

Building the Biocarbon Economy: How the Northwest Can Lead

The Biocarbon Paradigm: Mobilizing Nature to Stem Climate Change

How biocarbon can help stabilize climate while building stronger economies and a healthier environment – Mounting a Pacific Northwest initiative

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7.1.2010

ACHIEVING A GLOBAL TURNAROUND

Carbon dioxide, the major greenhouse gas increasing the capacity of the atmosphere to trap solar heat, is also the primary food source for plants. Meanwhile, plant materials can replace fossil fuels – ancient plant carbon whose rapid release into the atmosphere is the primary source of human-caused global warming.

These fortunate conjunctions together make up **the biocarbon paradigm**, which fundamentally aims at **leveraging plant growth and rich soils to halt the accumulation of carbon dioxide in the atmosphere and then to achieve a global turnaround**. By making nature a climate ally humanity can actually begin to draw down carbon dioxide toward levels that prevailed before we began massively consuming fossil fuels.

Over the past 250 years atmospheric concentrations of the powerful greenhouse gas have increased by one-third. Scientists increasingly call for reduction of carbon dioxide (CO₂) levels to 350 parts per million (ppm) and below. That contrasts with the current 387 ppm concentration now growing around 20 ppm a decade and rising at an accelerating rate. **CO₂ must be stabilized and reduced to avert massive polar ice melt, accompanying sea level rise and catastrophic release of natural carbon sinks dwarfing humanity's annual emissions.**

Such climate feedbacks, where global warming begins to feed itself, would intensify its effects ranging from intensifying storms and droughts, to increased disease in human populations. Feedbacks could well drive climate change beyond the capacities of human response. Therefore, **biocarbon can and must be mobilized in a concerted fashion if we are to meet the climate challenge.**

This is the introduction to a series of briefings on biocarbon, specially focused on how the Pacific Northwest can mount regional initiatives to accelerate biocarbon progress:

- ***The Biocarbon Imperative: Reaching Target 350*** – The science of emerging climate feedbacks driving the urgent need for atmospheric carbon reductions
- ***Reinventing Forestry: Growing Ecosystem Services*** – Diversifying forestry by growing carbon, water services, wildlife habitat and high-value wood products
- ***Re-grounding Agriculture: Restoring the Soil*** – Farm practices to build soil carbon, fertility and moisture while cutting fuel and fertilizer costs
- ***Working Lands Toolbox: Building Biocarbon*** – Supporting biocarbon-building practice changes by farm and forest landowners
- ***Re-greening Cities: The Carbon Landscape*** – Greenspaces and green infrastructure to build biocarbon and climate resiliency while saving energy and tax dollars
- ***Recycling Carbon: Bioeconomic Development*** – Building biocarbon through creating new jobs producing bioproducts and bioenergy

BUILDING THE BIOCARBON ECONOMY

The biocarbon paradigm points to economic transformation of land use practices in forestry, agriculture and urban/suburban development, accompanied by much greater efficiency in the use of biomass that comes from the land. At root this is an economic proposition. **Meeting the imposing challenges of climate requires a massive biocarbon scale-up that will happen only if grounded in economic viability. We must build a biocarbon economy.**

The biocarbon economy:

- ***Creates new value propositions for farming and forestry*** based on producing high-quality products and economically-valued ecosystem services
- ***Builds cities and settlements with high quality of life*** grounded in green features that also provide economical alternatives to high-cost hard infrastructure
- ***Generates new “bioeconomic” industries and jobs*** by transforming waste streams and sustainably produced biomass into bioproducts and bioenergy.

To have any chance of reaching the 350 ppm target, in the coming decades the world must accomplish two tasks:

- ***Vastly reduce fossil fuel emissions, with priority on closing coal-fired power plants that do not capture and store their emissions***
- ***Begin the decades- and centuries-long process of bringing down CO₂ concentrations by pulling the gas from the atmosphere to store it in healthier ecosystems and soils.***

The biocarbon economy contributes to accomplishing both by mobilizing nature’s power to capture CO₂ in plants and soils through improved land use practices, while offering fossil fuel alternatives through sustainable employment of biomass.

BIOCARBON FOR ECONOMY AND ENVIRONMENT

Fortunately, practices that build biocarbon can synergistically generate other benefits that meet a host of needs. These co-benefits provide powerful economic and environmental incentives to implement new practices in farming, forestry and urban/suburban development. This opens great opportunities to build policies and economic tools that promote biocarbon while building prosperity and overall healthier environments. These co-benefits are detailed throughout this series.

Forest practices that accumulate carbon also generally build their ability to deliver other vital ecological services including water supply, flood control, wildlife habitat and recreation.

In forestry the greatest accumulations in carbon are gained by minimizing disturbances to forests. This translates into preserving old growth and transitioning working lands forestry to longer rotations and selective cutting. With new management practices lands can be managed for timber while actually increasing carbon stocks. These lands also have superior capacity to hold water, support biodiversity and buffer against projected climate change impacts. Forests that are more mature stand up better against intensified storms and longer dry spells with accompanying wildfire dangers. Meanwhile, commercial forests that harvest on longer rotations provide higher-quality wood products that gain premium value in the market. New revenue streams for carbon and other ecological services also improve economic viability.

Farm practices that stock up carbon in soils improve fertility and can reduce costly inputs subject to wild price swings including fuels, fertilizers and chemicals.

A prime agricultural practice to build soil carbon is conservation tillage that either reduces or eliminates plowing. The resulting buildup of organic matter in and on soils adds carbon, reduces erosion and retains more water than conventional tillage. This prepares farming for increased drought stresses expected under global warming. With improved soil fertility, the need for costly inputs such as fossil-fuel-based fertilizers decreases. Conservation tillage also saves significant amounts of fuel and labor because it requires fewer tractor passes. Other practices that build soil fertility and carbon include new crop rotations and addition of organic fertilizers, which also replace artificial products. Such “climate-friendly” farming can generate valuable new products including bioenergy and higher-quality foods. Benefits for society as a whole include reduced air and water pollution and improved wildlife habitat. New ecological services markets can add to the economic sustainability of farms.

Urban and suburban communities that incorporate greenspaces and green neighborhood features into growth and development strategies will experience improved quality of life while building biocarbon and climate resiliency.

Adding and preserving green features such as wetlands, greenspaces and green roofs to the urban/suburban fabric builds local biocarbon stocks. This “green infrastructure” also acts as a replacement for hard pipe and drain infrastructure in capturing and controlling rainwater flows. Buildings with green features can even generate their own water supplies. Typically “greeninfrastructure” provides more economical solutions, saving taxpayer dollars. These features also cool the urban heat island effect, saving on energy bills. Greener cities will be better prepared to handle extremes of heat and precipitation. At the same time, maintaining greenspace reserves around cities preserves carbon in forests and fields. New development can be directed in ways that preserve natural carbon.

Recycling carbon by eliminating organic waste streams to generate valuable products builds new jobs, industries and biocarbon.

Organic residue streams from farms, forests and municipalities that currently are wasted or underutilized can generate bioproducts and bioenergy. All organic residues are prospective feedstocks for valuable products, and should be diverted from landfills to new production processes. This “bioeconomic development” opens tremendous prospects for creating new jobs and business sectors. It also closes carbon loops by replacing fossil fuel products and generating new products such as biochar and organic fertilizers that return carbon and other nutrients to the land. Biomass crops grown and harvested with sustainability criteria can also play on this stage.

SETTING A HIGH BAR FOR BIOCARBON

In building the biocarbon economy, it is crucial to be clear on how the biocarbon paradigm intersects with three controversial areas:

- ***Biofuels*** substitution for fossil fuels has raised many questions over whether carbon emissions are genuinely reduced, or in fact increased.
- ***Offsetting*** schemes to encourage carbon sequestration in forests and farms have come in for scrutiny, with many concerns over their effectiveness.
- ***Geoengineering*** proposals have included controversial “green-up” ideas such as seeding oceans with iron to encourage carbon absorption in plankton.

The biocarbon paradigm sets a high bar for the biocarbon economy – actions must stabilize and then reduce carbon dioxide, and take into account other potential consequences. Employing those criteria:

- ***All products employing bio-feedstocks must undergo analysis of full production lifecycles to determine overall carbon profiles.*** This is an important field for research that should be well supported. In particular, much more effort is needed to understand global land use changes spurred by generating new demand for biomass.
- ***Offsetting contracts must meet requirements that verify actual carbon reductions, and tools beyond offsetting will still be required.*** Offsetting only addresses new emissions, and the balance between incentives for offsetting and developing low-carbon energy sources must be taken into account. Meeting the

350 ppm target will require removing emissions accumulated over the past century or more. This will require additional tools that go beyond offsetting.

- ***Geoengineering plans hold huge potential for unintended consequences and require intensive research before any mass application.*** Whether or not geoengineering research should take place is beyond the scope of this series. The practices explored in this series build on a solid base of science. They apply procedures proven to build ecological and economic sustainability in uses of the land and its products, while adding to biological carbon stocks.

This series provides insights on issues surrounding offsetting and biomass sustainability.

A PACIFIC NORTHWEST INITIATIVE FOR BIOCARBON

The Pacific Northwest's forests are among Earth's greatest carbon accumulators, its farm soils are some of the world's most productive, and its cities are in the forefront of protecting and creating greenspaces. These **rich resources position the Northwest to mount a pacesetting regional biocarbon initiative that builds the biocarbon economy and innovates models for cooperation.** Such an initiative has strong potential to inspire and inform biocarbon efforts around the world.

The prospects for biocarbon are great, both to cool global warming and to improve economic and environmental sustainability. But there are practical challenges in changing land use management and economic frameworks. Overcoming them requires larger initiatives. Needed are new policies and economic tools that enable farmers, foresters, municipalities and bioeconomy entrepreneurs to make the leap to new practices. **By developing new tools and policies, the Pacific Northwest possesses a tremendous opportunity to drive forward biocarbon and realize its many benefits.**

Because biocarbon potential is inherently ecosystem-specific, building collaborative understanding at the regional scale is a logical angle of approach. The Northwest has massive biocarbon storage potential in an almost unparalleled range of forest, farm and metropolitan landscapes, spanning wet and dry climates. So knowledge and practicum can be developed in a diversity of areas. The region also possesses a world-class array of biocarbon innovators, researchers and policy experts ranging across the relevant sectors. By bringing all these assets to bear in a coordinated regional initiative, **the Northwest will develop practices, policies and tools that can be emulated around the nation and world.**

The Northwest starts with a competitive edge. The region's **natural resources** and entrepreneurial spirit have spurred **biocarbon innovations across the landscape** that are featured throughout this series. These assets provide a foundation of knowledge, experience and systems upon which far more extensive efforts can be built:

- Leading nonprofit groups and timber lands owners are **working to reinvent forestry** by exploring value streams for carbon storage, water management and

wildlife habitat, as well as higher-quality wood products markets that complement those services.

- A nationally leading cluster of groups and agencies is **developing ecosystem services science, protocols and markets** that engage a range of forest and farm landowners.
- Northwest agricultural scientists and innovative farmers are at the cutting edge in **developing science, technologies and practices for climate-friendly farming**.
- Regional researchers and public agencies are national leaders in **understanding biomass residue streams** from forests, farms, mills, food processors and municipalities, and **developing technologies** and markets to transform residues into valuable products.
- A range of business and nonprofit entrepreneurs are also **pushing forward advanced biomass business models** to make and market bioenergy and bioproducts such as biochar, a soil amendment with great carbon storage potential.
- Northwest municipalities are long-term leaders in **preserving carbon-storing greenspaces through growth management**, and are on the cutting edge of **developing green infrastructure**.
- Urban research centers at Northwest universities are **doing leading-edge science on carbon accumulation across metropolitan landscapes**.

These assets make the Northwest a natural laboratory for biocarbon research, development, demonstration and deployment. And a laboratory is what is needed now. Each area of biocarbon opportunity carries much complexity and significant need for developing new knowledge and practices. **The Northwest can pioneer in building the biocarbon economy by:**

- *Refining best land use practices* for agriculture, forestry and urban/suburban development
- *Developing biomass technologies and markets* to generate bioproducts and bioenergy
- *Creating new business models* that credit ecosystem services and build markets for high-quality farm and forest products.

These are large and complex areas. Full development is a process of decades. **Now is the time to start with research efforts and model projects that develop best practices, policies, economic tools and markets.**

The Northwest has emerged as a national and global climate leader. State and local governments are in the forefront of climate policy and action planning. Strong business clusters are growing in clean technology fields including wind, solar, smart grid and green buildings. **Biocarbon can and should be the Northwest's next leadership initiative.** This series of briefings is meant to inform that effort.

The Pacific Northwest grew from **a base of natural resources** – forests and farms that still play an economically important role. The region has built **cities that lead in technology and quality of life**. These are assets from which substantial biocarbon

innovations are growing and on which a coordinated regional biocarbon initiative can be built. **Growing the biocarbon economy is a process of decades. The time to start is now, and the place to start is the Pacific Northwest.**