

HB

1966

Sponsor: Representative Ethan Berkowitz

SPONSOR STATEMENT

House Bill 196

“An Act relating to carbon sequestration; and providing for an effective date.”

This bill provides the basis for Alaska's participation in the growing global market for carbon sequestration credits – a market that could provide the state upwards of \$450 million in revenue (based on extrapolations from current trading).

Carbon sequestration is the use of measures that increase the retention of carbon in the land or the oceans with the effect of offsetting carbon dioxide emissions from other sources. In order to offset carbon production, carbon producers can use carbon sequestration measures as a mitigation method. These measures translate into credits. Consequently, a new commodity market has evolved.

The bill responds to increased interest in slowing or reducing the levels of carbon dioxide and other greenhouse gases in the atmosphere. International agreements such as the Kyoto Protocol establish a limit on the amount of carbon that can be emitted into the atmosphere. Even if the U.S. does not sign the Protocol, in order to conduct business with signatory countries, U.S. companies will need to either reduce their carbon emissions below the baseline established in the Kyoto Protocol or obtain carbon sequestration credits to offset the amount that exceeds the established level.

Agricultural, forest and soil management practices and restoration of degraded habitat and wetlands have the potential to increase carbon sequestration on land. With Alaska's large land base and forested areas, the state could substantially profit from carbon sequestration credit trading.

The state must answer many questions before Alaska can enter the carbon credit market. This bill directs the Commissioner of the Department of Natural Resources to investigate and report to the legislature on the potential and the means for the state's participation. An advisory committee is established to assist the commissioner in developing the report. The process is modeled on legislation enacted in Idaho and Nebraska.

Though the carbon credit market is growing, it is a limited market. If Alaska fails to prepare now, we may miss this unique opportunity - and miss out on millions in revenue.

For more information:

http://www.fe.doe.gov/coal_power/sequestration/sequestration_terrestrial.shtml

<http://www.carbon.unl.edu/carbunde.htm>

Alaska State Legislature

House of Representatives

Minority Leader

Session address:
Alaska State Capitol
Juneau, Alaska 99801-1182
1-888-465-4919 (toll free)
1-907-465-2137 (fax)

Interim address:
716 West 4th Avenue
Anchorage, Alaska 99501-2133
1-907-269-0130
1-907-269-0132 (fax)

Representative Ethan Berkowitz

District 13

MEMORANDUM

Date: April 5, 2003

To: Representative Hugh Fate, Chair
House Resources Committee

From: Representative Ethan Berkowitz 

Re: House Bill 196

I respectfully request that you schedule a hearing in the House Resources Committee for HB 196, an act relating to carbon sequestration.

A copy of the bill, a sponsor statement, a sectional summary and additional background material are attached.

There will likely be several people from Fairbanks and Anchorage who wish to testify via teleconference. If you have any questions or need additional information, please call Lisa Weissler at 465-3163.

Thank you.

Attachments.

E-mail: Representative_Ethan_Berkowitz@legis.state.ak.us



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House of Representatives
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Alaska State Capitol
Juneau, Alaska 99801-1182
1-888-465-4919 (toll free)
1-907-465-2137 (fax)



Interim Address
716 West Fourth Avenue
(phone) 1-907-269-0130
(fax) 1-907-269-0132

Representative Ethan Berkowitz
District 26

Sectional Summary
HB 196

“An Act relating to carbon sequestration; and providing for an effective date.”

Section 1. Legislative findings that, due to increasing interest in slowing or reversing greenhouse gases in the atmosphere, there is the potential for a carbon credit trading market; the state has the potential to increase carbon sequestration on state and private land; and it is in the interest of the state for the commissioner of natural resources to document the state’s carbon sequestration potential. Specifies legislative intent to enhance the ability of the state to participate in carbon credit trading.

Section 2. Adds new sections to AS 44.37 (Department of Natural Resources).

Sec. 44.37.200. Creates a carbon sequestration advisory committee in the Department of Natural Resources consisting of state, federal and public members. Advisory committee members do not receive compensation but are entitled to per diem and travel expenses. The committee may assist the commissioner in developing reports, recommend policies or programs to enhance the state’s ability to participate in carbon trading, encourage production of carbon sequestration educational and advisory materials, recommend research needs, and review other states’ carbon sequestration programs and policies.

Sec. 44.37.210. The commissioner of natural resources, in consultation with the advisory committee, shall assess state and private land for past carbon sequestration and future carbon sequestration potential.

Sec. 44.37.220. Definitions.

Section 3. On or before January 31, 2004 the commissioner of natural resources, in consultation with the advisory committee, shall prepare a report to the legislature that includes the potential for greenhouse emissions regulation, the potential for development of a carbon trading market, systems or uses that increase stored soil carbon, methods for measuring carbon sequestration, areas of scientific uncertainty regarding carbon sequestration and advisory committee recommendations.

Section 4. Makes the Act effective July 1, 2003.

For questions, contact Lisa Weissler, 465-3163
April 5, 2003

Alaska State Legislature
House of Representatives
Minority Leader

Alaska State Capitol
Juneau, Alaska 99801-1182
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1-907-465-2137 (fax)



Interim Address
716 West Fourth Avenue
(phone) 1-907-269-0130
(fax) 1-907-269-0132

Representative Ethan Berkowitz
District 26

HOUSE BILL 196/SB 144
CARBON SEQUESTRATION
FAQS

Q: What is carbon sequestration?

A: Carbon sequestration refers to the capture and long-term storage of carbon in forests, soils or in the ocean. For example, a tree absorbs carbon dioxide during photosynthesis and uses it to construct its roots, trunk, stems and foliage. In the process, the tree sequesters (stores or conserves) carbon.

In the context of HB 196 and SB 144, carbon sequestration is the use of practices, technologies, or other measures that increase the retention of carbon in vegetation or soil to offset carbon dioxide emissions from other sources.

Q: Why is carbon sequestration important?

A: There is increased interest in reducing the levels of carbon dioxide and other greenhouse gases in the atmosphere. An international agreement known as the "Kyoto Protocol" is an agreement by industrialized and developing countries to reduce emissions of gases that contribute to the greenhouse effect and climate change. Carbon sequestration is a way to reduce greenhouse gas emissions while still enjoying the benefits of fossil fuel use.

Q: How is carbon sequestration a marketable commodity?

Though the Kyoto Protocol has not yet come into force, and the U.S. likely will not sign the protocol, many countries and industries are taking steps to address anticipated emission limits. In order to meet emission targets, a country or industry can purchase emission reductions, such as through enhanced carbon sequestration, by way of emissions reduction trading. Emission reductions are measured in terms of tons of carbon dioxide reduced and are often termed "carbon credits." Europe has already established a carbon credit trading market. In the U.S., a new market called the Chicago Climate Exchange is planning to begin carbon credit trading in the spring of 2003.

Q: How will Alaska benefit from carbon sequestration and carbon credit trading?

Agricultural, forest and soil management practices and restoration of degraded habitat and wetlands have the potential to increase carbon sequestration on land. With Alaska's large land base and forested areas, the state could substantially benefit from carbon sequestration credit trading. The potential exists for Alaska to receive revenues upwards of \$450 million.

Q: How can Alaska participate in carbon credit trading?

A: There are significant questions about how carbon credit trading markets will develop nationally and internationally. HB 196 and SB 144 call for the commissioner of the Department of Natural Resources, with the assistance of an advisory committee, to begin the process of answering these questions and to see that Alaska is able to fully and efficiently take advantage of any opportunities that might arise from carbon trading markets. The potential for Alaska to profit will increase if the state takes immediate action to benefit from emerging carbon markets.

The carbon credit trading market is finite. If Alaska fails to prepare, the opportunity may be lost to other nations or states, such as Idaho and Nebraska, that have already launched carbon trading initiatives.

For additional information, contact Representative Ethan Berkowitz or Lisa Weissler, Legislative Aide, at 465-4919

FISCAL NOTE

STATE OF ALASKA
2003 LEGISLATIVE SESSION

Fiscal Note Number: _____
 Bill Version: HB196
 () Publish Date: _____

Revision Date/Time (Note if correction): _____ Dept. Affected: Natural Resources
 Title Carbon Sequestration BRU Management & Administration
 Component Commissioner's Office
 Sponsor Rep. Berkowitz
 Requester (H) RES Component No. 423

Expenditures/Revenues (Thousands of Dollars)
 Note: Amounts do not include inflation unless otherwise noted below.

OPERATING EXPENDITURES	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Personal Services	50.3	50.3	50.3	50.3	50.3	50.3
Travel	19.6	19.6	19.6	19.6	19.6	19.6
Contractual	9.3	9.3	9.3	9.3	9.3	9.3
Supplies	1.0	1.0	1.0	1.0	1.0	1.0
Equipment	5.0					
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	85.2	80.2	80.2	80.2	80.2	80.2

CAPITAL EXPENDITURES						
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CHANGE IN REVENUES ()						
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FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF	85.2	80.2	80.2	80.2	80.2	80.2
1005 GF/Program Receipts						
1037 GF/Mental Health						
Other (Specify Type--Do not abbreviate)						
TOTAL	85.2	80.2	80.2	80.2	80.2	80.2

Estimate of any current year (FY2003) cost: 0.0
 Check this box (X) if funding for this bill is included in the Governor's FY 2004 budget proposal:

POSITIONS

Full-time						
Part-time	1	1	1	1	1	1
Temporary						

ANALYSIS: (Attach a separate page if necessary)

This legislation establishes a 14-member Carbon Sequestration Advisory Committee; requires the Department of Natural Resources to provide support for the committee; and requires the Commissioner of Natural Resources to conduct a carbon sequestration assessment and prepare a report for the legislature.

Fiscal impact is outline on page two.

Prepared by: Nico Bus, Acting Director Phone 465-2406
 Division: Support Services Date/Time 5/9/2003
 Approved by: Tom Irwin, Commissioner Date 5/9/2003
 Agency: Natural Resources

FISCAL NOTE

STATE OF ALASKA
2003 LEGISLATIVE SESSION

BILL NO. _____

ANALYSIS CONTINUATION

Personal Services \$50.3.

This provides for Natural Resource Manager I position (budgeted for 9 months), to provide support to the Advisory Committee and to the Commissioner of Natural Resources with the required assessment and report.

Travel \$19.6

The legislation allows for Advisory Committee members to receive per diem and travel expenses. The legislation does not specify how many times the Committee will meet. For purposes of calculating fiscal impact, it is assumed that 14 members will take two annual trips each, at an estimated cost of \$700 per trip. $\{14 \times 2 \times \$700 = \$19,600\}$. If the Committee meets more than twice a year, more funding would be required.

Contractual \$9.3

Assumes \$5,000 in contractual costs associated with meetings (room rentals, advertising etc.). Also includes \$4,300 for position costs (DNR lease space, phones and computer services).

Supplies \$1.0

General operating supplies for the Advisory Committee meetings and staff.

Equipment \$5.0 (one-time)

One-time computer equipment purchase for Advisory Committee staff position.



TIME

B U S I N E S S I N S I D E B U S I N E S S

Sunday, Mar. 02, 2003

Selling Smoke

On Wall Street, people say anything can be sliced up and traded. A firm called Natsource proves the point

By NINA SOVICH

When Dawn Schrepel, an environmental and energy consultant in Washington, wanted to thank her 10 interns for a job well done, she bought each of them an unusual gift — a ton of carbon dioxide. "They were pretty surprised," she says, laughing. "And it took a little explanation." Schrepel, 33, bought the carbon dioxide not in giant tanks but on paper, through Natsource, an energy brokerage based in New York City.

Natsource trades not only standard commodities like coal and natural gas but also a new currency known as greenhouse-gas credits. These credits represent, in effect, the right to emit a certain amount of carbon dioxide, methane or other gases thought to contribute to global warming. Such credits trade in earnest in nations like Britain and Denmark, which have capped emissions from such sources as factories and power plants. And the credits are trading on an experimental basis in the U.S., as industries anticipate the eventual imposition of similar emission limits here.

Natsource arranged for Schrepel to pay a retail price of \$17 a ton for carbon dioxide that is part of the natural chemistry of a 1,200-acre patch of Illinois grassland in a nature preserve. In return for part of that payment, the land's owner agreed not to burn, pave over or otherwise release that carbon dioxide. Schrepel wryly explained to her interns that buying the credits would help offset the carbon dioxide they emitted by, among other things, breathing.

Schrepel's gift is but a tiny part of a global greenhouse-gas trading industry that is growing rapidly. Between 1996 and 2002, about \$500 million worth of carbon dioxide was traded among companies in the U.S. and Europe. The World Bank's Prototype Carbon Fund, which helps countries preserve forest and reduce CO2 emissions, says the number of greenhouse-gas trades and the volume of gas affected will double this year. Experts predict that the right to emit a ton of carbon dioxide, which costs between \$3.50 and \$6 if purchased in bulk today, will cost between \$7 and \$12 by 2005. That would make the global market for greenhouse-gas credits worth well over \$3 billion a year.

Time Magazine Article

Two events drive this growth: the expectation that the Kyoto Protocol on Climate Change will go into effect this year and require many countries to reduce carbon dioxide emissions by 2008, and the emergence of government-backed emissions-trading schemes in Britain and Denmark. Despite President George W. Bush's assertion two years ago that Kyoto would wither, 2003 looks to be the year the treaty will come to life. Canada ratified it in December, and if Russia joins this year, as its President has promised, the treaty will have enough support to go into effect. It would not bind the U.S., but it could induce U.S. multinationals to reduce emissions by their plants in signatory countries.

Even in the U.S., there is a growing consensus that greenhouse-gas reductions are inevitable. In January, Senators John McCain of Arizona and Joseph Lieberman of Connecticut introduced legislation that would cap emissions and allow rights trading. Thirteen U.S. companies, including American Electrical Power, Dupont and Ford, have joined the new Chicago Climate Exchange. Members volunteer to reduce carbon dioxide emissions in a system that lets them practice trading greenhouse-gas credits while trying to deflect regulation and public criticism.

Jack Cogen, president of Natsource, couldn't be happier about this trend. Besides trading in energy and emissions credits, Natsource consults with firms that are weighing the idea of operating cleaner. Greenhouse-gas trading and consulting provide only 10% of Natsource's revenue, but the company expects that share to rise to 50% by 2007. "It's a fascinating business opportunity. Can you use market forces to effect environmental and societal goals?" asks Cogen, 46. "Can you put a cost on what was a free resource?"

Cogen thinks you can, and he's not alone. In 1990 the Clean Air Act capped emissions of sulfur dioxide, a major contributor to acid rain, and ordered that they be gradually reduced. The government issued "allowances" to companies and let them trade polluting rights on the open market. A power company that cut its emissions at relatively low cost could sell its leftover emission rights to another utility facing higher costs for pollution control.

Robert Stavins, an economist at Harvard's Kennedy School of Government, estimates that this cap-and-trade system, vs. a system of rigid caps on each firm's emissions, saves U.S. companies about \$1 billion a year in compliance expenses. "It's the most cost-effective way to reduce emissions," he says, "and companies have an incentive to cut pollution so they can sell credits." The Environmental Protection Agency estimates that sulfur dioxide emissions have been halved since 1990 and that Americans save \$50 billion a year in health and environmental costs associated with acid rain.

Expecting that international support for Kyoto will grow despite U.S. government opposition, companies around the world — including U.S.-based multinationals — want to be prepared. Cogen says today's

nascent trading of CO2 credits forces executives to "sit in a room and figure out how to manage, market, verify and account for their emissions. We call it learning by doing."

Some U.S. companies are not just experimenting; they are buying carbon dioxide credits today, at relatively low prices, as insurance against future regulations. World wholesale prices of carbon dioxide credits have jumped more than 600% since 1996, but prices differ from country to country. Kyoto allows credit trading only among signatory countries, and when it became clear in 2001 that the U.S. would not adopt Kyoto in the first round, the price of U.S. credits fell.

Michael Intrator, a managing director at Natsource, believes that the U.S. should have led the way. "America had a massive information advantage," he says. "We understood how cap-and-trade worked because we traded sulfur dioxide. Now we are left in a sea of uncertainty because we didn't ratify Kyoto. The overarching belief is that sometime we will. But by then, we might be at a competitive disadvantage."

Melissa Carey, a climate-change analyst at the Environmental Defense Fund, says that despite all the greenhouse-gas trading under way, it won't reduce emissions until Kyoto takes effect. "Sulfur dioxide was successful," she says, "because there are huge penalties for failing to comply." One Kyoto provision lets industrialized countries fund carbon-reduction projects in developing countries that do not have emission caps. For example, a U.S. utility may find that cutting its emissions is more expensive than planting a carbon-trapping forest in Bolivia. But until Kyoto is ratified, there won't be any independent verification that the forest has been planted.

Another obstacle to wider trading of emissions is nature. Forests burn down. Hurricanes wash away fields. Then there are governments that ignore international agreements and change environmental policies in ways that can radically affect the value of existing emissions credits. Until financial instruments are developed to ensure credits against the ravages of politics and nature, trading greenhouse gases will be a risky business. But the traders at Natsource are betting that multinational firms are also learning about the risks of doing nothing in the face of regulations that they know are coming, sooner or later.

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Opportunities for Carbon Offset Programs in Alaska

by
Tim King
Pacific Rim Regional RC&D,
Spokane, WA

Abstract

Timber salvage and reforestation of disturbed forests in Alaska offers several opportunities for offsetting carbon emissions and marketing emission reduction credits. First, trees killed by the spruce beetle or wildfires can be harvested for production of "bio-fuels" as renewable energy alternatives to fossil fuels. Secondly, the dead biomass is converted to useful energy before it decays, replacing fossil fuels. Finally, returns from salvage and bio-fuel sales can be used for reforestation and carbon sequestration. A major goal of regional and local Resource Conservation and Development Councils in Alaska is to establish producer-buyer partnerships for marketing carbon offset programs.

Key words: Carbon emission reduction credits (CERCs), spruce beetle (*Dendroctonus rufipennis* Kirby) epidemics, forest disturbances, forest health, timber salvage, "bio-fuels," biomass, Resource Conservation and Development Councils, Kenai Peninsula, Alaska, reforestation

Introduction

Presentations at the May 24, 2000 Alaska Reforestation Council's meeting on "Opportunities for Carbon Sequestration in Alaska" from representatives of the American Forest's Global ReLeaf Program, Washington, D.C., the USFS Southern Research Station, Triangle Park, North Carolina, and Edison Electric Institute's UtiliTree Carbon Company, Washington, D.C., indicated that partnership opportunities for market based carbon offset programs are now possible. Regional Resource Conservation and Development Councils (RC&Ds), nonprofit organizations dedicated to improving natural resources for economic and social benefits, support partnership agreements between private and public sectors for marketing carbon offset programs throughout the United States.

The Pacific Rim Regional RC&D Association has recently signed a nonbinding, nonexclusive carbon aggregation agreement with CQuest Ltd. of West De Moines, Iowa, a carbon market brokerage firm for marketing international carbon credits^a. Under this agreement, local RC&Ds with support from their Pacific Rim RC&D Region and their partners work together as a team to establish terrestrial-based changes in land use and land use management for sequestering measurable carbon.

The RC&D Team Concept

The RC&D team concept is a network of carbon producers, sellers, administrators, marketers, brokers, and buyers working to change land uses and land use management for sequestration and storage of atmospheric carbon in the earth's vegetation and soils. The team insures accurate base-line carbon measurements before land management changes, models increases in stored carbon from proposed land use changes, and verifies actual carbon stored for the life of the project from field biomass inventories.

Regional RC&D Associations also assist in establishing State Carbon Advisory Committees for third party carbon credit accounting (verification and registration) to assure non-duplication of carbon sales and accurate sequestration assessments. In support of the team networking process, RC&D Associations may establish Carbon Technology Transfer Centers to provide technical assistance for project development, establish science and research programs for solving carbon sequestration and storage problems, and provide outreach and education on the carbon cycle and climate warming.

Carbon Emission Reduction Credits

Carbon sequestered from partnership projects in land management and use changes would be marketed through services provided by CQuest and other companies as Carbon Emission Reduction Credits (CERCs). CERCs are measured in metric tons (tonnes) of C or CO² equivalent.

All overstocked or understocked forest stands have the potential for improving net carbon sequestration and storage. Carbon sequestered and stored in phytomass is the basis for CERCs. Any stand threatened by disease, insects, or fire has the potential for increasing net carbon storage. The first step is to establish a baseline for capturing carbon by inventorying the carbon stored in the vegetation and soil. The next step is to develop a management plan for increasing tree growth and carbon storage in the live phytomass. Using growth and yield models, the final step is to compare the net change in carbon sequestration between managed and unmanaged stands on the same sites.

New Markets for Alaska's Forest Resources

The Alaska State Division of Forestry (DOF) and Alaska Reforestation Council (ARC) presented many specific examples and studies of severe forest health problems currently affecting Alaska's forests. General discussions addressed how these problems, mainly forest disturbance issues, may be brought on by climate change. Restoration of forests following spruce beetle (*Dendroctonus rufipennis* Kirby) epidemics, wildfires, and other disturbances offer many good projects for land use management change, which could provide carbon offsets for emissions from combustion of fossil fuels and the conversion of forests to agriculture. Teamwork between both private and public sectors in Alaska is needed to plan and implement forest restoration projects for generating CERCs, which in turn, will fund additional intensive forest management programs for sequestering carbon.

On a three day tour of many forest health issues, RC&D, UtiliTree, Global ReLeaf, ARC, and DOF representatives concurred on the immense need and opportunities for carbon offset programs across Alaska. Our first stop was on Kenai Peninsula. Spruce forests, mostly composed of mature Lutz Spruce (*Picea X lutzii* Little), appeared as an expanse of gray-brown dead trees. With only slight increases in summer temperatures of the 1990s, overstocked spruce stands quickly fell victim to competition and moisture stress. Bark beetle populations flourished with the mild temperatures and prime feeding conditions. Scattered stands of smaller diameter black spruce (*Picea mariana* (Mill.) B.S.P.) could not support the beetle's life cycle and were standing alone among the dead stands of taller Lutz spruce. Only a few stands of larger Sitka spruce (*Picea sitchensis* (Bong.) Carr.) dominated the hybrid spruce on the higher, more productive sites. Only the large Sitka spruce appeared to have sufficient health and vigor to withstand the beetle attacks.

The Ninilchik Native Corporation Manager was busy salvaging and marketing dead Lutz Spruce. Proceeds from the timber sales were utilized for site prep and planting. Although these efforts seemed phenomenal in scale to previous restoration efforts, they are only a minute token of the reforestation and management needs in the region. The dead spruce export market was only temporary and finite, and failed to provide sufficient returns for the region's forest restoration needs.

The need to find new markets large enough to handle the dead wood volume without financially breaking everyone from excessive competition was apparent. Bio-fuels, a renewable energy replacement for fossil fuels, are a major opportunity for marketing dead wood. Bio-fuel options range from wood-fired gasifiers and steam electrical production plants to new technologies in ethanol production from cellulose.

The technology for converting wood waste to steam and electrical energy is very basic. Production costs per kilowatt range nationally from \$0.06-\$0.12. In the Pacific Northwest where hydroelectric power is abundant and cheap, converting wood to steam and electrical power is not competitive. Nevertheless, wood is still converted to electricity commercially in northeast Washington. When touring the Copper River Area, we learned that electricity was approximately \$0.50 per kilowatt-hour with the state subsidizing up to \$0.30 per kilowatt using fossil fuel energy sources. Wood to steam and electrical energy conversion appears to offer multiple carbon offset opportunities. First, wood is an alternative energy source for fossil fuels. Second, the dead spruce is converted to energy before it decomposes into carbon dioxide and water via respiration of heterotrophic microbes. Third, returns from the sale of the wood for electricity can be used for putting forests back into wood production for carbon sequestration to offset wood fire and fossil fuel emissions.

The carbon offset opportunities from the sale of dead wood and the pure economics of producing electricity for 25% of current costs provide savings both to the public and state. Inexpensive power also means new jobs and manufacturing opportunities, which also utilize the abundant local natural wood resources.

The Sealaska Native Corporation of southeast Alaska has been working with Arthur Daniels Midland (the owner of patents on cellulose to ethanol conversion) and the Environmental Protection Agency on converting bio-fuels and wood waste to ethanol production in the Ketchikan area. One ethanol production plant at Ketchikan could provide the full gasohol needs of the Anchorage area. Alaska is the domestic leader in fossil fuel production, and needs to examine the possibility of becoming one of the nations major sources of bio-fuels.

Summary and Recommendations

Alaska's forests need a great deal of management to improve their health, and to reduce the impact of natural and human-caused disturbances. Funding for forest management and protection is imperative. Carbon offsets and bio-fuels production are sources of funding for which Alaska has both the need and resources.

Existing and proposed RC&D regions situated across Alaska have the potential to bring together the "TEAM" Internet concept. The Internet concept merges the efforts of local, state, and federal agencies and programs with Native Corporations, the general public, private business, and industry. These entities work together to benefit Alaska, it's people, it's resources, and the world. The time is now; the opportunity is at hand and it is knocking. Will you answer the call?

Notes

^a A carbon credit is one metric ton (tonne) of carbon or CO₂ equivalent that is captured from the atmosphere and stored in plants and organic matter (biomass).



Electric Power R&D ■ Oil/Gas R&D ■ Fuels R&D ■ Oil Reserves ■ Electricity Regulation ■ Regulation

Electric Power R&D

Home > Electric Power R&D > Carbon Sequestration

Carbon Sequestration - Terrestrial Approaches

Carbon sequestration in terrestrial ecosystems is either the net removal of CO₂ from the atmosphere or the prevention of CO₂ net emissions from the terrestrial ecosystems into the atmosphere.

Enhancing the natural processes that remove CO₂ from the atmosphere is thought to be one of the most cost-effective means of reducing atmospheric levels of CO₂, and forestation and deforestation abatement efforts are already under way.

The terrestrial biosphere is estimated to sequester large amounts of carbon (approximately 2 billion metric ton of carbon per year). R&D in this program area seeks to increase this rate while properly considering all the ecological, social, and economic implications. There are two fundamental approaches to sequestering carbon in terrestrial ecosystems: (1) protection of ecosystems that store carbon so that sequestration can be maintained or increased; and (2) manipulation of ecosystems to increase carbon sequestration beyond current conditions.

This program area is focused on integrating measures for improving the full life-cycle carbon uptake of terrestrial ecosystems, including farmland and forests, with fossil fuel production and use. The following ecosystems offer significant opportunity for carbon sequestration:

- **Forest lands.** The focus includes below-ground carbon and long-term management and utilization of standing stocks, understory, ground cover, and litter.
- **Agricultural lands.** The focus includes crop lands, grasslands, and range lands, with emphasis on increasing long-lived soil carbon.
- **Biomass croplands.** As a complement to ongoing efforts related to biofuels, the focus is on long-term increases in soil carbon.
- **Deserts and degraded lands.** Restoration of degraded lands offers significant benefits and carbon sequestration potential in both below- and above-ground systems.
- **Boreal wetlands and peatlands.** The focus includes management of soil carbon pools and perhaps limited

Program Area

- Carbon Capture
- Geologic Storage
- Ocean Sequestration
- Terrestrial Sequestration
- Advanced

SPECIAL REPORTS

- Sequestration Technical Baseline Roadmap - Draft
- Potential for Technology Pacific Northwest Laboratory Report
- R&D Program 1999-2000

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Program Contacts

Robert Kane
Sequestration
Office of Fossil
U.S. Department
Washington, DC
Telephone: 202-546-4600
e-mail: robert.kane@doe.gov

Scott Klara
Product Management
National Energy
Laboratory
U.S. Department
PO Box 10940
Pittsburgh, PA
Telephone: 412-326-7000
e-mail: klara@doe.gov

conversion to forest or grassland vegetation where ecologically acceptable.

The program area is being conducted in collaboration with DOE's Office of Science and the U.S. Forest Service of the U.S. Department of Agriculture.

[▲ Back to Top](#)