flexible research strategy. "We need access to money so that we can do things quickly," such as refocusing research on a topical problem, says Sykes.

But where will this nest egg come from? Imperial can't hike tuition fees, which are set by the government, so Sykes plans to copy an American tradition: tap alumni for cash. "We haven't gone after the money in a professional way like the Americans do," says Sykes, who has now set up an office to raise funds from past students. One former student, technology investor Gary Tanaka, has recently set the ball rolling by bestowing $36 million to create a new business school and upgrade dated 1960s entrance buildings. "Just think of the wealth generated by the people who have come out of here in the last 100 years," says Sykes.

Sykes also hopes to increase the financial returns from Imperial's intellectual output. Imperial is no stranger to industry: It has generated 57 spin-off companies and begets new ones at a rate of about two a month. "These will have a significant role in moving the college forward," says Sykes, who boasts that some are quoted on the stock exchange and that the college has already reaped wealth from investments in these companies. Others are less enthusiastic. "Spin-offs will never bring in large proportions of funding. Even the most successful institutes in this field only generate a few percent of their income from them," says Peter Cotgreave of the pressure group Save British Science.

Sykes's keen commercial instinct is also persuading him to develop the Imperial brand: He has assigned several senior members of his administration the task of raising the college's profile and selling Imperial abroad. "In the past we have been arrogant enough to believe marketing wasn't necessary," says Chris Towler, director of strategy development, but this is no longer viable in today's competitive world. Sykes admits, however, that developing a brand to match Oxford or Cambridge will be a challenge. "We're up against 700 years history," he says. But he's determined to give it a shot.

—JOHN PICKRELL

John Pickrell writes from Hertfordshire, U.K.

ECOLOGY

A True-Blue Vision For the Danube

Romanian scientists are at the forefront of a European effort to balance the protection and exploitation of vast, diverse wetlands

BUCHAREST—In 1983, dictator Nicolae Ceausescu decreed that the Romanian Danube delta, one of Europe's largest wetlands, be diked for growing rice and maize. The edict came despite evidence that the soil was too salty for agriculture and after industrial-scale reed production in the 1950s and fish farming in the 1970s had produced disastrous results. "Every time the scientists had the opposite opinion, but these were political decisions," says Basarab Driga of the Romanian Academy's Institute of Geography in Bucharest. Nearly 15% of the delta had been transformed into marginal cropland by December 1989, when both Ceausescu and his grand plans for the Danube were laid to rest—just in the nick of time, say many Romanian scientists.

Fast forward to 30 April 2001, when, ironically, Ceausescu's extravagant House of the People here in the Romanian capital hosted a major conference on the Danube region. In a speech, Romanian President Ion Iliescu, a reformed Communist, acknowledged that past economic development along the Danube had caused "unacceptable material and human costs." He vowed to cooperate with 13 other European countries on an ambitious effort to restore the Danube—particularly its unique delta wetlands—while economically energizing the mainly impoverished region.

In their efforts to undo the ecological harm of the past, Romania and other countries are trying to implement the trendy, complex notion of sustainable development. Although this term means different things to different people, in Romania, at least, scientists are poised to play an important role in studying the Danube delta's pollution and wildlife and advising the government on policies to remedy the watershed's problems. "Scientists are very important, because they are the ones who can imagine new processes, who can try to make activities more friendly to nature but at the same time economical and efficient," says George Romanca, an ecologist at the National Center for Sustainable Development, funded by the United Nations Development Program. "It's our duty to realize projects that will lead to long-term development."

How well they will succeed, however, is an open question—particularly in the

CREDITS: (LEFT TO RIGHT) WWF–AUEN INSTITUTE; ERIKA SCHNEIDER

A new vision. Romania's Cold War dictator, Nicolae Ceausescu, hoped to transform the Danube delta (box) into cropland. Today, scientists are helping to forge a sustainable development plan for the delta's rich but fragile resources. (The Danube River basin is shown in green.)

Danube delta, where one environmental problem is often traded for another, and public understanding and support for conservation is weak. Still, Angheluţă Vădineanu, head of Bucharest University's Department of Systems Ecology and Sustainable Development, is cautiously optimistic: "I don't know how much the politicians understand about sustainable development, but it's there in the documents. That means there's a new model to follow for economic development, and that's a very important step."

The delta shows vividly how this post-Communist experiment could play out. The entire watershed, says ecologist Kate Lajtha of Oregon State University in Corvallis, "is a great natural lab." It's a prime place to answer ecological questions underpinning sustainable development: how far pollution travels and how it affects fish, for example, and how farming practices can affect water quality all the way down the Danube River.

Adapt or die

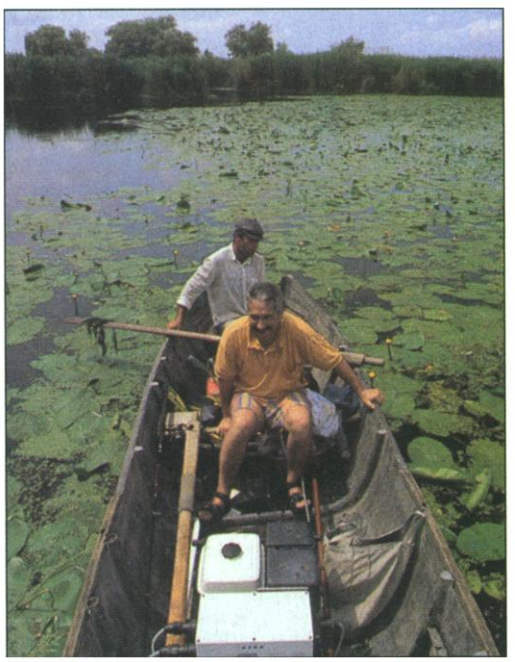
As the Danube River bleeds into the Black Sea, its sediments fan out over 4200 square kilometers—3500 in Romania and 700 in Ukraine—and form a mosaic of 32 types of ecosystems. These include shallow floodplain lakes speckled with white water lilies, sand dunes with liana-covered Balkan oak-ash forests, and what is believed to be the world's largest stand of reedbeds.

This diversity creates a haven for creatures rarely seen elsewhere in Europe; its most famous denizens are the 320 species of birds, including white and Dalmatian pelicans. In winter, more than half of the world's red-breasted geese stop there, and in spring and summer, pygmy cormorants gather in large, raucous colonies.

Other wildlife leads a stealthy existence. While creating the first Red List of delta species last year, "we discovered 37 species new to science!" exclaims Mircea Staraş, scientific director of the Danube Delta Research Institute (DDRI) in Tulcea. Among the finds are many wetland insects and an endangered fish, *Knipowitschia*, that lives in fresh and brackish water and is a key link in the food chain of pike perch.

Fishers have been attracted to the delta since Neolithic times; fortress walls and mosques of past settlers are common sights. The biggest human impacts, however, came in the 20th century—and not just because of Ceausescu. Shipping canals built in the late 1800s to ease transport to the Black Sea were widened and branches were added, which changed the water flow from the Danube and allowed pollutants to infiltrate deeper into the wetlands, says Nicolae Panin, director-general of Romania's National Institute of Marine Geology and Geo-Ecology. In addition, the Iron Gates dams built upstream in the 1970s and 1980s cut sediment supply by half, causing catastrophic beach erosion of up to 20 meters per year in some areas and allowing more saltwater from the Black Sea to move into the delta's freshwater lakes and ponds.

These changes eroded the wetlands' ability to sequester and detoxify pollutants, which were accumulating due to increased industrial effluents, pesticide and fertilizer runoff, and sewage from 80 million people in the Danube basin. By the late 1970s, algal blooms linked to nutrient pollution and oxygen starvation, or eutrophication, began appearing with alarming frequency.



CREDIT: DDRI

Voyage of discovery. Scientists with the Danube Delta Research Institute, here on a monitoring day trip, found 37 new species in the delta in recent surveys.

Around then fish populations also began to change, says Staraş. Carp and other species requiring access to upstream spawning areas declined in numbers, as did those that thrive in clear water, such as pike. Species able to adapt to turbid conditions and algal blooms, such as bream, became more common. And since beginning their decline 3 decades ago, the Danube's beloved sturgeons have dwindled from six species to two, Staraş says.

While some wildlife has suffered, overall the delta has withstood the human onslaught surprisingly well, according to Panin. As polluted as it is, compared to other European wetlands the Danube delta "is still one of the cleanest and most natural deltas in Europe," Panin says. That's why in 1990, almost immediately after the Communist regime crumbled, a large portion of the Romanian Danube delta was declared a biosphere reserve, joining a United Nations network of sites dedicated to sustainable development. Approximately half of the 5800-square-kilometer reserve was designated an economic zone where some fishing, farming, forestry, and habitation is allowed. About 9% of the reserve became strictly protected areas—because of their rare and sensitive species—that are off limits to all but researchers with permits. The remaining 40% is buffer zone with limited human activity.

These designations were a leap into the unknown: the start of an experiment to balance human uses while protecting natural resources. The reserve boasts the first management plan, the first public awareness strategy, the first ecological information center—"the first for us in everything," says Grigore Baboianu, executive director of the government's Danube Delta Biosphere Reserve Authority.

Today, officials and scientists such as Baboianu face the challenge of making their experiment succeed against a backdrop of continuing economic and political change. So far, many of the variables have worked in their favor. In 1995, for instance, Oregon's Lajtha found that when compared with other wetlands worldwide, the Danube delta did not appear to be heavily polluted with metals—a benefit, perhaps, of many Communist-era industries' having closed. Fertilizer and pesticide runoff is also less of a threat, because Romanian farmers can't afford chemicals and are abandoning cropland. "The Danube delta was full of nutrients and suffering from eutrophication, but it's getting better now," says Baboianu. These days, algal blooms occur mostly in the summer.

But many people fear that those trends could reverse themselves as economic development kicks in again. Already some of the delta's fish, for example, are more beleaguered than ever. Under Communism, fishing was a state-run industry that used only low-tech nets and other equipment. In the past decade, the free market has ushered in high-tech gear, while weak laws and poorly paid civil servants fail to limit catches. "It's a disaster," says Staraş. "Nobody knows how many fishermen there are." Romania issued a law in April requiring licenses and closed seasons, and which establishes a new agency to regulate fishing, but Staraş is dubious. "Because the law came so late," he says, "it will be very difficult to correct the situation."

Turning buzzwords into action

Similar problems may soon arise on land, as Romania attempts to reinvigorate its agricultural sector—efforts that may boost fertilizer use. International conventions for protecting

Restoring the Vitality of Rich Wetlands

BUCHAREST—Nicolae Ceausescu made serious mistakes in the Danube delta, but at least they seem to be reversible. Several sites converted under Communism to agricultural fields, fish farms, and forestry projects are already being returned to nature. Now many more restorations are planned. As part of a World Wide Fund for Nature (WWF) project called "Green Corridor for the Danube" launched in June 2000, the governments of Romania, Bulgaria, Moldova, and Ukraine have pledged to create a network of at least 600,000 hectares of floodplain habitats along the Lower Danube River and the Prut River, and in the Danube delta. That will require ecological restoration of 200,000 hectares.

The delta's Babina Island will serve as a model. Under a Ceausescu order, the riverine island of 2100 hectares was diked in 1985, drying out its ponds and rivulets. The salty soil was then plowed and crops were unsuccessfully cultivated. After the creation of the biosphere reserve in 1990, a team of ecologists from the WWF, the Danube Delta Biosphere Reserve Authority (DDBRA), and the Danube Delta Research Institute decided to try to undo the damage. In spring 1994 they breached the dams on Babina to reconnect the island with the river's flooding regime.

Natural regeneration occurred surprisingly rapidly, according to the project leaders. By the second year, most of the aquatic and swamp plant communities had returned, as well as fish, birds, and other native creatures. "If we let nature work by itself, it's very wise," says the DDBRA's Grigore Baboianu. "It's not necessary to have a complicated philosophy of restoration."

MyRestoration in action. Since Babina Island's dams were breached in 1994, the swamp ecosystem has regained its vitality surprisingly quickly.

Next, the team opened the dikes at another riverine island and a polder once used for forestry. Last year, they began work at a failing fish-pond complex called Popina. "The local people were the first rehabilitators. They were making small openings to bring in fresh water," says Erika Schneider of the WWF's Auen Institute for Floodplains Ecology in Rastatt, Germany. She and her colleagues punched more holes and are waiting to see if Popina's circulation has improved enough to bring back native fish. **–K.S.**

the Danube call for all Danubian countries to cut nutrient pollution 40% by 2010. Romania could hold the key to whether that goal is met. "We're concerned and hope that post-Communist countries take a different approach than the West," says Jasmine Bachmann of the World Wide Fund for Nature in Vienna. Vădineanu's group recommends that Romania prevent runoff through smart landscape planning by placing buffer zones between fields and the Danube River, and by restoring 150,000 hectares of wetlands (see sidebar). He estimates that the cost of restoration—an estimated $275 million—could be recouped within 6 years from ecological goods and services provided by the delta, including nutrient retention, flood control, and rebuilding of fisheries.

Selling these lofty ideas is not easy. Many delta inhabitants resent the fact that they are banned from entering the biosphere reserve's strictly protected areas and are allowed to catch only 3 kilograms of fish per day, for the sake of the nebulous concept of sustainable development. Romanca understands such sentiments. "After 10 years, there's been no change for the better for them," he says. He blames the economic stagnation and concomitant resentment on heavy exploitation—of fish, mushrooms, reeds—by poor migrants and entrepreneurs looking for quick cash, and on weak law enforcement. Budget cuts have reduced the number of reserve wardens from 75 in 1995 to 40 today.

A paltry science budget—just 0.2% of Romania's gross domestic product—has also provided little support for research at the delta. But one group, the DDRI, has managed to come out ahead. Under Communism the institute emphasized economics, but in the 1990s it changed its focus to ecology and shrewdly took advantage of the new biosphere reserve. As Staraş puts it, "We trust in the national and international attraction of the Danube delta." Indeed, the institute, located on the reserve's edge, won the lead research role in a $4.5 million World Bank biodiversity project that ended last year. The funding enabled the researchers to modernize labs and expand programs for monitoring water quality, vegetation, and wildlife populations. Well-equipped researchers, however, may not necessarily make a difference to the delta's ecology. "The money has been spent, but the fish stocks are worse off than before," says DDRI biologist Zsolt Torok.

Healthy tension? One of the biggest challenges will be to limit fishing to designated parts of the delta.

Still, the DDRI and other Romanian institutes are now gearing up for more experiments to try to balance economic development with nature preservation. The European Union has provided $145,000 for a pilot project that, among other things, will evaluate habitats and species and restore alluvial forests at Braila Island, another wetland sanctuary along the Danube. The World Bank, meanwhile, has pledged $5 million to a project along the Romanian Danube that aims to make farming harmonious with conservation. A second World Bank program may plow $24 million into sustainable forestry.

Environmental researchers in Romania should benefit from this surge in international funding. But whether they help achieve the goals of sustainable development remains to be seen. "Until now, we scientists have complained about the politicians," says Vădineanu. "But now it's our turn to show that we can put this into practice."

–KAREN F. SCHMIDT

Karen F. Schmidt is a freelance writer in Bucharest.

CREDITS: (TOP TO BOTTOM) ECKBERT SCHNEIDER; DDRI