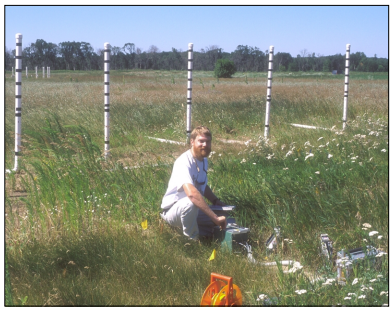
Preserving the Planet

Brookhaven scientsts are exploring ways to preserve nature, clean up environmental pollutants, and use energy technologies more efficiently.

Benefits of Biodiversity

Brookhaven scientists involved in a major field study have found that more diverse plant ecosystems are better able to absorb carbon dioxide (CO_2) and nitrogen (N), both of which are on the rise due to human activities and industrial processes. The study was conducted in a natural grassland environment using Brookhaven's free-air carbon-dioxide enrichment (FACE) technology, developed to study the effects of CO_2 levels expected to be reached by the middle of the 21st century. Only such experiments, conducted in open air rather than in greenhouses or other enclosures, can mimic "real world" conditions to simulate how entire ecosystems will cope with predicted higher CO_2 concentrations.



Plant physiologist David Ellsworth at a FACE research plot; pipes emit CO_2.

Better Pollution Traps

Better catalytic converters and smokestack scrubbers could help free the air of more pollutants. Using neutron facilities worldwide and Brookhaven's National Synchrotron Light Source, researchers are conducting structural and thermodynamic studies of how pollutants and catalysts interact at the molecular level. Their results may make it possible to develop new or improved catalysts. The team has shown that when hydrogen sulfide adsorbs on magnesium oxide, two or three uniform layers form at distinct intervals as the gas pressure increases. Also, their studies show that the adsorption process can be reversed if the magnesium oxide is heated to release the trapped gases. Thus, the sorbant can be reused.

Cadmium Decontamination

Brookhaven scientists have proposed a way to combine chemical treatment with "pollutant-busting" bacteria to remove cadmium from contaminated soil. First, thiosulfate, an inorganic compound, is injected into the subsurface soil. Thiosulfate forms highly soluble complexes with cadmium. Then, when water is pumped out of the soil, the dissolved cadmium thiosulfate should come along for the ride. The extracted water then can be treated with a new form of bacteria recently isolated from coastal salt marshes on Long Island. The bacterium metabolically converts cadmium thiosulfate to cadmium sulfide, an insoluble form, which precipitates out of the solution. Alternatively, the bacteria could be injected directly into the soil following thiosulfate injection to complete the process *in situ*. This would leave insoluble cadmium sulfide in place of the original toxic metal.

CN8-270-00

Appathurai Vairavamurthy combines chemistry and bio-remediation to clean cadmium from soil.

Harbor Sediment Cleanup

Brookhaven scientists are using the New York/New Jersey Harbor as a real-world laboratory for studies on sediment decontamination. Dredged sediments in this area often contain metals and organic contaminants that limit options for their disposal. Brookhaven, working with the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, other agencies, and industry, is investigating methods for removal of these contaminants from the sediments. The project ranges from basic research to the planned operation of commercial facilities that clean the sediments to prepare them for beneficial uses, including manufactured soil and construction-grade cement. This work will help solve sediment management problems in harbors worldwide.

CN3-227-01

Scientists hope to turn dredged harbor sediment into useful materials.