The Circular Economy and BCarbon: Addressing Climate Change Through Nature
(a.k.a. Confessions of an Environmental Lawyer)

By Jim Blackburn

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I became a lawyer in 1972 and dedicated my professional life to practicing environmental law on the environmental side rather than the industry side. I received a graduate environmental science degree at Rice in 1974 and began teaching environmental planning in 1975 that today has evolved into a class on sustainable design. I also now teach environmental law as well. Throughout, I have been an ardent supporter of environmental regulation which is the cornerstone of United States environmental law.

One can think of environmental laws as band aids on a flawed economic system. Our economy is a built structure, powered by tax policies, lending policies and governmental direct assistance with regulation being passed to provide corrections. The National Environmental Policy Act was passed in 1969 to redirect the thinking of the federal government to include environment. The Clean Air Act was passed in 1970 and amended several times to "patch" the economy relative to air pollution. The same is true relative to water pollution in 1972, endangered species in 1973, drinking water in 1974 and hazardous waste in 1976 and 1980. These laws were absolutely necessary patches on an economic system that was failing and is still failing to protect human and natural systems.

Figure 1. Band aids on the economy. Illustration by Isabelle Scurry Chapman from Blackburn and Chapman, *Earth Church*, Verse and Vision Press, 2021.

A basic flaw of the old system was that it was linear rather than circular. In a linear system, humans mine or otherwise develop and then manufacture products which are used and discarded. It is straightforward. Mine, manufacture, use and discard. We fill up holes in the ground with our waste materials. We dump into the air and water. We take what we need often without regard to Earth-based or human centered consequences.

Figure 2. The linear economy as illustrated by Zero Waste Yukon. https://zerowasteyukon.ca/about/the-circular-economy/

As we have progressed into the 21st Century, it has become clearer that the old system must be replaced by new economic thinking – thinking that is much more in sync with the Earth, thinking that is much more concerned with longevity and consequences rather than shorter term gain. Here, there is much that can be learned from Earth systems that have evolved over 3.4 billion years since the first photosynthetic organism and over 500 million years since the first vascular plant. It is from this base that the circular economy begins to take shape.

At its center, the circular economy is about biomimicry. It is about humans intentionally tailoring their economic system to come more into sync with the Earth's ecologic system. It is about designing an economy that follows nature's prompts and integrates recycling and nature's cycles into the design of the economic system. In the circular economy of the future, "dig, make, use and discard" will no longer be the model.

The Circular Economy

The starting point for the circular economy is the natural economy of the Earth. The Earth's system is fueled by the sun's energy, with life being based upon photosynthesis converting carbon dioxide to oxygen which supports most living organisms. Over time, a balance was created wherein the carbon dioxide taken into plants was converted into organic carbon which formed leaves and trees and root systems that supported other living things. When these living things died, decomposition returned the organic carbon to carbon dioxide that was emitted to the atmosphere. This is known as the carbon cycle and is shown in Figure __.

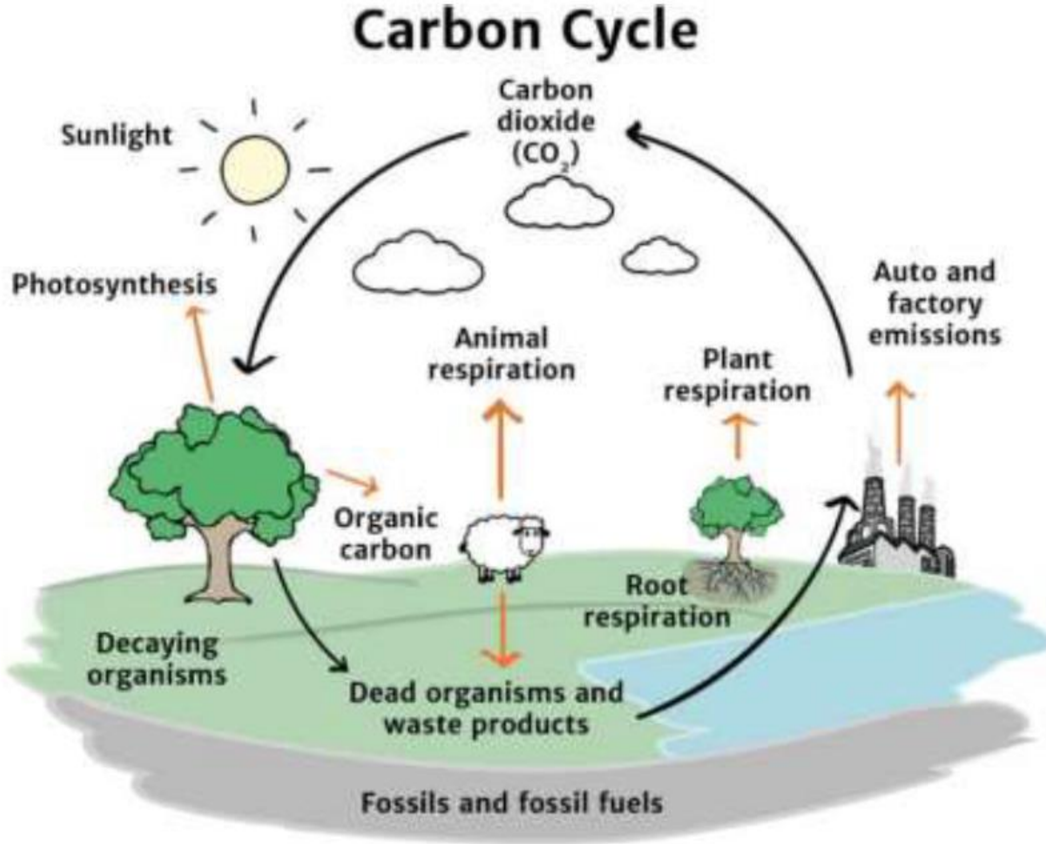

Figure 3. The carbon cycle as depicted by Jeffrey A. Amelse in preprint of article titled "Achieving Net Zero Carbon Dioxide by Sequestering Biomass Carbon".

The old economy has significantly disturbed the carbon cycle. Starting with the industrial revolution, the combustion of coal and later oil and gas transformed our economy by releasing energy stored through photosynthesis that had been entombed in the Earth and had not decomposed. Over millenia, these energy resources accumulated. Over 250 years with the advent of the industrial revolution, the human economy made use of this stored energy and in the process has raised the carbon dioxide level in the atmosphere from just over 300 part per million in the 1950s to almost 420 parts per million in 2020.

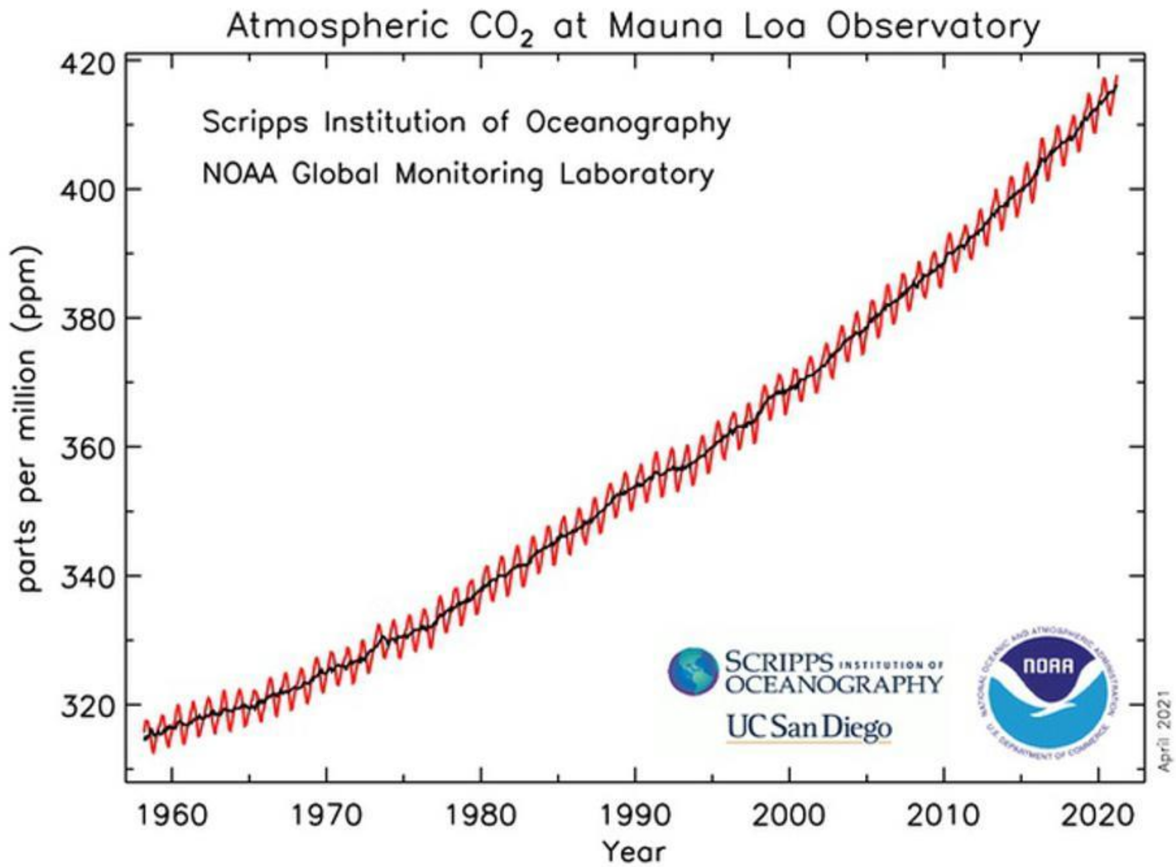

Figure 4. Carbon dioxide levels from the Mauna Loa Observatory in Hawaii as compiled and reported by Scripps Oceanography, UC San Diego and the National Oceanic and Atmospheric Administration.

The basic idea of the circular economy is to prevent the build-up of waste products by eliminating waste and returning used products into production. As such, waste becomes product. This concept has been strongly espoused by the Ellen McArthur Foundation and has now been adopted by numerous major corporations. https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview.

The idea of the circular economy is straightforward. The basic production of goods and services becomes focused on re-use and recycle rather than upon use and disposal. Rather than "take, make and discard", the focus becomes use and then re-use, bending the linear system into a more circular one. To realize this outcome, substantial effort must be invested in the design of a circular system that works for each of the users. This design would include not only reuse of used products but also keeping products in use and coupling with natural systems where possible. A conceptual diagram of the circular economy is shown in Figure 5.

Figure 5. Diagram of the concept of the circular economy from "How I Found the Circular Economy: Biomimicry and the Power of Design" by Sophia Stiles | Sep 23, 2020 | Blog, Biomimicry In Design.

The circular economy has been widely adopted for use by numerous corporations, particularly in the plastics sector that is under tremendous pressure to transform their economic model to eliminate plastic waste accumulating on the Earth's surface and particularly in the oceans. Significant work in this area is being undertaken by Dow Chemical https://corporate.dow.com/en-us/science-and-sustainability/2025-goals/circular-economy.html and Alpla plastics company https://sustainability-report18.alpla.com/en/environment-environmental-impacts/recycling-circular-economy which specifically references coordination with the Ellen McArthur Foundation.

The Circular Economy and Carbon Emissions

The issue of carbon dioxide emissions and the circular economy is less well documented or understood than is the case with plastics and plastic waste or perhaps aluminum which is very advanced toward recycling. The generally accepted pathway to reduce carbon dioxide emissions is to avoid emissions, minimize emissions and mitigate emissions. These three approaches were set out in the seminal article by Pacala and Socolow titled “Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies”, *Science*, August 13, 2004, p. 968 that laid out the pathways by which humans could bring carbon dioxide emissions down significantly when compared to business as usual. They discussed these options in terms of billion ton “wedges” of emission reduction associated with avoidance strategies such as moving to renewables, minimization strategies such as natural gas substitution as well as mechanical efficiency improvement and mitigation or carbon capture and storage by technology and by nature.

There is no doubt that business as usual is no longer possible for the hydrocarbon industry or other industries that are heavy users of petroleum products or electricity. The only question is how to transform and how quickly? The Paris Accords set out a goal of reaching net zero emissions by 2050 and a 50% reduction by 2030 comes from the more recent international evaluations. In Figure 6, a graphic setting forth the steps that companies must climb as they move toward the circular economy is presented.

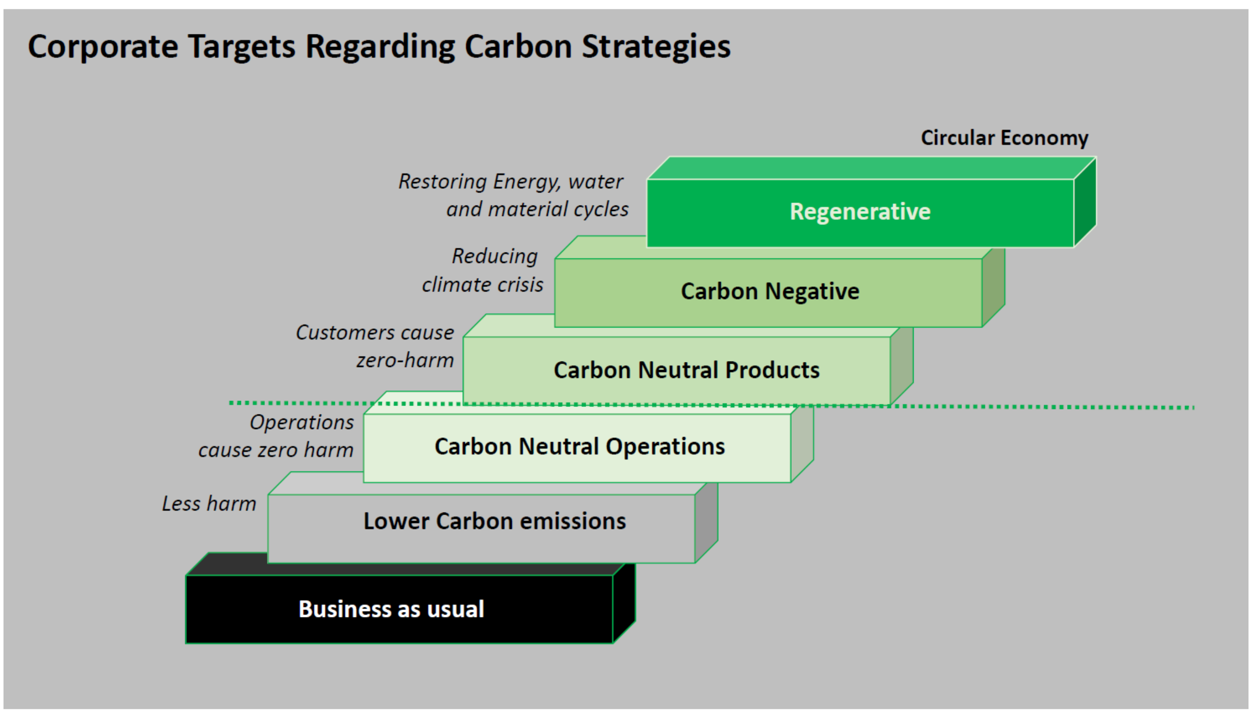

Figure 6. Corporate targets for carbon reductions from Dr. Henk Mooiweer, Grassroots Carbon.

Figure 6 is important as it clearly illustrates the stairway to the circular economy as it relates to carbon dioxide emissions. The progression is from business as usual to reduced carbon emissions to carbon neutral operations. Carbon neutral operations mean the Scope 1 (direct) and Scope 2 (purchased electricity and steam) emissions are addressed. To address carbon neutral products and other upstream and downstream activities requires that Scope 3 emissions be addressed, including customers causing zero harm along with aspects of the supply chain, including investments and employee commuting. For a company to be able to claim to be carbon negative, more carbon must be removed from the atmosphere than is being added by that company, including the full Scope 3 emissions. To become fully circular, more than carbon dioxide must be addressed in the business plan for the company. An illustration depicting scope 1, 2 and 3 emissions is shown in Figure 7.

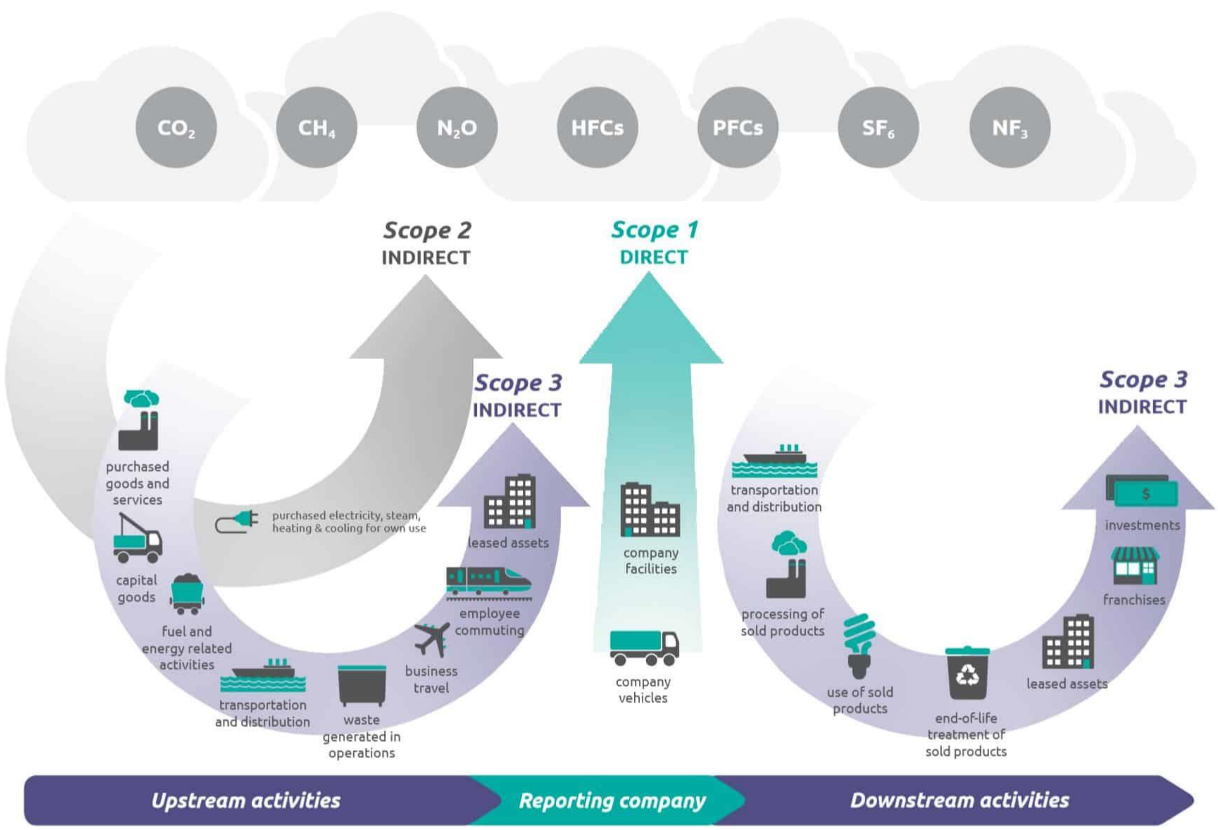

Figure 7. Graphic depicting scope 1, 2 and 3 emissions. Source: https://compareyourfootprint.com/difference-scope-1-2-3-emissions/

In addressing this stairway, different strategies will emerge for different scopes of emissions. For example, companies can address Scope 2 emissions by substituting renewable sources of electricity for coal or natural gas-powered electricity, either by building these facilities themselves or by direct purchase, although direct purchase is delivered through the grid which will also delivers from fossil sources. Scope 1 direct emission reductions will come through increased efficiency of operations and potentially from shutting down obsolete, inefficient processes and direct vehicular emission can be reduced by moving to electric vehicles, although the problem of the grid source of electricity remains.

Scope 3 emissions are quite varied. As shown in Figure 7, Scope 3 sources include both upstream activities such as purchased goods and services, capital goods, fuel and energy related activities, transportation and distribution to the facility, waste from operations, business travel, employee commuting and leased assets. Scope 3 sources also include downstream activities including transportation and distribution of products, processing of sold products, use of sold products, end of life treatment of sold products, franchises and investments. Although some of these emissions can be addressed through supply chain contracts and other similar decisions, many of these Scope 3 emissions are beyond the control of the company generating the product that is central to the diagram. It is important to note that not all companies report Scope 3 emissions in the same manner, and it is important to delve into the computations to understand what is and is not included.

The bottom line is that as avoidance and substitution are practiced, there will be emissions remaining in Scopes 1 and 2 and certainly within Scope 3. For those remaining emissions and for the transitional period that may be implicit in substitution and avoidance strategies, physical removal of carbon dioxide from the atmosphere may be the only way to conform to the requirements of the circular economy for zero or net negative carbon emissions more in line with the natural carbon cycle. This is where an alternative such as BCarbon becomes a key asset in an emission reduction portfolio.

BCarbon and the Economy of the Future

BCarbon is a nature-based carbon dioxide capture and storage system developed by a stakeholder working group assembled by the Baker Institute at Rice University. BCarbon is based upon the technology of the natural carbon cycle which is photosynthesis. BCarbon can be contrasted with technological capture and storage as depicted as aa vacuum cleaner for the atmosphere in Figure 8.

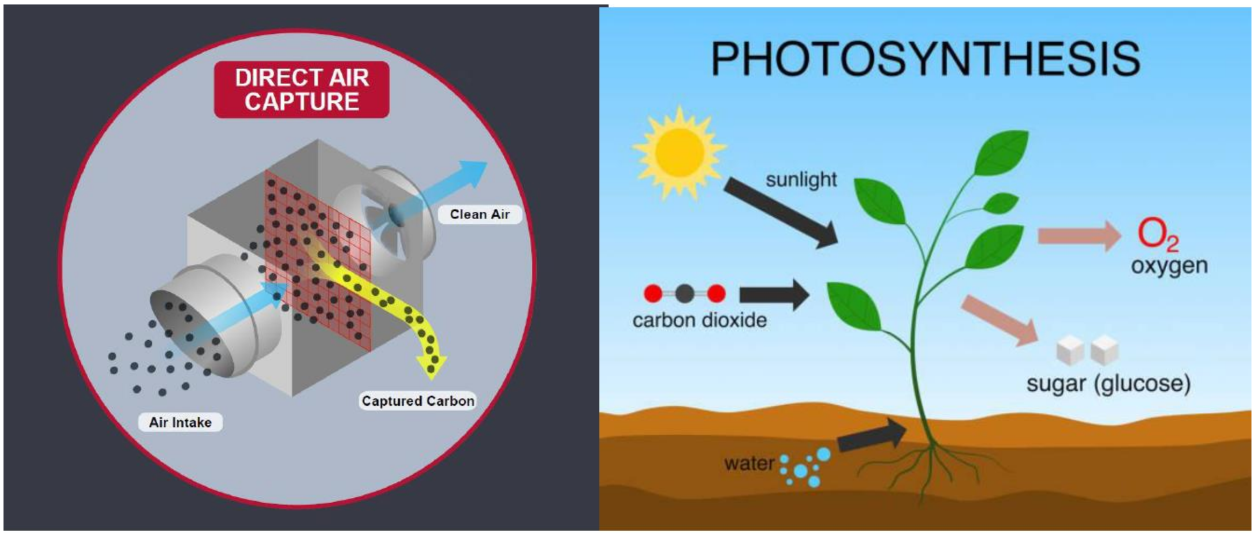

Figure 9. Technological carbon capture and storage compared with photosynthetic carbon capture and storage. Images from https://www.theengineer.co.uk/direct-air-capture-net-zero/ and https://www.istockphoto.com/vector/photosynthesis-gm1292516712-387291153

BCarbon emerged from earlier work at the Severe Storm (SSPEED) Center at Rice University. Here, research into protecting the Texas coast from storm surge flooding focused upon non-structural alternatives to set aside natural areas such as coastal prairies that could survive storm surge with minimal damage. Research led to investigation of carbon dioxide sequestration payment systems in use at that time, and it was determined that all of the better known and respected systems were based upon the Clean Development Mechanism of the Kyoto Protocol.

As can be seen from Figure 10, the Clean Development Mechanism is rather complicated and has a series of disqualification requirements that made it unacceptable to the Texas coastal landowners consulted by the research team, a finding borne out by subsequent discussions with landowners from many areas of the United States and overseas. As can be seen on this diagram, there are several barriers to participation including a financial test to determine if the project is otherwise unlikely to be financially attractive, another test to determine if barriers exist that would otherwise keep the project from being implemented and a third test to determine if the management concepts to be utilized is in common practice or not. Most landowners that were interested in further discussions were making some money off of current practices, had no barriers to participation and would be utilizing practices that were either common or would quickly become common with any type of carbon-related cash flow. In short, the CDM approach would not work for our needs.

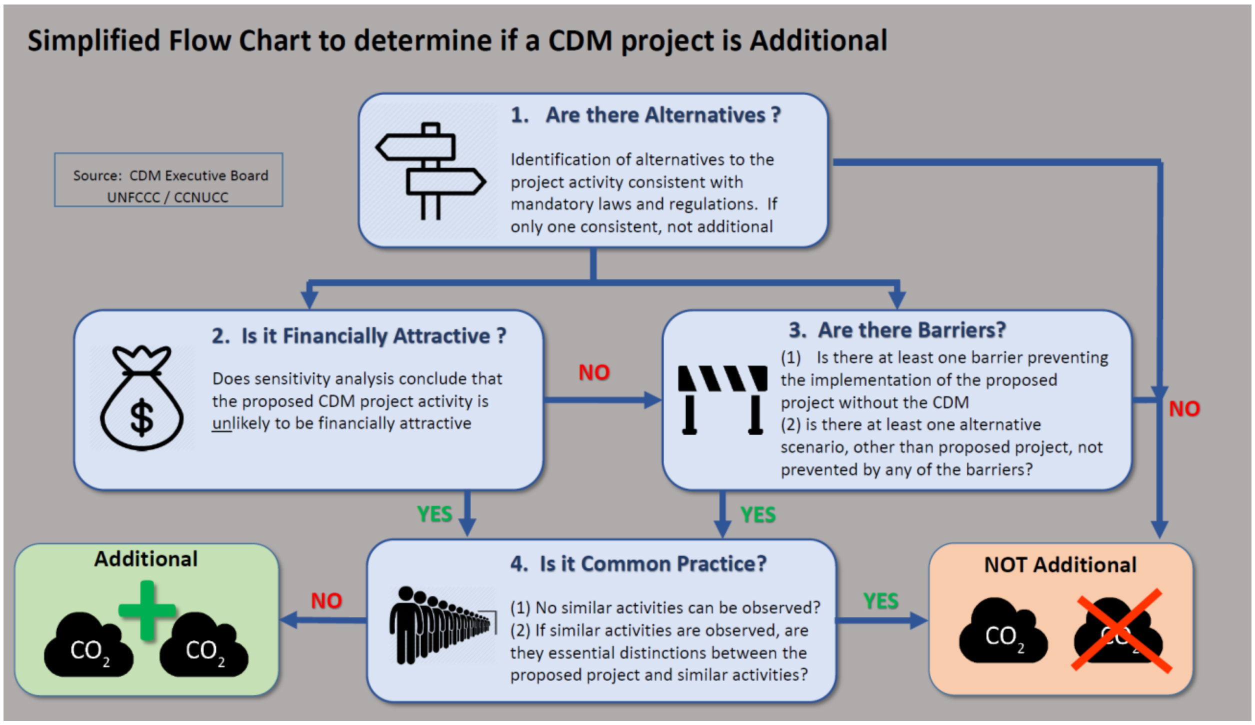

Figure 10. Meeting the additionality requirements of the Clean Development Mechanism of the Kyoto Protocol. Image by United Nations.

To address this problem, a working group of stakeholders was assembled by the Baker Institute at Rice University in Houston. These stakeholders included landowners, environmental groups, carbon emitters and governmental entities that agreed to come together with the intent of developing a carbon sequestration payment system that worked for both landowners and emitters. Out of this group emerged the eleven principles of BCarbon that form the backbone of the BCarbon certification system (see appendix A).

The primary goal of the stakeholders was to meet the basic needs of both the landowner participants and the buyer participants. Landowners wanted a system under which it was easy to qualify and participate as a carbon grower. Buyers wanted to be sure that they were buying a product that in fact existed. To address this issue, BCarbon stakeholders created a system wherein if a landowner could prove that they put carbon into the subsurface, they could sell it. It was just like growing potatoes. If you grow it, you have right to sell it.

To address the buyers' requirements, the stakeholders recommended that rigorous testing be required to provide documentation that carbon was in fact being removed from atmosphere and stored in the soil. To this end, a testing protocol was developed and a document setting forth the measurement protocol was written by the metrics subcommittee of the stakeholder working group. https://bcarbon.org/our-standards. The stakeholder group also required that the carbon be maintained for a minimal period of ten years for each transaction without significant subsurface disturbance such as plowing. Each of these concepts is included in the BCarbon principles.

The BCarbon system does provide for certification of carbon credits after the first measurement and before the second that is required to prove the amount of carbon storage. These so-called interim credits are an innovation that is being applied conservatively at the initiation of credit issuance and evaluation. Interim credits are not automatic but are discretionary based upon a rigorous evaluation of soils, climate, and management concepts. They are important, because they allow the cost of testing to be covered by these interim transactions with perhaps a bit extra. However, if the issued interim credits exceed the actual accrual as determined by the second round of testing, then the landowner must make up the difference by either purchase or commitment of additional year's storage, a process referred to as "trueing up". On the other hand, if more has been accrued than estimated, then more credits will be issued. This true-up requirement makes it in everyone's interest to be conservative in these interim credit estimates.

By making it easy for a landowner to qualify under the BCarbon standard, it is both foreseeable and reasonable to believe that a large scale of carbon removal and storage will be obtained. No landowner will be rejected because they are making money with their current operation as is the case under the United Nations Clean Development Mechanism approach adopted by many other certification entities. No landowner is rejected under the BCarbon approach if other landowners in the area are using the same management approaches. And no landowner is rejected because they chose to become good stewards at some point in the past.

Simplicity

BCarbon's stakeholders made the decision to be inclusive to create a market consistent with the circular economy's concept of support of natural cycles. That is the overall solution that BCarbon is enabling. All BCarbon requires is proof that carbon is being stored in the soil and not being disturbed for ten years after the date of the transaction. Under the BCarbon system, the ability to sell this stored carbon is considered an element of property rights, just as a landowner that grow potatoes has a right to sell those potatoes. It's that simple.

In fact, property rights define all aspects of the BCarbon approach. The carbon dioxide that is emitted is the property of the emitter. By contract, the emitter pays a landowner to remove and store carbon dioxide as organic carbon on their property. Property emitted becomes property stored on private property or on property leased for such purposes.

There is beauty in simplicity. A simple system invites landowners to participate, and the more landowners who choose to participate, the sooner large volumes of carbon dioxide can be removed from the atmosphere and placed into storage that as an aspect of the circular economy has the potential to last for decades. And while some of this carbon dioxide removal will occur on land where good stewardship is currently practiced, observations and anecdotal discussions indicate that many if not most landowners are either not practicing good stewardship or are involved in marginal agricultural activities that will be converted to carbon dioxide removal and storage by the creation of dollar value for natural carbon sequestration.

Scale and Land Use Change

As the market grows and the price increases as nature-based solutions begin to be accepted, the potential for massive removal and storage of carbon dioxide becomes immense and transformative. That is the vision of the BCarbon approach. Stated otherwise, BCarbon could be said to be based upon the concept of market as an environmental solution. In this way, it is a conceptually different approach than any other currently practiced to addressing environmental problems. Most of our current environmental laws address externalities such as pollution arising from our past and current market system by regulation. BCarbon is about developing a market system as an environmental solution, and that is a very different approach to addressing environmental harms.

The concept of market seems at odds with an environmental solution, yet nothing could be further from the truth. For decades, economists have been decrying the fact that nature provides ecological services that are not valued in our economic structure. That was certainly true in the past. However, the evolution of the circular economy changes that past error and makes dollar value for natural services a part of the compensation pattern for the future.

BCarbon does not require any specific land management practices. We have learned that landowners do not like to be told what to do. However, some studies indicate that certain types of practices such as regenerative grazing, restoring lands with native grass species, and reducing overgrazing will bring greater carbon yields than other practices will achieve. As the cash begins to flow to those landowners with the better management practices, the more likely it is that those practices will be adopted by others. The word will get around in the local coffeeshop and at the sales barn. Best practices will be adopted in pursuit of financial gain.

One opportunity seems particularly important for a massive change in the status quo. Large areas of the United States are currently being used for row crop production that is not sustainable in the long term due to reduced and/or uncertain water supplies for irrigation. This is particularly true on the western side of the Ogallala Aquifer as shown in Figure 11 and in areas of California and Arizona irrigated by water from the Colorado River - water that is diminishing with changed rainfall patterns, lower reservoir yields and over-pumping or over-allocation.

Figure 11. The Ogallala Aquifer underlies large portions of Texas, New Mexico, Okalahoma, Colorado, Kansas, Nebraska, Wyoming and South Dakota. As this water resource wanes, conversion of irrigated cropland to native prairies will likely occur with a payment system being in place to reward landowners for sequestering carbon. Image from https://museumonmainstreet.org/content/ogallala-aquifer-nebraska.

These lands have the potential to convert to native pastures that can be supported by local rainfall. As the need to convert these marginal lands increases, BCarbon will be available with a market-based approach that will make the transition to more sustainable land management practices financially achievable and relatively straightforward.

Similarly, there are many land areas that are dedicated to growing crops for animal food. These animal feeding operations generate large volumes of methane as well as carbon dioxide emissions which will be significantly reduced if those row crop areas are converted to native grasslands and grazing. There are currently 200,000,000 acres of land dedicated to growing animal feed in the United States. If just half of that was converted to native pasture that utilized regenerative grazing techniques and/or restored native prairies, the potential exists to increase the removal and storage of carbon by 100 to 400 million tons per year depending upon area and management techniques utilized.

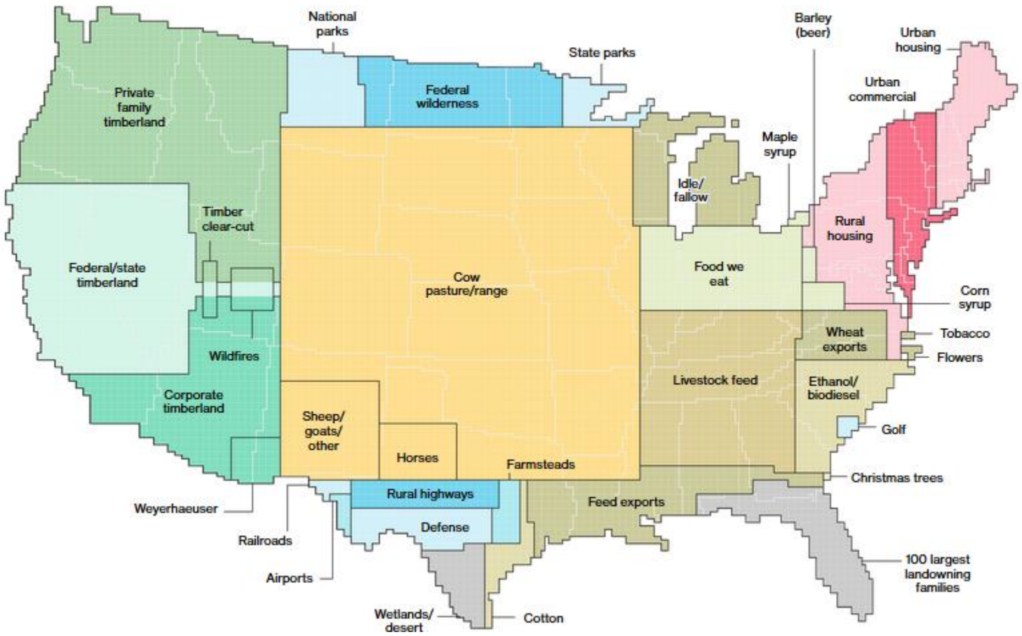

Figure 12. Map depicting land usage in the United States. Area shown in light brown indicates that percentage of U.S. land dedicated to growing feed for livestock as opposed to being used for pasture lands. This area is approximately 200 million acres.

These massive changes in the use of agricultural land will only be possible if there is cash flow that rewards management practices that yield larger and larger volumes of carbon storage in the soil. This is where BCarbon stands apart from all other standards. By making participation so difficult, the standards that follow the Clean Development Protocol of the United Nations make the emergence of a viable nature-based, circular-economy market that is large in scale unlikely to occur. That is why the BCarbon stakeholders chose to make participation easier – to encourage the expansion of this market to create a huge scale of emissions drawdown and long-term storage.

BCarbon and Company Strategic Decisions

As discussed earlier, many companies either have or are in the process of making carbon reduction commitments. Business as practiced in the past is no longer viable. Most major companies have a full understanding of their greenhouse gas emissions or at least their Scope 1 and 2 emissions which are most often expressed as carbon dioxide equivalents. All companies are in the process of evaluating strategies to address carbon dioxide emissions, often to address environmental, social and governance (ESG) requirements. Company strategies generally involve emission avoidance, emission minimization and emission mitigation or removal.

Nature-based solutions such as BCarbon have a major role to play in addressing all three scopes. However, natural solutions may be the only reasonable alternative available to most companies to fully address Scope 3 emissions or to become carbon negative and may be a viable alternative to remove what cannot be addressed by avoidance and minimization on Scopes 1 and 2. This is where the cost of nature-based solutions becomes a major factor in pushing companies to solutions such as BCarbon.

Technological carbon capture and storage options are currently under development by many companies but remain extremely expensive, generally exceeding $100 per ton removed if not $150 to $200 per ton or more. And while these prices may come down to some extent, the current market for rigorously tested soil carbon is currently in the $20 to $25 per ton range, with that price expected to increase to $40 to $50 per ton over the next year or two as it has in Europe, representing a bargain when compared to the technological alternatives.

Buyers, however, have been hesitant to invest heavily in nature-based solutions. There is no agreement as to which alternatives will be acceptable to stockholders, advocacy organizations or governmental entities. There is no current regulatory system. The Clean Development Mechanism of the Kyoto Protocol applies only in limited circumstances and is not binding on companies seeking to reduce their carbon footprint that are not otherwise subject to agreements adopting these standards. Yet many companies are hesitant, and they may ultimately fail for lack of understanding these newly emerging markets or for being hesitant at a time when decisive leadership is required.

Companies choosing to participate in this more “open” pathway that BCarbon is developing are needed to step up and play their part in making sure this new system succeeds. Strong arguments exist for buying BCarbon-certified credits. If companies are not prepared to support excellent systems that are based upon circular economic thinking using market solutions that enable scale and are reasonably-priced and if governments are not prepared to support them, then massive carbon removal will simply not occur in the shorter term, and affirmative acts to address climate change will be set back decades.

BCarbon and Scale

The strongest argument for BCarbon is the scale that can be realized with the circular economy's biomimicry of natural cycles. There are about one billion acres of grazing lands in the United States and much of that land is owned by the private sector or state governments. Additionally, there is the previously mentioned 200 million acres of land on which animal feed is grown. If this land were managed for carbon, we could increase the natural capture and storage of carbon by upwards of a billion tons per year. That would represent a reduction of at least 15 to 20% of the United States carbon emission footprint. But to do it, an open, simple market system such as BCarbon seems to provide the fastest and most efficient pathway.

Secondly, with the scale brought about by BCarbon would come a massive increase in the extent of native prairie. Native plants have very deep root systems that pump carbon into the soil. These native plants are adapted to local climactic conditions and can survive on local rainfall and local soils. In this manner, one of the most heavily impacted ecosystems within the United States – the native prairie system – would be restored across much of the central and western United States. The market enabled by BCarbon and the buyers participating in the BCarbon system would bring about the most significant ecological restoration program in United States history. Imagine the grassland ecosystems of the United States restored by steps taken to reduce the impacts of climate change. What a double victory that would represent.

Consider what a major restoration of the native prairie would offer in terms of co-benefits. One of the BCarbon's stakeholders – David Langford – is past president of the Texas Wildlife Association, and he prepared a list of the co-benefits that come with restoration of native prairies, one of our most heavily impacted natural ecosystems. David's concepts are set in Figure 13.

Figure 13. Illustration showing the co-benefits of prairie restoration. Information from David Langford.

DEI: The Social Dimension of BCarbon

And that is not all. There is also a social dimension to BCarbon that involves diversity, equity and inclusion or DEI. BCarbon has adopted the principle of inclusion as Principle 11 (see Appendix A) and has undertaken research and outreach in an effort to create a nature-based carbon sequestration program that is beneficial to all sectors of society. There is no doubt that lower income families and families of color are likely to be hit hardest by the impacts of climate change, and any program to address climate change will be beneficial to those most heavily impacted. However, BCarbon depends heavily upon private landowners to achieve its climate mitigation goals, and the vast majority of landowners in the U.S. are white, a fact that cannot be overlooked.

For this reason, BCarbon has made DEI a major aspect of its approach. There are many ways to be inclusive, starting with attempting to identify and include black, Hispanic and indigenous landowners. BCarbon's staff is assembling lists of such owners and will be reaching out through these and other organizations to identify and include such owners. Here BCarbon expects to encounter difficulties due to smaller tracts that will need help in addressing the cost of the rigorous BCarbon testing protocol. To this end, BCarbon is attempting to create a fund to help defray the cost of such testing.

There are other DEI strategies being considered as well. BCarbon is investigating providing a source of funding to help minority landowners keep ownership of their lands by making funding available as well as seeking to provide funding to assist new minority landowners in obtaining property to be used for carbon storage. BCarbon is investigating creating a system of credits for urban agriculture such as farmer's markets that reduce carbon emissions by avoiding transportation of foods over long distances. And BCarbon is investigating other forms of urban credits through tree planting and urban open spaces.

The DEI commitment of BCarbon continues into professional arrangements and training. BCarbon is seeking alliances with historically black (and Hispanic and indigenous) colleges and universities. As BCarbon expands, it is reasonable to anticipate a significant increase in consulting and testing firms advising landowners on compliance with the BCarbon testing methodology. Here BCarbon will attempt to populate the professional service industry supporting BCarbon testing and evaluation with qualified professionals from these as well as other institutions.

Expanding BCarbon to Forests and Oyster Reefs

Additionally, BCarbon has learned that many minority landowners possess timber tracts rather than grassland properties. Due to this fact as well as general interest by many landowners owning forested tracts, BCarbon is investigating expanding its standard to incorporate a forest credit. As envisioned by the forest subcommittee of the stakeholders' group, the basic rules for forest participation would be similar to the rules for grassland participation with a few distinctions based on the nature of the forest credit.

First, tree carbon credits represent a riskier carbon investment than does soil storage due to the risk of fire. BCarbon requires a buffer requirement of 10% for soil storage projects and has not yet determined what the buffer amount for forest credits will be, but that number will likely approach 20 to 25%. BCarbon's forest approach will likely include using fire as a management tool to reduce the risk of a huge, consumptive fire in which all carbon is lost. However, by allowing such techniques, BCarbon recognizes that the amount of carbon being sequestered per acre and available for sale necessarily will be reduced.

Second, ecological integrity has always been a goal of BCarbon, one insisted upon by the stakeholders who have always opted for good stewardship alternatives. With regard to forests, there is a strong ongoing discussion about harvesting and clear cutting of forests and how that should or should not be included. At the time of this writing, that decision had not yet been made, although integration of sound harvesting with concepts being utilized by architects in utilizing timber for carbon sequestration in building construction will be fully considered and possibly included.

BCarbon is also exploring other concepts for nature-based carbon credits. One of the most interesting is the potential to utilize oyster reef construction as a carbon capture and removal strategy. In conjunction with the Harte Research Institute and Texas A&M Corpus Christi, BCarbon is developing a proposal for the stakeholder group to consider relative to oyster reef construction and seagrass bed development in association with newly created oyster reefs. Again, the ecological co-benefits of this carbon capture strategy are extensive.

Conclusion

In conclusion, let's return to the secondary title of this article – Confessions of an Environmental Lawyer. Twenty or thirty years ago, I could not have envisioned an economic solution wherein business investment decision might be a pivotal approach to addressing a major environmental problem, and certainly not something as massive as reversing the atmospheric build-up of carbon dioxide. Yet, that is what I believe today.

In many respects, I have come to trust the ability of money to achieve social goals. If we set up an economic system to reward certain types of behavior that conforms with natural cycles, I believe that such as system will work much better and achieve a long term end goal much faster and more efficiently than would come from regulation.

The circular economy is the great hope for an economy in the future that can bring prosperity without destroying the Earth in the process. Our current system has failed, and we are all in the process of making the adaptations that are necessary to correct these past failures. A new and different economic system is the fastest way to this end point relative to climate change.

Regulation will not solve this problem. And with that confession, this environmental lawyer says no more.

Appendix A. The 11 Principles of BCarbon

The 11 principles below were developed by the working group, and describe various aspects of the BCarbon system:

> **Principle 1. The credits under this U.S. system are for the removal of carbon dioxide from the atmosphere by photosynthesis and storage in the soil as carbon.**

The Baker Institute proposed standard is based on carbon dioxide capture by plants through photosynthesis and storage of that captured carbon in the soil as it is transported through the root system and bio-deposition. It is a managed natural engineering solution whose success will depend on protecting and restoring the natural ecosystem or by innovative agricultural systems using cover crops and no till processes. By creating storage credits, the BCarbon system intends to enable a trading system based upon storage of removed carbon dioxide stored in the soil.

It is important to note that this system is carbon capture and removal and not traditional offset. Under this system, the tradeable carbon dioxide must be removed from the atmosphere and stored in the soil. The transactions enabled under this system pay a landowner for maintaining an ecosystem that physically removes a molecule (or ton) of carbon dioxide from the atmosphere – carbon dioxide that was emitted at another place - and physically storing that carbon dioxide in the landowner's soil. BCarbon is a nature-based solution based on nature's technology - photosynthesis.

> **Principle 2. Any landowner who sequesters carbon dioxide in the soil within a given calendar year is eligible for soil storage payments for that year.**

The basic concept under the BCarbon system is that landowners should be paid for establishing, maintaining and/or expanding a vegetative system (an ecological system) that removes carbon dioxide from the atmosphere and stores it in the soil as carbon. The current system presently in use around the world does not really enable that end-result, hence the need for this new standard. It is an important goal of BCarbon to change that aspect of our current economic and legal practices.

As stated in Principle 1, a credit is enabled under the BCarbon system for the landowner's ecological service of removing carbon dioxide from the atmosphere and storing it as carbon on his/her property. This standard allows the buying and selling of this ecological service by any landowner whose lands are performing this function in the calendar year within which sales are occurring. BCarbon does not differentiate between lands upon which carbon has been stored in the past and lands which are storing carbon for the first time in centuries. Existing sinks for carbon dioxide must be protected just as new sinks need to be developed. This standard imposes no requirements other than that carbon dioxide be removed and stored in the soil, that the storage be proven through measurement and that the landowner agree to keep the carbon in the soil for a period of ten years after each year's transaction.

As such, the Baker Institute standard for carbon dioxide removal from the atmosphere and storage in the soil does not embrace the traditional concept of additionality that is a cornerstone of the trading enabled by the Clean Development Mechanisms of the Kyoto Protocol. The decision to rethink additionality was not undertaken lightly but was considered necessary to optimize the removal and storage of carbon dioxide by photosynthesis through natural ecological systems. For a further discussion of additionality and BCarbon, please see the BCarbon White Paper on Additionality.

Under BCarbon, the landowner is a focus throughout as is the concept of private property rights. This is because this standard is tailored to the needs of the United States where much of the land is privately owned. As such, BCarbon respects private property rights and treats carbon storage and its sale as one of the "bundles of sticks" that come with private property ownership. Under the constitution of the United States, if you can prove that you are adding carbon to your soil and keeping it, you have a right to sell it to those who need to store their carbon dioxide emissions somewhere. In order to sell the carbon dioxide stored on their property, private property owners will need to make representations about land restrictions. For this reason, the standard is written to be implemented by landowners.

Carbon removed from the atmosphere can also be stored for long periods of time in our trees and forests. BCarbon does not currently focus upon carbon stored in trees, choosing instead to focus upon carbon dioxide removed and stored in the soil. A subcommittee of the Baker Institute Working Group that developed the BCarbon standard is currently considering the potential expansion of BCarbon into the carbon storage in timbered areas.

Principle 3. Soil carbon testing is required to validate transactions which can be based upon estimated values subject to verification.

Testing is a cornerstone of the BCarbon system. These standards do not mandate specific performance criteria. Instead, this approach allows for the sale of carbon that is added each year to the soil. This incremental increase in soil carbon must be determined by measurement or estimating techniques subsequently verified by measurement.

The starting point for testing is statistically sound field testing using proven soil sampling methods. Here there are many important details. As used in the Baker Standard, soil carbon means all of the below ground carbon in the soil, including root mass as shown in figure 1A. It is important to point out this distinction because many soil scientists exclude root carbon from their studies that are more focused upon the biological interactions within the soil rather than carbon dioxide removal from the atmosphere and storage as carbon in the soil. Additionally, no “above ground carbon” will be offered for sale under these transactional standards for grasslands and agricultural croplands. Here, the assumption is made that the above ground carbon either returns to the atmosphere as carbon dioxide as part of the natural carbon cycle or is stored in the soil. It is the enhanced storage in the soil that is the focus of the Baker standard.

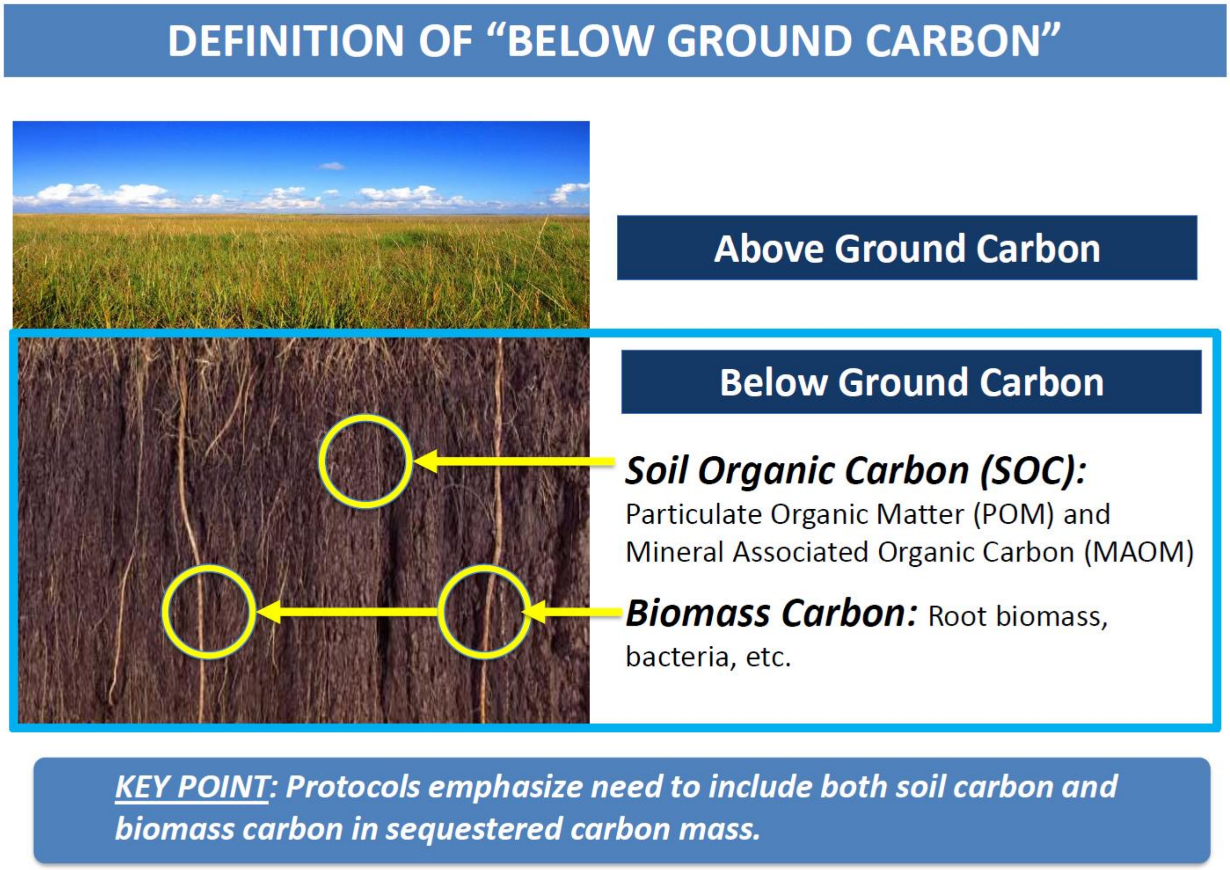

Figure 1A. Identification of the "below ground carbon" being measured, with the incremental increase being offered for sale. Image by GSI, Inc.

To enter the BCarbon trading system, representative testing must be initiated. This testing protocol is set out in BCarbon soil testing standards which can be found in a stand-alone white paper. https://bcarbon.org/our-standards. The BCarbon soil standard sets out a testing protocol designed to provide greater than 80% accuracy as to the amount of carbon stored in the soil. However, that process is expensive and cumbersome and will be difficult to implement at scale. For this reason, BCarbon and Rice University and many other entities are searching for faster and easier, yet reliable, testing methods. It is anticipated that a hybrid approach much like identified in Figure 2A will emerge after much further discussion.

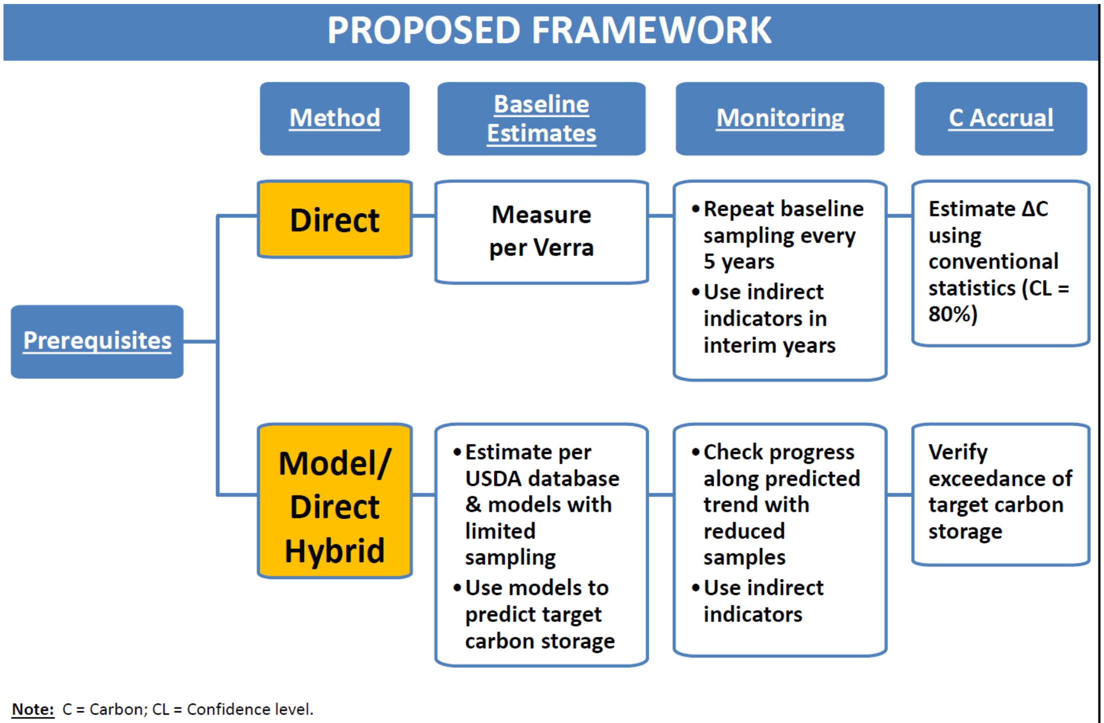

Figure 2A. Proposed testing framework including a direct testing approach using the detailed soil testing and hybrid approach that utilizes modeling and direct testing. Diagram by GSI, Inc.

Principle 4. Transactions may occur on an annual basis after an initial declaration of intent to participate in the soil carbon sales program and the initiation of soil carbon testing requirements.

Participation in the BCarbon credit issuance system officially begins with the submission of a letter of intent and then an application leading to undertaking the initial soil carbon measurement protocols. Upon completion of the initial round of testing and meeting the BCarbon qualification criteria, sales of stored carbon may begin. These initial sales are discretionary and based on both estimated and then subsequent measured increases in the soil carbon content of the soil on a per year basis. Once an applicant is eligible (e.g., testing has been commenced), then credits may be issued, and transactions undertaken after approval by BCarbon. Storage generated during years prior to initial testing is not allowed to be sold as a general proposition. Ongoing carbon storage after initiation of testing is eligible for sale based upon the rules set out in this standard regardless of prior use of the property.

Although this system is based anchored by testing, transactions during the first several years are allowed to be based upon literature values, knowledge of the region, meteorology, soil types and applicable models, if any. These initial estimates must be specifically approved by BCarbon technical staff, and the issuance of these credits is at the discretion of BCarbon. After three to five years, a second round of testing is required to be undertaken. At this time, a determination will be made as to whether the estimated amount of carbon sold was actually stored in the soil. If there is more carbon in the soil than was sold, additional credits will be issued. If initial estimates were high relative to the results of the subsequent testing, then the underage must be made up by the landowner by foregoing sales in subsequent years or by purchasing carbon storage credits equivalent to the shortfall.

This concept of sale pending final testing results is illustrated in the set of steps set out in figure 3A. In this diagram, the initial testing is shown in Step 1 and the estimation is shown in Step 2 with yearly saleable increments identified in Step 3. In Step 4, the second sample is taken after several years, and the actual carbon accrual is determined. As shown in Step 5, if that carbon accrual is greater than the estimated amount, it can be added to the saleable inventory at the time of the second measurement.

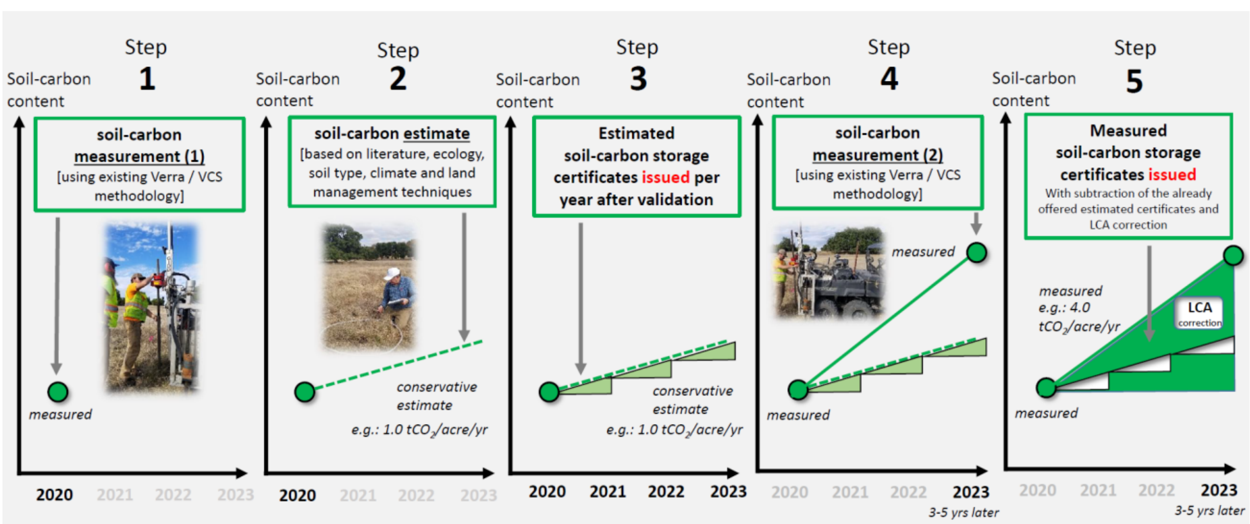

Figure 3A. Diagram showing the various stages in the verification of an estimated sale based upon measured soil carbon. Diagram by Dr. Henk Mooiweer, Soil Value Exchange.

The estimation of future carbon yields is a very sensitive step that will be subject to critical examination by the BCarbon and is discretionary. It should be possible to reach a general consensus about the carbon storage potential of various soils in various regions with certain types of land management regimes. However, it is important to note that an unscrupulous project manager could take advantage of this estimation process, emphasizing the critical role of BCarbon's determination and integrity as a reviewer and credit issuance entity.

Principle 5. To become eligible for payments, a landowner must agree that the land will be maintained and protected in a way that promotes and protects soil health and landscape ecological health for ten years. Transactions occurring in subsequent years will require renewal of the ten-year commitment, creating a "rolling" ten-year requirement.

Another concern in a soil storage system is the potential that the carbon that has been stored in the soil could be released back into the atmosphere. Here, the landowner is the key. Under Principle 5, the landowner must commit to leaving the carbon in the ground undisturbed for ten (10) years after the credit is issued. The landowner must agree to this restriction on the use of their land if they are to receive payments for storing carbon. This agreement will be enforced by contract between the landowner and the assembler or between the landowner and BCarbon, with BCarbon having the right of enforcement in either situation.

Most of the current standards originating under the Clean Development Mechanism of the Kyoto Protocol require a minimum of 20 years encumbrance upon the land and some require 40 or even 100 years. However, most United States landowners will not restrict their land for that amount of time. Instead, the working group agreed that ten years was a reasonable minimum time period for each transaction. If we are to realize the full potential of United States range and farmlands to remove carbon dioxide from the atmosphere and store it in the soil as carbon, the system has to workable for landowners.

In discussions with landowners, it has been determined that a 10-year commitment for each transaction would be considered reasonable. Given that these transactions are made on a yearly basis, each year's sale represents another ten-year commitment. Therefore, the BCarbon standard adopts a "rolling ten-year" land protection requirement based upon the prospect that the market will become stronger over time and that the landowners will act in the financial best interest and pursue these carbon sales for multiple decades.

All contracts between the landowner and the assembler must contain language obligating the landowner to maintain and protect their land in a manner that promotes and protects the soil health and landscape ecological health for ten years. "Maintained and protected in a way that promotes and protects soil health and landscape ecological health," for the purposes of this standard, is defined as allowing natural processes to proceed unhindered and does not require but allows active management to improve the ecosystem health. Disturbance of the soil by mechanical means, such as paving, plowing, or building is not allowed, but minimal disturbance associated with progressive management approaches will be allowed.

Notwithstanding the foregoing provisions, the following conditions and surface activities will not constitute breach of a contract established pursuant to this standard: 1) natural alterations such as erosion and natural caused fires; 2) planned and/or prescribed burning for management of vegetation; 3) mechanical disturbance of no more than 2% of the property for purposes of pipeline maintenance or construction, or oil and gas exploration, development and production or development of solar or wind power; 4) maintenance and/or improvement of existing interior roads; 5) typical surface activities involved with grazing livestock, mowing, fishing, crabbing; 6) placement of approved fill and plant materials and related construction activities to combat vegetative erosion and 7) other activities determined to be compatible with maintenance and protection are permitted.

This commitment to maintain and protect the land will be executed through signed contractual agreements. As part of that contract, landowners must agree to either replace carbon that may be lost by failure to abide by the contractual documents or buy carbon storage equivalent to that involved in the contractual agreement. This contract shall be maintained and enforced by the assembler as part of the assembler obligation of by BCarbon, either through a direct contract with the landowner or by secondary enforcement authority in all contracts between assemblers and landowners.

Principle 6. Landowners are not required to manage their land in any particular fashion. However, certain land management techniques will lead to greater carbon sequestration than will others.

The BCarbon standard does not require any specific land management activities. Period. Unlike project-related systems that determine credits based upon land management representations and modeling based upon land management assumptions, the BCarbon standard does not require any specific land management activities of a participating landowner. However, certain land management techniques, such as overgrazing of grasslands, may yield zero to perhaps even negative carbon storage in the soil. On the other hand, certain land uses such as regenerative grazing have been reported to sequester up to or beyond 4 tons or more of carbon dioxide per acre per year, with restored native prairies also doing quite well at carbon sequestration.

In other words, management makes a difference, and it here that the market system is relied upon to increase soil carbon yields. Landowners who employ good land management practices will make more money than their neighbors. The bottom line is that better soil health will lead to higher carbon storage rates and therefore certain land management activities will lead to better soil health and higher storage rates. Good soil health is the key, and the BCarbon standard adopts the proposition that better payout will be more effective than prescriptive rules in increasing carbon yields in the long term. The contrast between a well-managed and overgrazed pasture is shown in Figure 4A.

Figure 4A. These two tracts show significantly different ecological productivity in the exact same region with similar soil conditions, indicating the difference that management can make in the health of the grassland ecosystem and carbon sequestration.

Principle 7. A buffer account will be maintained to ensure that all credits issued under this standard are protected against failure risks.

BCarbon Principle 7 requires the assessment and set aside of a buffer account. A buffer account is a hedge against non-performance. If a landowner defaults on their obligation to protect the carbon that they have collected in their soil, the buffer account will be called upon to compensate for the lost storage. It is an insurance policy on behalf of the buyers that will be maintained by those that assemble the credits for sale.

The key question with the buffer account is how much carbon storage should be set aside for what length of time, and the answer to this question is related to examination of the risk of the loss of the stored carbon. Soil storage is very different from forest storage in that fire is not a major threat. The BCarbon storage standard does not award credit for above-ground storage but instead is based upon below-ground storage. Relative to this approach, the major risk is land use change, either by tilling or by change of ownership and use.

The amount of risk, it seems, would be based upon the legal ability of the landowner to break the contract. If, for example, the landowner voluntarily committed to a permanent conservation easement recorded in the deed records, the risk of conversion to another land use type would be very low to nil. On the other hand, if the document restricting the conversion was the ten-year, no disturbance contract set out in principle 5, the risk of default would be greater. Therefore, the Baker Institute soil storage standard will require a 10% buffer for all projects relying upon the generic contract under Principle 5 and no buffer if the land is covered by a conservation easement.

Principle 8. It is anticipated and specifically allowed that a third-party entity will act as an assembler of credits for purposes of expediting the communications and exchange between buyers and sellers.

Under the BCarbon soil standard, there is a role for an entity known as the assembler (or what some refer to as the project manager or project developer). As shown in the Figure 5A below, the assembler acts as a “middleman” between the seller and the buyer. In particular, the assembler works with individual landowners to secure their participation in carbon sequestration under the standard. Another entity – the certifier – also is proposed to be created in order to implement the standard. This is the non-profit entity named BCarbon, and it is discussed under Principle 9. The role of the certifier is to certify that the credits assembled by the assembler meet the requirements of the standard.

Institutional Structure for BCarbon

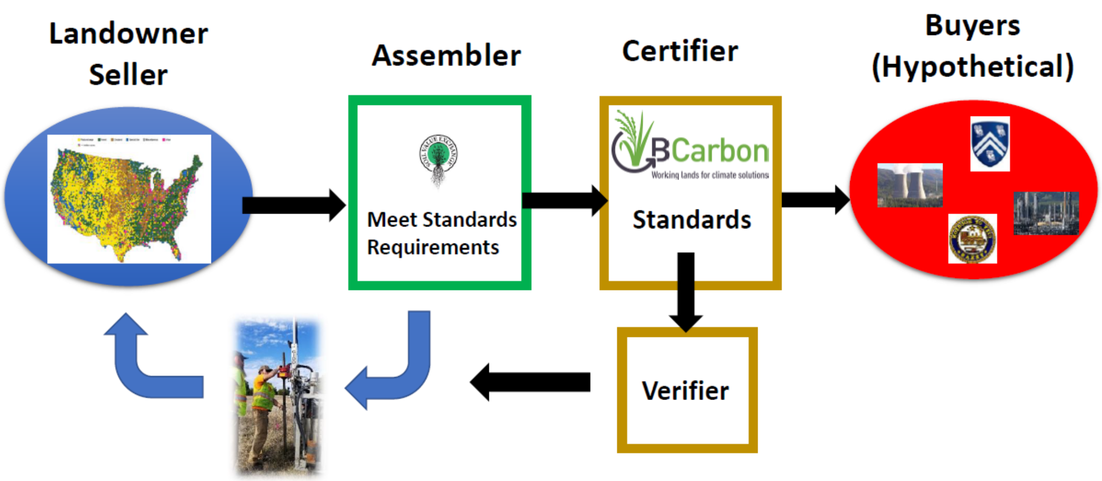

Figure 5A. Conceptual diagram showing the role of various parties in the institutional structure emerging to implement the BCarbon standard for removal of carbon dioxide from the atmosphere and storing it in the soil as carbon.

An assembler is a necessary element as a practical matter under the Baker standard. There are various tasks that must be performed in order to meet the standard. Documentation must be prepared and submitted to the certification entity. Testing must be designed and undertaken. Buffer requirements must be set aside. Contact must be made between buyer and seller. Contracts must be executed between the landowners and the purchasing entity. In most respects, a single landowner will not have the ability to undertake these tasks alone. Instead, these tasks most likely will be undertaken by an assembler that provides a bridge between the buyer and the seller, including the necessary staff and financing to work through the initial qualification steps.

At the current time, the number of assemblers currently in existence is limited, but under the BCarbon standard, all potential assemblers are welcome. The standard is being established as open source and can be used by anyone as long as the requirements of the standard are met. On the Baker Working Group, potential assemblers are welcome.

The assembler stands between the landowner and the buyer as shown in Figure 5A. As a practical matter, the assembler becomes the transactional focal point under this system. Specific tasks likely to be performed by the assembler include but are not the following:

1. Explaining requirements of the standards and executing a contract with the landowner.
2. Defining the land area subject to the contract
3. Assuming responsibility for initiating and continuing testing in accord with the metrics requirements of the standard.
4. Establishing the initial estimated carbon sequestration value for each transactional package (including back-up documentation).
5. Executing contracts with buyers to sell certified credits.
6. Monitoring contract compliance and assumes enforcement responsibility.
7. Working with certifying entity to maintain buffer account.

As contemplated under this system, the assembler will submit a package of credits to the certifying entity for certification. Included in the package will be sufficient documentation to allow the certification entity to determine compliance with the substantive requirements of the standard. The application for credits is a stand-alone white paper.

Principle 9. All credits issued under this standard must be certified.

The certifier stands between the landowner/assembler and the buyer as shown in Figure 5A. A non-profit corporation – BCarbon – has been created to perform the function of the certification entity. As of November, 2021, BCarbon is proposing to issue its first credits to Grassroots Carbon and is in various stages of processing applications from Future Foods in the United Kingdom as well as four other entities in the United States and several more from around the world.

The key to the success of the soil storage standard created by the Baker Institute Working Group is credibility, and a solid certification process is the key to credibility. This is the role of BCarbon as the certification or registration entity that will issue credits and stand behind them. It is essential that the carbon storage credit be reliable. If some corporation or individual or non-governmental entity relies on this standard, they need to be able to demonstrate to outside parties that the carbon dioxide is stored in the ground at a real ranch at a specific location. And while the testing protocols can provide ground truthing that the carbon has been deposited in the ground, there is a need to oversee the assemblers and ensure that the credits they are managing do in fact meet the requirements of the standard.

The role of the certifier is to determine that the Assembler correctly applied the standards to develop the credits that they are offering to the buyers. It is a key function because the credibility of the transaction depends upon compliance with the agreed-to standard. The following is a list of the functions that the certifier is expected to perform:

1. Review documentation provided by assembler of credits.
2. Certify that the property is properly described.
3. Certify that testing has been initiated as per the standard.
4. Certify reasonableness of the initial carbon storage estimates.
5. Certify that contracts are signed and that they provide for the ten-year protective period.
6. Certify the number of tons of carbon credits per review package.
7. Certify the "buffer" requirements are met.
8. Issue the credit.

Principle 10: All credits certified under this standard may be bought and sold until retired, with all transactions being recorded with the certification entity.

The trading function under the BCarbon standard is straightforward. The supplier (landowner/assembler) of carbon storage must receive independent certification of available storage capacity from the non-profit BCarbon. At the end of this certification process, BCarbon will issue tradeable certificates for a year's time period. The certificates each represent one metric ton. Under this system, the asset is terrestrial carbon storage capacity and a dollar price per ton of carbon is established with the initial transaction. Each certificate is for one ton of storage capacity, and once allocated cannot be resold by the landowner. It can, however, be sold by the holder of the certificate, which may be the case if the holder does not wish to immediately use the stored carbon to reduce its carbon footprint.

Verification of designated terrestrial carbon uptake is an ongoing process; it is vital to creating a market that clears on proper supply-demand signals. Verification also warrants that the seller will have a verifiable capacity allotment for each period of storage which will initially be an annual period. When sales are based upon an annual basis, carbon uptake capacity will have to be nominated based on "average" annual storage that accounts for seasonal flux pending final accounting at the "true-up" process. It is possible as measurement becomes more sophisticated that trading may occur on flux from season to season.

The certification entity will maintain a record of all transactions involving BCarbon tradeable certificates. This will be accomplished through the use of blockchain technology that will maintain a ledger of transactions, and a contract was signed in November, 2021 with a company called topl to provide this service. A credit may be bought and sold until it is retired (e.g., applied to reduce an inventory) by the buyer. All transactions must be recorded with BCarbon through he topl system and notice of retirement must be received and recorded by BCarbon prior to application of the credit.

Principle 11: Develop a soil carbon credit trading program that embraces diversity of people, is equitable in policy and practice and inclusive of power, people and culture, recognizing that this is an ongoing process that must have full transparency.

During the course of the development of the BCarbon principles and standards, the issue of diversity, equity and inclusion was raised. The initial response was that climate change was being addressed by BCarbon and climate change is a huge threat to lower income and minority communities which will be hit harder by the various impacts of climate change. However, after taking this issue to a subcommittee of the stakeholder working group, the decision was made to commit to a more aggressive DEI policy.

There are many avenues open to BCarbon as implementation begins. First, a major attempt will be made to create a data base of minority landowners with the goal of identifying those that would qualify for inclusion in the BCarbon system and searching them out for inclusion. Secondly, the expectation is that these parcels will be smaller in size than many of the landholdings initially seeking carbon credits. Smaller parcels will likely incur higher testing costs for initial inclusion. Therefore, BCarbon will establish a fund to defray the testing costs of these smaller parcels. This fund will come into existence in years 3 through 5 based on cash-flow projections and grant funding will be pursued to start this process sooner.

There are several other initiatives under consideration for DEI purposes. The potential expansion of BCarbon into timber credits is anticipated to increase the pool of minority landowners that may qualify for credits. Additionally, BCarbon is considering creating an urban agriculture credit for carbon dioxide emission reductions associated with locally grown and distributed vegetables and meat. This effort will take significant research to provide the technical basis for the offsets which will be the first considered by BCarbon.

Numerous other potentials are being considered. Through BCarbon and Rice University, the involvement of historically black colleges and universities in the agricultural arena is being investigated. The potential for hiring minority staff members for BCarbon and for the various testing and analytical positions is being evaluated. In short, every effort will be made to create a model program that integrates diversity, equity and inclusion into all aspects.