Encyclopædia Britannica, Inc., copyright 2014; used with permission.*

Additionality. Additionality can be a confusing concept and different definitions and interpretations have been developed. One definition of additionality is designed to conform to articles of the Kyoto Protocol, an international agreement intended to operationalize the United Nations Framework Convention on Climate Change. In the Kyoto Protocol, 'additionality' of GHG emission reductions or offsets is defined as reductions in the target GHG exceeding those that would have occurred under a business-as-usual scenario. In the grazing lands example, if carbon accumulation is expected under current management, then only additional accumulation above that expected rate resulting from a change in management could be credited. Adherence to this definition requires estimation of soil carbon accumulation under the business-as-usual scenario, plus measurement of accumulation from the prescribed management in the contract. Definition of additionality may also include a clause that the practice causing accelerated accumulation (e.g., a management change) would not have occurred without payment for a credit. This requirement implies that if a management change was financially viable without the incentive of carbon credit sales, then it would likely have already been implemented and therefore credits should not be issued.

Other standards define additionality more simply as the accumulation of carbon in excess of current levels, rather than in excess of the projected future carbon stock under a business-as-usual scenario. While this is typically a more direct measurement it may not be accepted in certain markets or by certain parties depending on their adherence to the Kyoto Protocol. For example, many member states of the European Union are Party to the Kyoto protocol, but the United States is not. Some standards do not consider the financial incentive element of additionality. Prospective credit purchasers may distinguish among credits generated under different standards, depending on this definition. Understanding the additionality definition of the contract is imperative.

Permanence. Standards may also differ in approaches to assuring the duration of holding accumulated carbon. While the implied goal of CO_2 removal from the atmosphere is to permanently reduce the 'excess' CO_2, determination of permanence is difficult. Land-based removal activities are subject to reversals due to both climatic and management effects. During periods of drought, soil carbon may be released back into the atmosphere as CO_2. Alternately, land use may change and result in a release of previously accumulated carbon. Some contracts or standards may require a permanent easement or other legal mechanism that eliminates certain future use or activity. Other contracts may have a more finite term of performance. Often, a mechanism exists within a standard to set aside a portion of any generated accumulation of CO_2 equivalents into a reserve account as a hedge against future potential reversals of accumulation. While this activity is seen as necessary to ensure the environmental integrity of the issued carbon credits, it reduces the amount of credits potentially generated and marketable by the landowner. Because of the differences among standards, and also among the developers of carbon accumulation contracts, it is important to have clarity on the standard governing the contract.

CARBON MARKET FACILITATORS

Registries. The ultimate purpose of a registry is to prevent double application of a credit, such that each credit is used to offset one unit of emissions, and then be 'retired'. Once carbon credits are generated, a registry system is utilized to track the certified credit, assign or transfer ownership,

and to apply the credit to a debit (i.e., 'retire' the credit). Because the entities that develop standards typically review a proposed crediting activity for adherence to the standard, and then certify and issue the credits, these same entities typically create and maintain the registry system for credits issued under their standard. While different registries may utilize different technical processes and notification practices, their purpose is similar.

Verifiers. To achieve certification and issuance of carbon credits in accordance with a standard, an independent verification is often required. Verification consists of review of the contract application materials and consistency of the methodology to ensure adherence to the standard. The verifier, typically a third-party entity, issues a finding and then the registry certifies and issues credits in accordance with their policies. The registry may have specific eligibility requirements for verifiers and may maintain a list of verifiers approved to evaluate projects according to one or more standards that they oversee. The cost of verification cannot depend on the outcome; thus, verification costs will be assumed even if no credits are issued.

Developers, Aggregators, and Brokers. Contracts for generating certified carbon credits have a number of technical requirements that may be specific to the standard, registry, and protocol chosen. Project developers may either seek land managers that have a common interest or capacity to follow a certain protocol, or may be able to access several different protocols in accordance with the features of a given ranch. There is nothing that prevents a ranch from serving as its own developer, but this requires deep familiarity with the details of the target standard and protocols for sampling, measurement, reporting, and verification. Ranchers may prefer to work with a developer instead of taking on these requirements themselves. Contract developers may try to increase scale by assembling several ranches into one project; in this case they might be referred to as an aggregator, putting several smaller projects together to form one large project. This can create market access for smaller operators or acreages.

Contract developers may provide access to carbon credit markets. In some cases, the agreement with a developer may give the developer the exclusive right to market the generated credits. In these situations, the 'developer' is also the 'broker' of the credits. Alternately, there may be brokers who facilitate transactions between buyers and sellers of credits, but are not directly involved in carbon credit generation. It is important for land managers to understand who will serve in each role; the ranch independently, a single service provider, or several providers that all have a different role (Figure 2).

Entry into a carbon credit contract is similar to a commodity production contract with committed future delivery. As with a contract for future delivery of livestock, a rancher may work with a developer to identify a marketing opportunity. The terms of delivery are governed by a standard, and performance to the standard is verified by an independent party, after which the soil carbon accumulation is certified and can be marketed. The registry maintains the accounting of certified credits, their allocation, application, and retirement. From the landowner perspective, the commitment is to accumulate a specified amount of CO_2 equivalents in the form of soil-borne carbon (or other form, dependent upon the standard) and maintain the accumulated carbon for a specified period of time. The ranch is subject to risks similar to those in other production enterprises, including production (accumulation) risk, price risk, and

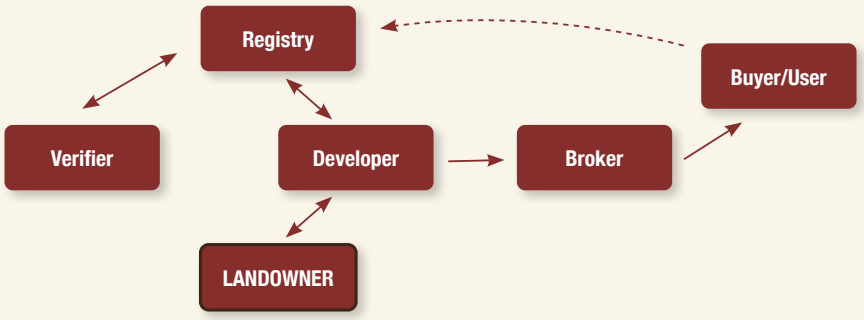


Figure 2. *Carbon market participants. Landowners provide the space and mechanism for soil carbon accumulation and may work with a developer to establish a process for measuring that accumulation according to a standard. The process and measurements are submitted to a registry, who seeks third party verification of adherence to the standards, and then certifies and tracks the issued carbon credits. Brokers seek to connect those offering credits and those seeking to buy them. Once purchased and applied as an offset, the user of the credit notifies the registry so that the credit is retired, avoiding duplication.*

transaction risks that may be contained in, or mitigated by, the specific contract terms.

PRODUCTION RISK

The fundamental consideration for a rancher contemplating a carbon credit enterprise is the physical capacity of the ranch to accumulate soil carbon above current levels. The potential is unique to each site. Important factors include climate, soil type and depth (clays typically have greater potential, sandy soils less). A primary determinant of capacity for accumulation may be the current state of the soil relative to long term potential – sites that have suffered from degradation in the past may have greater opportunity for accumulating soil carbon under changes in management. Sites in better condition may be closer to capacity and have less soil carbon accumulation potential. Estimated accumulation rates for grazing lands vary geographically from 0.2 to 0.6 tonnes of CO_2 per acre, but some observations as high as 5 to 7 tonnes of CO_2 per acre have been reported in response to various management practices. Periods of drought or soil disturbance can result in losses of soil carbon. Strategies associated with 'good' grazingland management, that increase forage growth and reduce bare ground, are expected to promote soil carbon accumulation. The uncertainty of soil carbon accumulation rates, and factors beyond the control of managers that can impact these rates, create 'production risk'. Managers should consider this uncertainty in the development of the soil carbon accumulation enterprise.

Soil carbon variability across the landscape makes detection of small changes difficult, and inability to detect change prevents certification of credits.

It is difficult to gain precise measurement of soil carbon across large landscapes, and measurements can vary considerably across a single property or management unit. Measures of change in soil carbon must be statistically reliable in order for credits to be issued. The change in soil carbon measurement (% carbon in a soil sample) that represents 1 tonne of CO_2 per acre is very small – 0.014 % if measured to 30-centimeters depth, 0.004% if measured to 1-meter depth. Reliable detection of small changes generally requires a large number of samples, and the inherent variability creates considerable risk that small changes cannot be detected. While aggressive research efforts are ongoing to increase sampling reliability and reduce sampling costs, this variability and uncertainty remains an area of risk for managers. Soil sampling is likely to be the greatest expense incurred in the development of a carbon credit project, and clarity about the magnitude of soil carbon increase that can be expected coupled with the number of samples required to detect

that change are essential in the decision-making process. A commitment to accumulate carbon is similar to a commitment to produce and deliver a commodity. Managers face 'production risk' due to the factors that can impact plant growth and soil carbon accumulation, many of which are beyond their control. Soil carbon variability across the landscape makes detection of small changes difficult, and inability to detect change prevents certification of credits. While uncertainty cannot be eliminated, managers should consider these factors, seek reliable estimates of soil carbon accumulation potential and have clear understanding of sampling requirements to make the best decisions about entering a carbon contract.

TRANSACTIONAL RISK

As with almost any contract, the devil is in the details in carbon storage contracts. This is particularly important in the developing carbon credit marketplace. Several terms in currently offered carbon contracts are unique and may be unfamiliar to some ranchers. It is important to seek counsel from an attorney with experience in negotiating these types of agreements. The items below provide a starting point for contract evaluation.

Required & Prohibited Practices. Determine what activities are required and what activities will be prohibited pursuant to the contract. Ranchers should

ensure the contract clearly describes required practices. For example, a contract requiring "regenerative grazing" may not spell out the specific requirements of the ranch. Ensuring clear definition of requirements is important so both parties are assured of expected performance. Ranchers should consider potential land use opportunities they may forego by entering a carbon contract. For example, what if a landowner enters into a carbon contract and is later approached by a solar company offering 50 times more compensation per year (which is entirely possible in some regions)? How will a carbon contract interact with hunting leases or oil and gas production? These considerations should be carefully analyzed and addressed in the contract.

Payments. The payments being offered to landowners can essentially be put into two buckets: 'payments for practice' and 'payments for outcome'. A payment for practice contract is one where a set payment is guaranteed if a rancher adopts the required practice. A payment for outcome contract offers a payment per metric ton of CO_2 equivalent captured in the soil or no longer emitted from production activities. These payments will be based on soil measurements, computer modeling, or a combination of both, according to the contract standard. Unlike a payment for practice contract, a payment for outcome contract is variable and depends on the actual amount of carbon stored or emissions reduced.

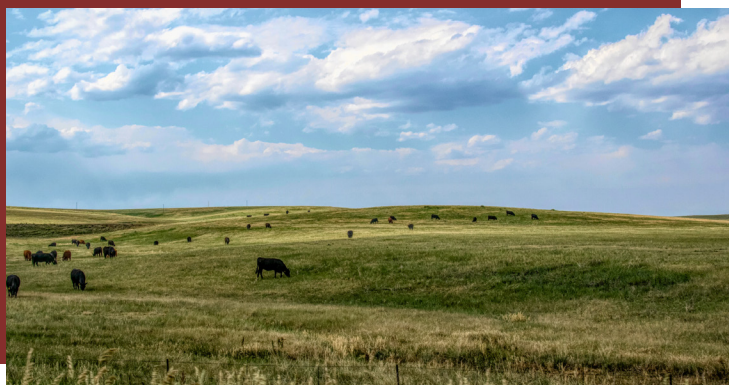
Term. Another important consideration is the length of the contract. Most currently offered contracts last 10 to 15 years. Some contracts require landowner participation until a certain amount of carbon is stored, regardless of the time that may take. Others may have ongoing requirements, even after the performance period of the contract has expired. Ranchers should also look for extensions included in a contract that may allow the company the right to automatically extend the length of the contract, and seek to delete such extensions during negotiation.

Potential penalties. Ranchers should carefully consider any potential penalties they could face under a particular carbon contract. Again, contracts differ greatly, but in every contract there will likely be various penalties that could be triggered based upon actions by the rancher. For example, a proposed contract may allow early termination by the rancher but may impose penalties for doing so. Taking the time to understand exactly what actions a rancher must take – or not take – to avoid penalties is critical.

Ranchers should also consider potential land use opportunities they may forego by entering into a carbon contract.

Some contracts contain "no-reversal" clauses. These clauses essentially provide that in the event the amount of carbon stored in the soil decreases from one measurement period to the next, the rancher is liable for that carbon loss. The specific liability depends on the contract, but could result in the contract termination, monetary penalties, forfeiture of prior payments, and even some instances where a rancher might be required to indemnify the purchaser for any lawsuits against the purchaser related to the purchase of the contracted carbon credits. Ranchers must consider these clauses very carefully in the context of the production risks for carbon accumulation in their particular circumstances.

Stacking prohibition. Most, if not all, contracts will include a stacking provision. These provisions generally provide that a rancher cannot enroll the same land in multiple carbon contracts. For example, a rancher with a section of land cannot sign a carbon contract with ABC Carbon and XYZ Carbon for the same acreage. Some stacking provisions are written much more broadly, and may state that the rancher may not participate in any other carbon contract or program. This could prohibit the landowner from signing up for any future government program offering carbon payments. Some contracts disallow participation in any government programs and prohibit the receipt of any government payments. This type of broad provision could have major impacts on certain landowners.



All contracts will require landowners to provide extensive data about their land and their operation, including information about prior management practices, pesticide and herbicide records, stocking rates, and production records.

Data provision and ownership. All contracts will require landowners to provide extensive data about their land and their operation, including information about prior management practices, pesticide and herbicide records, stocking rates, and production records. Many contracts allow the purchaser to enter the property for inspection and allow for aerial views by unmanned aerial vehicles (UAVs; drones). Most contracts provide that all data generated and collected under these agreements is the property of the landowner.

Measurement and verification. Measurement and verification are central to any carbon contract. Clear reference to a standard outlining these requirements, or inclusion of contract specific details, is important. Contracts should specify which party will pay for the cost of any measurements. Ranchers should reserve the right to audit or appeal measurement procedures, particularly given the uncertainty and frequently changing technology related to measurements.

Taxes and insurance. A landowner should require the counterparty to the contract or the purchaser of carbon credits to be liable for any change in property valuation and/or increases in ad valorem taxes that result from the carbon enterprise. Ranchers should require the purchaser and any contractors entering the property to carry insurance and to list the manager as an additional insured.

Choice of law and venue clauses. Contracts will likely include a clause determining which state's law will be applicable in the event of a contractual dispute and will identify a particular county and/or court where lawsuits must be filed. These provisions are generally enforceable, so ranchers should negotiate them appropriately.

Class action waivers. Interestingly, some contracts contain a class action waiver whereby a rancher agrees not to be part of any class action lawsuit against the purchaser related to the contract or carbon purchases. This term limits future legal options for the rancher.

Amendments and assignments. There are some contracts with amendment provisions that essentially allow the developer to make any contractual modifications they choose. Most, if not all, contracts allow the company to assign their rights without any approval from the rancher. The opposite, however, is likely not true. Most contracts have at least some limitations on the rights of a rancher to make a similar assignment. Ranchers should pay attention to provisions related to how contracts may be amended.

Overall, the wide variety of opportunities in the emerging carbon marketplace have resulted in a variety of contracts offered to landowners. There are no 'standard' contracts, and care should be taken to review the terms and gain clear understanding of the proposed agreement. Ranchers can mitigate some risks through the contracting process, but should be aware of terms that create long term liabilities, and understand limitations that may be imposed by an agreement.

MARKET RISK AND VALUE OF CARBON CREDITS

Entering into a carbon credit contract is an additional enterprise to the ranch portfolio. The gross revenue is the contracted price of a carbon credit times the number of credits secured. The gross unit price of a carbon credit in the United States is currently $18 to $22. Some fraction (often 20%) of generated credits are not eligible for sale, but are placed into a 'reserve pool' as a hedge against future potential accumulation reversals (for example, due to drought). This reduces the effective volume of credits marketed from a given ranch. Additionally, fees are assessed by developers, verifiers, and registries, and

sampling costs are incurred. While the details of these arrangements should be described in the contract, and may include sampling expenses, these costs and fees may represent an additional 20% or more of gross potential revenue. The net price for generated credits is therefore 60 to 80% of the gross price (i.e., $12 to $16 if the unit price of a carbon credit is $20). The net returns per acre for grazingland may be much less. For example, if the grazingland can be expected to accumulate 0.1 tonnes of CO2 per acre then the net price of the carbon credit, at $12 per tonne, would be $1.20 per acre. As with any commodity, because carbon credits are intended to be interchangeable, price volatility can be expected.

The carbon price is determined by a market with the characteristics of many other markets, both new and long established. Price discovery, the low number of sellers and buyers, and transparency are all issues in this emerging market. Companies buying carbon credits may have market power to set prices to ranchers, until the 'true value' of the credit to their firm is discovered. Like any other market there is a supply of and demand for soil carbon credits - their intersection results in the carbon credit price.

Supply of credits comes from land managers who implement practices to increase soil carbon accumulation. But changing practices comes with implementation cost. Because operators tend to be technically efficient, it is likely that cost-effective management practices have already been adopted. The least cost, most profitable management practices are implemented first at a lower carbon price. Over time, it gets more expensive to provide or store additional carbon, and prices must rise to provide adequate incentive for the rancher to adopt additional practices to generate more salable credits. Demand from carbon credits by companies is expected to continue to grow, leading to higher prices. Higher carbon prices will allow more costly practices for accumulating soil carbon to become feasible, therefore increasing the supply of carbon credits to meet growing demand. These same forces will likely create additional competition among potential generators of carbon credits. There may be other land uses, technologies or processes that emerge and enable carbon accumulation at a lower unit cost than current ranch management strategies. The ability of these other systems to store carbon at a lower cost than grazing land management will limit price upside.

Demand from carbon credits by companies is expected to continue to grow, leading to higher prices.

The developing market for carbon may evolve in a number of ways. There are a few key market questions for ranchers to consider:

- Does the realized price cover profit and risk of adopting a new enterprise?
- Does the rancher pay money back if the purchased level of carbon accumulation is not achieved and how is that risk best managed?
- Does it work in a portfolio of ranch profit centers that might include livestock, hunting, and other activities?
- Should a rancher consider selling (contracting) only a portion of the carbon holding acreage on the ranch and retaining the remaining acreage as an option to capitalize on future higher prices?

There are multiple companies in this market paying producers to store carbon. There are differences in the contract terms that may make a given strategy more or less valuable for a given ranch. These different opportunities should be explored to find the highest value proposition, which may not always be at the highest transaction price.

SUMMARY

The emerging market for carbon credits may offer an important opportunity to ranchers. As with the decision to add any enterprise to the ranch portfolio, the costs, benefits and risks should be explored. The carbon enterprise is essentially a contract to produce a commodity (carbon credits) and managers are faced with production and market risks associated with such activities. The details of actions or practices that must be taken or avoided in the production process, and how production itself will be evaluated and compensated, are unique to specific contracts and should be reviewed carefully. Managers should consider the potential for price escalation – or decline – as they consider the timing of sales, and should also consider the potential costs and liabilities associated with this emerging enterprise.

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