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Editorial

Research is Fundamental

Using the logo RIF, a public service announcement once proclaimed "Reading Is Fundamental." When it comes to this month's cover topic of sustainability, we can also say RIF, here meaning "Research Is Fundamental."

A major threat to our sustainability is global climate change. Unfortunately, we are a long way from understanding the complex relationships between CO_2 emissions and atmospheric CO_2 concentrations and the resulting environmental effects.

That's where Biosphere 2 plays an important role. Built in the 1980s as an experiment to see if eight people could live in a sealed self-sustaining environment, today Biosphere 2 is a giant living laboratory for Earth systems research, specifically CO_2 in the atmosphere. Scientists there are studying the effects of increased CO_2 in various biomes (or land types), such as a rainforest, ocean, forest and desert.

Biosphere is unique in its ability to isolate an environment of interest and monitor and control such parameters as temperature, humidity, airflow and CO_2 levels. Chemical engineer John Persson is responsible for that instrumentation and control system. You can read about him and his job in the Profile on p. 96.

The project that I found most interesting when I toured the facility a few months ago takes place in the intensive forestry biome (IFB). It is aimed at answering the question "Can the release of CO_2 emissions be offset by responsible forestry practices such as planting and harvesting trees?" The IFB is partitioned into three fully instrumented compartments in which cottonwood trees (chosen for their incredibly fast growth rate, up to a meter a month) have been planted. In one section, CO_2 concentrations are maintained at current atmospheric levels, in another at double today's levels (which is what is expected at the end of this century), and in the third at triple the current levels. Light, humidity, temperature and CO_2 concentration throughout the day, as well as leaf photosynthesis and soil respiration, are measured, and an overall carbon balance is calculated. The researchers have found that carbon uptake (*i.e.,* photosynthesis) increases with increasing CO_2 concentration. In the first year of the study, there were significant differences in above-ground biomass production among the three bays — the higher the CO_2 level, the more biomass. In the second and third years, the differences in biomass production were not as great, although carbon uptake still varied significantly from one bay to another. This leads me to believe that the cottonwood tree might be one important component of a CO_2 control strategy. But a great deal more research is needed to make this a reality. (The results of a related research project being conducted in the IFB are discussed in R&D Update on p. 18.)

Biosphere is currently managed by Columbia Univ. Unfortunately, Columbia has announced that while it will continue its management activities until its contract expires in 2010, it is considering discontinuing its financial support. Given the importance of the work being done at Biosphere, it is my hope that if that happens, other universities and industrial partners will step forward to enable its research — which is so fundamental to our sustainability — to continue.

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