On May 26 and 27, American researchers and Veolia Environnement managers began discussions about ecological sciences and environmental services research. Their radically pioneering initiative, instigated by the Veolia Environnement Foundation, took place at Biosphere 2[1] or B2 in Arizona, a setting as ambitious as the project. Focus on a unique experiment.

BIOSPHERE 2

BACK TO EARTH

Some places just foster the emergence of ideas. The ecological greenhouse B2, near Tucson, Arizona, is one of them. Looking like an alien spaceship, it is unlike anything else in the world. Beneath its rounded metal and glass frame flourish five full-scale tropical & subtropical ecosystems: a desert, savannah grassland, mangrove wetlands, an ocean and a forest! Three laboratories specializing in environmental sciences observe the ecosystems, while an underground "technosphere" of impressive machinery regulates the whole environment. With its two hemispheric "lungs," B2 puts nature under a microscope in a controlled setting.

Birth of experimental ecology

A reversal of trends has converted this facility that was originally designed to prepare humans for space exploration to investigating the earth-bound concerns of the moment: environmental challenges. Trading in the dream of the 1980s for the more urgent issue of how the human race will survive climate upheavals, B2 has enjoyed a renaissance, confirmed by the signature of a partnership with the University of Arizona in 2007. Under the science program Biosphere 2 *(see box),* the environmental sciences departments now test their models in this singular space, led by Joaquin Ruiz, the university's dean, and Travis Huxman, B2's Director. "Learning how to work together is vital to understanding phenomena and finding solutions," explains Huxman. "Climate change has several facets—temperature, greenhouse gas concentrations, species and landscape distribution—and ecologist, hydrologist, biologist and geochemist specialists ask the same questions while approaching them from different angles." So B2 fulfills three essential purposes: converting theories, models and concepts into complex experiments; creating new disciplines able to formulate questions common to all earth sciences; and relaying knowledge, educating, teaching and conducting research. "B2 is organized to encourage citizen science, education and an interdisciplinary approach," says Travis Huxman. "Not to mention the partnerships in the works, like the one with Veolia Environnement. It is great to be able to offer our young scientists a chance to participate in programs and use their talents! An opportunity Veolia Environnement can offer, through the future design of its products and services, especially those related to altered urban ecosystems, where nature and the city meet." This echoes the views expressed by Robert Bozza, Strategic Intelligence Director at Veolia Environnement Research & Innovation, and the team of university professors present, concerning the company's position in fostering innovation and the key role of the Veolia Innovation Accelerator or VIA[1], created to promote cleantech in partnership with start-ups, investors and large companies. Ultimately, six areas of collaboration were identified *(see box),* which will continue to come into sharper focus throughout 2011.

A few figures
A total facility area of **14** hectares.
4 ecosystems spanning 1.27 hectares
30 meters high
6,500 windows
30,000 square meters of meeting rooms, classrooms, administrative space, a conference center, housing, laboratories.

Joint program

In May 2011, Veolia Environnement suggested to the university's management team that they conduct a joint workshop. Its goal would be to eventually plot a common road map identi-

1- See *Planète Veolia* No. 27 (March 2010).

A giant laboratory

Enclosed ecosystems
The 1.27-hectare Biosphere 2 is the biggest enclosed ecosystem ever built. This unique resource can conduct experiments in an environment midway between laboratory and field.

Science and education programs at Biosphere 2

B2's management team introduced two programs in 2011: water & climate and energy & sustainability. The first, dubbed LEO for Landscape Evolution Observatory, will have three water basins, under construction and slated to be operational in spring 2012. LEO's carefully configured "landscapes" will be used to study the interactions between soil, climate and water. Biosphere is already using its own Campus—30 cabins across 13 hectares—for the second program. Their job is to evaluate various strategies combining renewable energy, energy efficiency and public grids. Lastly, the Biosphere Institute, dedicated to educating citizens, holds sessions on specific topics during the year. Using the Campus and its buildings in B2, the Institute promotes dialogue by inviting teachers to come and familiarize themselves with the sciences. Scientists, experts and politicians are also invited to share their experiences with professionals devoted to disseminating knowledge as widely as possible.

Thierry Vandevelde

Foundation Executive Officer and member of the B2 Advisory Board

"The decision to create a joint workshop was the result of chance, with a bit of a helping hand. The idea came to me when I ran across Joaquin Ruiz, Executive Dean and Professor in geosciences at the University of Arizona, shortly before, through a biodiversity protection program called MABA/Madrean Archipelago Biodiversity Assessment of which we have been a partner for several years. When he told me about B2's scientific transformation, I thought the Foundation could be a catalyst of ideas. How do plants behave during droughts and what can we do to restore water basins? How does ground that is suddenly soaked react and how can we bolster the resilience of regions at extreme risk? How is nature factored into organizing services in the city? How can we be good stewards of our natural resources? And so on. B2 is a laboratory that will save us time, by conducting controlled, full-scale studies so that we can create invaluable models for our services."

Mitchell Pavao-Zuckerman

Research Scientist and Assistant Professor at the University of Arizona

"The main subject of my research is nature's place and beneficial role in artificial urban environments. Studying plants amid concrete and a carbon-heavy atmosphere, or water after downpours have pounded against impermeable surfaces, driving the pollution into the soil, requires the combination of a number of scientific disciplines, including biology, geochemistry, physics and ecohydrology. So an integrated approach is the only one that can deal with cities' adaptation to the climate change under way. The Treelog program, a highlight of my research, attempts to "cool" Arizona desert towns through the appropriate planting of trees. It owes its success largely to volunteers who collect the data. The information is then used to evaluate the effectiveness of such urban forests (carbon sequestration) over time. Paradoxically, it was curiosity about the Arizona desert—where it only rains two weeks a year—that prompted me to leave New York, to find out how nature deals with this shortage of water. What could be more fascinating than predicting the effect of global warming, a more pressing issue here than elsewhere?"

fying the research needed to better pinpoint the environmental services of the future. "We put together a manageably sized workshop, composed of equal numbers of Veolia Environnement managers and university researchers," says a pleased Thierry Vandevelde *(see box)*. "It aims to find common areas we can work on together." One of the many research topics mentioned during the two-day meeting was a detailed explanation of the Water Impact Index. The product of lengthy development by the teams of Edwin Pinero, Chief Sustainability Officer, Veolia Water North America, and Laurent Auguste, CEO of Veolia Water Americas, the Water Impact Index caught the attention of the US scientists, sparking detailed discussions. Topics focused mainly on the reliability of the index's mathematical models and analysis of the parameters set for the indicators. "We could turn all these subjects into research questions," concluded Yann Moreau, Vice-President, Research & Innovation, North America. The initial workshop's results were presented to the Foundation's Board of Directors at a meeting attended by Denis Gasquet, Veolia Environnement's Chief Operating Officer, who wanted to schedule a second workshop without delay. The time to turn words into action has already begun. ■

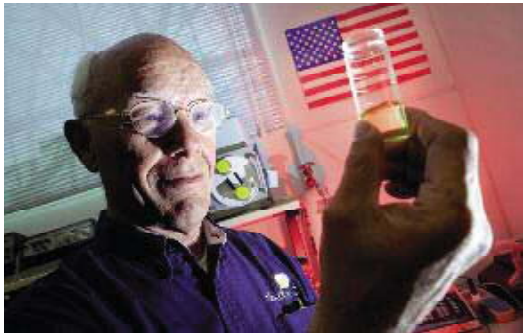
The six areas of cooperation
Following the preparation meetings, a workshop comprised of equal numbers of Veolia Environnement managers and University of Arizona researchers came up with a list of six areas of cooperation.
- Earth dynamics and predictive models.
- Wastewater treatment and recycling.
- Climate assessment and development scenarios.
- Decision-making tools, instrumentation and marketing.
- Governance and risk management, adaptation and civic responsibility.
- Education and communications.

*** To learn more:** *http://www.b2science.org/*

A hub for exchange

Citizen science
At B2, a hundred researchers from the University of Arizona and Veolia Environnement mingle with a broad segment of the general public. Visitors can familiarize themselves with the complexity of topics related to climate impacts by taking organized tours.

Dedicated scientists



Experimental ecology
Because of its history, B2 is the source of an emerging science: experimental ecology. Rainforest soil, unusually rich in organic compounds, is ideal for carbon cycle research. And the miniature ocean is used to better monitor the effects of carbon concentration on coral growth.

Go Volunteers!

How can we foster a sense of solidarity at Veolia Environnement? A network of partners and contributors is rallying around the Allo Solidarité hotline number and the association Vivons Solidaires, to support our most vulnerable employees. Their achievements include initiatives that focus on creating a social business model, a commitment of our sustainability strategy.

When economic insecurity sets in, it is often around for a while, with alarming consequences such as poor housing, personal debt, evictions, isolation and depression. The economic crisis has made matters worse, spurring on Veolia Environnement's Corporate Human Resources Department to take a more organized approach to helping its most at-risk employees in France. An Active Solidarity Plan rolled out in October 2008 and backed by union organizations has spawned two initiatives: the Allo Solidarité call center, which takes calls from struggling employees and then refers them, in the strictest confidentiality, to a social worker or specialized association; and the Vivons Solidaires association, which steps in when all the traditional solutions for helping with a pressing emergency have been explored. As François Barthalon, Advisor to the Corporate Human Resources Department, explains, "When you deal with a social emergency, you are keeping someone physically or psychologically safe."

Stepping up prevention

For Hervé Deroubaix, secretary of the CFDT union, taking care of emergencies is good, but recognizing the warning signs is better, especially by stepping up prevention. "Before Allo Solidarité and Vivons Solidaires, the issue was dealt with by social workers and the French works council. This was a first step, but it was not enough to get to the root of employee problems. That is why I am recommending that the social worker position be upgraded, by creating several positions in each company division in France. Social workers play a key role in the company: being in direct contact with and listening to employees qualifies them to anticipate problems, spot emergencies and also to help employees accept and understand certain situations."
The Allo Solidarité call center, staffed by a team of independent social workers and psychologists, currently covers four delegations—Greater Paris, Northern France-Normandy, Central-Eastern France and Provence/Alps/Riviera—until it can be expanded to serve all Veolia Environnement delegations in France. Of the 50 calls these professionals answer each month, three to five are emergencies that require an immediate decision, plus, in most cases, financial help from a social assistance fund to which the company contributes up to €200,000 a year. Fifteen calls are prompted by financial problems and the solutions involve a network of social workers and partner associations. Not to mention the company's internal resources! For instance, with the help of a social worker, one employee was able to plan a vacation for several disabled family members. Veolia Transdev supplied them with a vehicle and a driver so they could get around. Another employee, living with his wife and six children in a 15-square-meter apartment, had only €550 a month (service charges included) to find more spacious housing. Alerted, Allo Solidarité contacted one of its partners in the Action Logement (formerly 1% Logement) network. A five-room apartment for the requested rent was found for the family. In two years of operation, more than 70 callers have found decent housing this way. Seven to 10 of them now no longer have to sleep outside. These results prove that the model works, even if we still need to expand partnerships and learn more skills from associations. "The initiatives taken are encouraging," agrees Catherine Griffon, a social worker at Veolia Water. "But the effectiveness of the program may be limited by its size. We must increase our resources through higher contributions."

Responding to distress

Allo Solidarité and the Vivons Solidaires association now pool their resources to take some of the pressure off employees. Once initiated, assistance evolves into customized, long-term support. "We

Allo Solidarité
The center was launched in May 2009 and takes 50 calls a month. It helps mainly with housing and debt problems, which make up 80% of the situations dealt with.