

# World Rivers Review

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## Can We Save Earth's Rivers?

by Sandra Postel and Brian Richter

The new book *Rivers for Life: Managing Water for People and Nature\** (reviewed in the October issue of WRR) explores the unhealthy state of the world's rivers following decades of industrial damming, diversions and other insults, and describes the tools and techniques that could be used to restore them back to health. The following excerpt, from the book's last chapter, asks the tough questions: What will it take to change our destructive ways before it is too late?

**N**o generation before ours would have asked the question posed in this title. It has an ominous ring: how can it possibly be up to us to save earth's rivers? But the degree of our dominion over rivers has put us in exactly this position. Most rivers are no longer controlled by nature, but by us.

Human impacts on the hydrologic environment have increased on the order of nine-fold since 1950. This is an enormous change in a very short period of time. Only a portion of this impact stems directly from withdrawals of water for irrigation, industries, and cities, which have tripled over the past half century. Most of it stems from human manipulation of natural flow patterns through the construction and operation of dams, reservoirs, dikes, and levees. Species that evolved over the millennia within earth's aquatic ecosystems are now reeling from these human-induced impacts. We have cast them into a race for survival for which they are not evolutionarily prepared.

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Photo: Paul Morrison

The Taku River was one of Canada's 10 most endangered rivers for 2003 (see [www.earthwild.ca](http://www.earthwild.ca)).

By virtue of our domination, we have become their stewards.

Ecologists now are warning us that stewardship of nature is not an altruistic act, but rather a rational one of self-preservation. The goods and services that aquatic ecosystems provide are too central to human well-being for us to get along for any great length of time without them. They perform functions we depend upon and cannot replicate. Technology has not freed us from this dependence, but has blinded us to it. Whether we realize it or not, our staying power as a species depends upon our ability to coexist with other species.

The deep conundrum we face is how to exercise stewardship of other species when the needs and aspirations of our fellow *Homo sapiens* are so large, and still growing. Within a generation, some 3 billion people will be living in water-stressed countries. Is there hope for rivers and freshwater species in those places? Between 1950 and today,

about 3.5 billion people were added to the planet; 3 billion more will likely be added over the next half century. All people must have access to sufficient water, food, and energy for a healthy and secure life. At the same time, a large global middle class aspires to the high-consumption lifestyles now enjoyed by the richest 1 billion people – including meat-rich diets, luxurious caches of clothes and cars, and sizeable homes with lush green lawns. Even as world population is growing, per capita global water demand is rising, intensifying total human impacts on freshwater ecosystems.

As if this predicament was not difficult enough, global climate change from the buildup of greenhouse gases will greatly complicate our efforts to create a water-secure future. Glaciers and mountain snowpacks, the natural reservoirs that feed many of the world's rivers, are melting. As temperatures rise, they will melt faster. Glaciers are

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# The Poor Be Dammed

**A** coherent theme has emerged in the last couple of years in the promotion of big water and hydro projects. Countries are poor, it is implied, because their rivers are under-dammed and under-diverted.

Soon after the release of the World Commission on Dams report in 2000, the World Bank's senior water staff flew around the world meeting the water and power ministries of the major dam-building countries. The main message they reported having heard was that "dams are essential for growth and poverty reduction." That message guided the Bank's 2003 Water Resources Sector Strategy, the institution's first major policy paper on water for a decade.

In its promotion of the poverty-reduction benefits of what it now terms "high-risk high-reward hydraulic infrastructure," the World Bank regularly cites the huge gap in the amount of reservoir capacity per person between Australia and Ethiopia. Yet this does not explain why Ethiopia is poor, or prove that building lots of big water projects will end its poverty. (Ethiopia also has many less suspension bridges, coal plants, airports and probably every other form of modern infrastructure than Australia; but this is as much a symptom as a cause of the wealth gap between the countries.)

In any case, the water infrastructure gap between rich and poor countries is less clear than the Bank claims. Zambia and Zimbabwe have around twice the water storage capacity per person than Australia. Paraguay generates nearly 10 times more hydropower per capita than Australia.

Water, of course, is essential for life, and energy for development, yet big dams and diversions are not the only method of supplying water and energy. And despite its claims, the World Bank has produced no evidence to show that investments in big dams are more effective at reducing poverty than other types of development strategies.

Meanwhile there is plenty of evidence to suggest that any direct link between big dams and poverty reduction is dam-booster wishful thinking. The countries that are most dependent on major dam and canal water projects are poverty-stricken Pakistan, Tajikistan, Turkmenistan and Uzbekistan.

One frequently used example which supposedly proves the dramatic anti-poverty benefits of big water projects is India's Bhakra Dam. However, an in-depth study on Bhakra by Shripad Dharmadhikary of the Manthan Research Centre indicates that Bhakra's actual role in agricultural growth was much smaller than commonly assumed. The economic boom in the region, the study notes, was due mainly to massive inputs of chemicals, energy, and subsidies to farmers, and an explosive growth in groundwater pumping.

The 24 countries that are dependent on hydropower for 90% or more of their electricity supply include many of the world's least developed nations such as Burundi, Rwanda, both Congos, Ethiopia, Malawi, Afghanistan, and Laos. This statistic certainly does not prove any simplistic link between hydro-dependence and poverty, but it does show that hydro-dependence is no sure-fire route to sustained economic growth and poverty reduction.

The only wealthy country among the 24 most hydropower-dependent is Norway. But Norway's pattern of hydropower development was largely to build small- and medium-sized projects dispersed throughout the country (especially in the early years of hydro development), with assured benefits going to local communities. This contrasts strongly with the centralized hydro megaproject model the World Bank pushes in developing countries. (The average size of a large hydro project in Norway is 82 megawatts; in Brazil, the average size is 460MW.)

Most of the world's poverty is in rural areas of developing countries. Most of the world's poorest people are farmers on rain-fed marginal lands. Making a serious dent in poverty levels will require raising the income of these farmers, and new water infrastructure will be an important part of this.

But the water infrastructure projects that most help poor farmers on marginal lands have to be low-cost, meaning they have to be small-scale. Big schemes soak up big money. They also provide big benefits – but mainly to big contractors and wealthy farmers. The assumption that these benefits will trickle down to the poor and rain-dependent has time and again been shown to be false.

Small-scale and affordable water harvesting technologies are providing real benefits in terms of agricultural growth and poverty reduction, as revealed in the work of Paul Polak featured in this issue (see p. 8), and India's water-harvesting movement (see *WRR*, Dec. 2002), among other hopeful examples.

The World Bank and many national water ministries and agencies, as currently structured and staffed, have shown themselves to be poorly suited to reducing poverty. But even if these institutions as they actually exist cannot be a major part of the solution to global poverty, they can at least stop pushing oversized and overpriced projects which only divert attention and resources from approaches which truly can help the poor.

Patrick McCully

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# Under a Thailand Sun

by Peter Bosshard

A red sun settles over Baan Pueng, a small village near Rasi Salai in the plains of northeast Thailand. The air is brimming with a great sense of excitement. Some 300 dam-fighters from 62 countries have gathered on the banks of the Mun River for "Rivers for Life," the international meeting of dam-affected people and their allies that IRN and other groups have been preparing for more than a year. Community leaders, grassroots activists and NGO professionals from India, Honduras, China, Argentina, Namibia, the Philippines and elsewhere are meeting for five days to exchange experiences and devise new strategies to protect their rivers and fight destructive projects.

The program of Rivers for Life includes educational sessions on the state of the dam industry, presentations on dam struggles and movements in different parts of the world, and 30 workshops on issues such as the social impacts of large dams, the role of international financial institutions in funding them, the value of options assessments in pressing for better water and energy projects, and efforts to decommission dams. Field trips will take the visitors to the Pak Mun and Rasi Salai dams, two dams on the Mun river that have been the focus of intensive struggles for more than a decade. The participants are evaluating strategies and discussing new ideas for further action. Cultural

presentations, a fair of exhibits from around the world and countless informal chats over meals and coffee breaks allow the hard-working participants to relax a bit and strengthen their bonds and friendship.

"I hope that 'Rivers for Life' will make our campaigns more effective by further strengthening the links between local, national and international groups," said Latha, a leader of local struggles as she arrived from Kerala in Southern India. "Local groups need the timely support of international NGOs," Latha argued, "and international groups need to work closely with local partners so their campaigns do not get detached from on-the-ground realities."

Jose Josivaldo de Oliveira is a farmer from Northeastern Brazil. Through Brazil's Movement of Dam-Affected People (MAB), he is fighting a dam that is threatening the livelihood of his community. He helped organize the first international meeting of dam-affected people in Curitiba, Brazil six years ago. "People learn by organizing themselves," says Josivaldo. "Step by step, we have taken this process of self-organization from the local to the national and international level. The large number and diversity of groups that are attending the 'Rivers for Life' conference testify to the progress that our movement has made since the first meeting in Brazil."

Not least due to the strength of local and



Photo: Ma Yong-Un, KFEM

Rasi Salai leader Aphirak Suthawan leads participants on a march to the Mun River for the closing ceremony.

international resistance, the rate of building large dams has dropped sharply since its peak in the 1970s. Recently, however, the dam industry, the World Bank and many governments have begun to try to reverse this trend and revive dam building. Rather than simply promoting individual dams, they are increasingly devising large schemes to link rivers or create regional power grid systems based on hydropower. In turn, many groups have created regional networks to develop visions and strategies for their river basins and regions, instead of fighting individual destructive projects. The conference's motto, "Rivers for Life," expresses this new direction in the movement.

The location of the global gathering of dam-affected people and their allies could not be more suitable. People affected by dams on the Mun River constructed a small village for participants with meeting halls, dormitories and bamboo huts constructed of local, hand-made materials. The village was built in a floodplain that had been submerged by the Rasi Salai reservoir in the 1990s. After a long fight by affected communities, the government decided to open the dam's gates in order to restore the ecosystem and revive the fisheries of the Mun River. The charming "Rivers for Life" village is a symbol for this achievement of dam-affected communities.

"With unity and insistence, such successes are possible all over the world," said Phraijit Silarak of Thailand's Assembly of the Poor, as he welcomed participants at the opening ceremony of the conference. ■

Conference proceedings will be available from IRN in 2004; write Aviva Imhof (aviva@irn.org). See [www.irn.org](http://www.irn.org) for the Rasi Salai Declaration.



Photo: Patrick McCully

A group of Rivers for Life participants in a workshop on the World Commission on Dams.

# Undamming the Penobscot River

## The Campaign to Restore Maine's Largest Watershed

**A**fter decades of decline, the Penobscot River is on a path to health again. A recent agreement between dam owners, tribes, environmentalists, fishing groups and governments will open up 500 miles of watershed to fish species and other aquatic life by removing two dams and pursuing a fish bypass at a third. The coalition of groups working to save the river will have to raise \$25 million for the project. We talked to Laura Rose Day, director of the Penobscot River Restoration Project, about this effort.

### Describe the campaign to save the Penobscot.

The Penobscot River, which drains a full third of Maine, once was vibrant with life – millions of alewives, shad and other river herring, prehistoric-looking sturgeon, rainbow smelt, tomcod, and – certainly most famous – the leaper: wild Atlantic salmon. Today, the river is nearly devoid of its native fish above a gauntlet of dams.

In an unprecedented collaboration that has inspired hope in many who love the Penobscot, diverse interests that have fought for decades over its future have agreed on a path for recovery of its native aquatic life. The Penobscot Indian Nation, American Rivers, the Atlantic Salmon Federation, the Natural Resources Council of Maine, Maine Audubon, Trout Unlimited, the Department of the Interior, the State of Maine, and PPL Corporation, the dam's owners, have reached an agreement that calls for the:

- purchase and removal of the two dams closest to the sea,
- purchase, decommissioning and proposed bypass of a third dam,
- opportunity to increase power generation at several dams resulting in maintenance of more than 90% of the company's energy, and
- improved fish passage at four other dams.

The agreement restores access to virtually all historic habitat to several species, such as striped bass and sturgeon, and significantly improves access to over 500 miles of habitat for others that historically migrated beyond the first major falls in great numbers, including American shad and Atlantic salmon. It rebalances the Penobscot ecosystem back in favor of migratory fish and the wildlife, people, culture and recreation that rely on a healthy free-flowing river.

### What makes this river special?

The Penobscot River is the largest watershed in Maine and the second largest in New England. It is home to the Penobscot Indian Nation and has been for more than 10,000 years. Their current reservation consists of

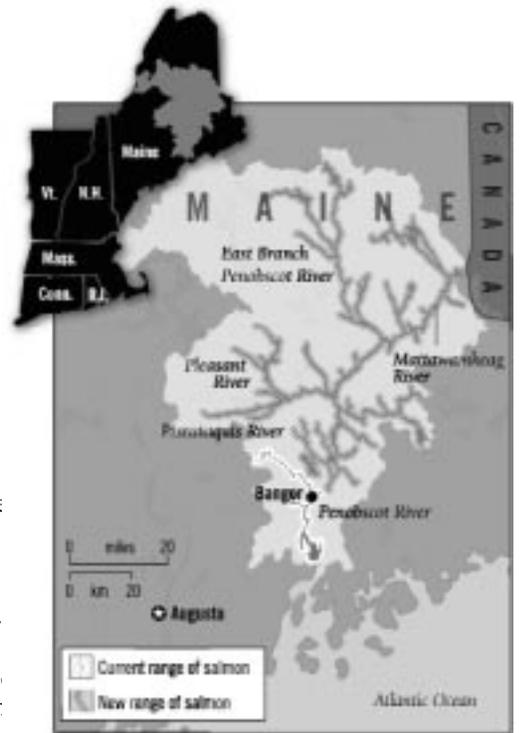
hundreds of islands in the river above the first major falls, the site of massive historic fish migrations. The Penobscot is also home to a tradition of salmon fishing, with the first salmon club in the nation – the Veazie salmon club – along its banks. The passing of a salmon fishing tradition from one generation to the next has temporarily ceased, with Atlantic salmon fishing now prohibited because the fish is at the brink of extinction. Finally, the river is a ribbon that connects the ocean to the heart of the North Woods of Maine.

The biology of wild Atlantic salmon is special, too – they migrate back and forth across the Atlantic several times in a lifetime, rather than dying upon their return as do Pacific species. Scientists view this effort as the most significant chance to restore wild Atlantic salmon to the only US river that currently supports more than a thousand returning fish. Several other Maine rivers already receive specific protections under the federal Endangered Species Act.

### What are some lessons for others in the collective work to remove these dams?

First, we must ensure that the laws of this country protect our rivers. Laws regulating hydropower and water quality resulted in the denial of proposed dams on the Penobscot that would, if permitted, have made the current restoration effort impossible. It is these laws that give the fishery, wildlife, cultural, and other values a chance.

Second, diverse parties can come together to find and implement innovative solutions, even where problems are longstanding and seem intractable. We have been inspired by citizen efforts across the country and the world. Don't give up on a river, even if the odds don't look good at times. Be diligent and patient. Stick to your principles – legal, policy and otherwise – but be open-minded. Listen to people; people who are on the "other side of the table" can have great insights too, even if you have very fundamental disagreements. Do not assume that there is no common ground.



Map: Adam Weiskind © 2003 The Christian Science Monitor ([www.csmonitor.com](http://www.csmonitor.com))

**It has been said of this campaign that "everyone gave up something." Do you have any words of advice about the art of the compromise in this campaign?**

For us, the guiding negotiating principle was that this is all about the river – not about the tribe or the organizations or the government or the company. The river cannot negotiate for itself, and that is our job. We were very fortunate to have government officials at the state and federal levels who also understand the public trust in the river and who understand the need for balance. And it was important to recognize that although the company clearly has different goals, a healthy river still provides common ground and benefit to them as well.

To negotiate with the river in mind is not to negotiate without people in mind. When the river is healthy, communities around the river reap benefits – in culture, recreation, traditions, in more diverse economic opportunities, in natural heritage to leave to future generations, in holding on to what makes their home and region special.

How much is too much to give up? The key for us was to understand and have a solid agreement about what the river needs in order to restore migratory fish and other benefits of a restored Penobscot. Every choice was then gauged by that standard. And there is much to be done to implement the preliminary agreement that we have reached.

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The other way to look at this question is “What’s a river worth?” We know that this is immeasurable, that we cannot afford to pay what we know the river is “worth.” But it is worth letting go of rigid ideas about how to save a river so that we would even consider purchasing the dams. It is worth being as creative as possible, worth developing trust among people who have fought over the future of the river for many decades and still had not found a path to recovery. Worth convincing people that, in this case, this solution is the right one – and getting them to invest in it.

**Maine has more than 1,000 dams. Will this agreement lead to more dam removals and decommissionings? Will your groups be working to replicate this agreement elsewhere, with other communities and groups and private dam owners?**

Dam removal is a very site-specific question that depends on many factors. There have been dam removals in Maine before because they made most sense given the specific facts of the situation. In 1999, for instance, the Federal Energy Regulatory Commission ordered the Edwards Dam removed from the Kennebec River in Maine. In that case, that was the right solution. The river has rebounded beyond expectations, even in four short years. For instance, for the first time in 160 years, people are catching American shad, a commercial alewife fishery has begun, sturgeon now use the pool at the far reach of the free-flowing stretch of river, and aquatic invertebrates have increased – evidence of water quality so improved that

the river was upgraded under Maine’s water quality standards.

The Penobscot River Restoration Project clearly is a different model with enormous ecological promise. We do hope that this project will provide a model of persistence and innovation, a model in which many parties with very diverse interests found common ground from which to recover a river. However, the model of purchasing the dams to remove or bypass them makes sense for many reasons specific to this place, this time. Migratory fisheries and other aspects of free-flowing rivers will be restored through a variety of means including fish passage, dam removal and other means. Models of how to restore migratory fish will continue to be site-specific.



Photo: Lia Morris

*This birchbark canoe seems poised for adventure on a newly restored Penobscot River.*

This model will not necessarily apply in other places. As for us, we intend to stay very focused on seeing this project to a successful conclusion – a free-flowing Penobscot once again abundant with life.

***You have a big task ahead of you to restore the river, including raising \$25 million to buy the dams.***

Well, this takes us back to a more basic question: what’s a river worth? We believe this project is a relatively small price to restore the public trust in the Penobscot fisheries and benefits to the ocean system, the federal tribal trust to the Penobscot Nation, fisheries to communities to whom they were once a cherished resource, and more. This project promises a very high return on the investment – and a diverse return in terms of ecological, cultural and economic opportunity. But we also recognize that raising the money will be a challenge in the current economic climate.

We are confident, however, that people of Maine, the state and federal governments, tribal and private interests will understand the once-in-a-lifetime historical nature and magnitude of this opportunity. We are confident that we will work together to make sure that this opportunity for leadership does not pass us by. Wild Atlantic salmon need a large, resilient river system to survive, and the deal that we’ve struck is a small price to pay to give it back to them – and to the people of the region. Challenging, yes. Achievable, yes. ■

*Learn more about the Penobscot River Restoration Project, including how to be part of it, at [www.penobscotriver.org](http://www.penobscotriver.org).*

## More Decommissioned Dams

**In addition to exciting news from Maine, some 57 dams were slated for removal in the US in 2003. The following decommissioning projects are just two recent examples.**

### **Merced River, Yosemite National Park, California**

Eighty-five years ago, the National Park Service dammed the Merced River with timbers, boulders and debris for a hydroelectric project that brought hot water and lights to the park. Now, the 184-foot-wide Cascades Dam is being removed.

“This will allow the river to return to its natural flow,” said project manager Mike Pieper. He said the newly freed river should help remove a wall of silt that built up behind the dam. Crews will work through April to complete restoration and roadside work on the \$2.8 million project.

When the dam was built, the park hosted 35,000 visitors a year, compared to the millions who visit today. The dam generated about two megawatts of power from 1918 to 1986. The park has been hooked into the state’s central grid for years.

### **Bearcamp River, New Hampshire**

A diverse partnership of public and private sponsors is working to restore the Bearcamp River, a program that includes taking down the Bearcamp River Dam. Removal of the dam will allow 28 miles of river to flow unobstructed and eliminate a public safety hazard. The state Department of Environmental Services (DES) River Restoration Program is coordinating the project, which is estimated to cost \$124,000. Flowing from its headwaters in the White Mountains to its confluence with Ossipee Lake, the Bearcamp River watershed provides excellent habitat for native brook trout, wild brown trout and landlocked Atlantic salmon. The dam’s removal will improve fish movement and further enhance fishing opportunities, as well as restore natural habitat conditions at the dam and impoundment site. The dam has also blocked the movement of organic debris that would naturally have been distributed downstream, providing important habitat structure and nutrients to fish and other aquatic species.

# Looking Beyond Aluminum's Glitter

## Activists Come Together Over Environmental, Social Problems of Aluminum Production

by Glenn Switkes

The aluminum industry is on the move. Smelters are being closed in the US and Europe, and new smelters, often accompanied by large hydroelectric dams to power them, are being planned for pristine regions around the world. New production capacity in China is causing a glut on world markets, driving prices down, at the same time that composite materials are threatening to replace aluminum in vehicles and other products. In the face of all this turmoil, the industry characterizes aluminum as a “green metal,” despite the enormous amounts of electricity needed to produce it and declining efforts to recycle it.

But the shine is off aluminum for a growing movement of activists, communities and trade unionists, who are working to reveal the hidden costs of the aluminum production chain. In Africa, Brazil, China, Iceland, and Chile, closed-door negotiations are raising public concern over whether aluminum smelting facilities, and the energy projects that must accompany them, will be good or bad for overall development. The problems include environmental degradation, forced resettlement for bauxite mining and dams, health impacts, poor labor conditions, and the inequities that come when one population has to bear the costs of development while others reap the benefits.

The “First International Strategic Roundtable on the Aluminum Industry” in São Luís, Brazil (organized by International Rivers Network, the Container Recycling Institute and Brazil’s Carajás Forum) brought together representatives of communities and specialists to discuss the impacts of bauxite mining, alumina production and primary aluminum smelting, labor concerns, hydroelectric dams and other energy generating facilities powering the aluminum industry, and consumption of aluminum products. Our goal was to find a common front to address problems caused by aluminum production.

### Molten Rivers of Energy

Aluminum production is the most energy-intensive industry in the world, requiring around-the-clock energy for primary aluminum smelting. More than half of all electrical energy for aluminum processing comes from hydroelectric dams. Hundreds of large



Photo: Greenpeace Canada

Greenpeace activists protested in November outside the Noranda mining firm’s offices in Toronto, Canada. Noranda plans to build numerous dams to power its aluminum smelter in Chile. The company suspended work on the \$3 billion Alumysa development earlier this year amid a storm of objections.

dams worldwide have been built to service the aluminum industry, including some of the world’s largest – the 6,180MW Grand Coulee Dam (US), the 10,300MW Guri (Venezuela), and 5,350MW Tucuruí (Brazil). The reservoir for the huge Akosombo Dam, built exclusively to power a Kaiser aluminum plant in Ghana, inundated 4% of that country’s land mass – an area the size of Lebanon.

Activist campaigns to stop large dams proposed by the aluminum industry have made progress recently. Earlier this year, Alcoa, BHP Billiton, and Vale do Rio Doce announced they were dropping plans for a large dam on Brazil’s Araguaia River. The Brazilian environmental authorities also refused an aluminum company’s request for a license to construct a dam on the Ribeira do Iguape River in the Atlantic Coast rainforest. Chilean environmentalists celebrated Noranda’s suspension of plans for a hydroelectric/smelter complex in Patagonia. But elsewhere, the news is mixed: Alcoa’s huge Karahnjúkar Dam and smelter project is now under construction in Iceland, and dams to power smelters have been proposed on the Zambezi River in Mozambique (Mphanda Nkuwa Dam), and on the Lom River in Cameroon (Lom-Pangar Dam). The Bakun Dam, whose power is in part intended for a

smelter, is now under construction on the Balui River in Malaysia. These and other “aluminum dams” reveal that the aluminum industry remains a serious “river-predator.”

Hydroelectricity is generally provided to aluminum smelters by public utilities at a highly subsidized rate. In its case study on Tucuruí Dam in the Brazilian Amazon, the World Commission on Dams calculated that two aluminum smelters received between US\$193 and \$411 million in subsidized energy per year during their 20-year contracts for Tucuruí electricity.

The new reality of the aluminum industry is that the availability of subsidized energy can be the single most important determining factor in locating smelter and dam complexes. Such is the case with the now-delayed Alumysa plant proposed for Chilean Patagonia by Canadian aluminum company Noranda. “In the case of Chile, there is no source of bauxite nor alumina, and no market for the aluminum – only apparently cheap hydroelectricity. Chile’s accepting the Alumysa smelter, which would pollute a pristine region and destroy its rivers, is environmental prostitution,” says Juan Pablo Orrego of Chile’s “No Alumysa” campaign. The Chilean group Codeff Aisén is proposing that the Aisén region be declared a “life reserve” and that ecotourism and other activities capable of providing longer-term benefits to local communities be prioritized.

While new jobs are often touted as a benefit of proposed smelters, Célio Bermann of the Sustainable and Democratic Brazil Program says that aluminum smelters are one of the most inefficient ways of producing jobs, based on the enormous quantities of electrical energy they require. Bermann also noted that many aluminum smelters in the global

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South not only import the raw materials of aluminum smelting, but also export only low-value aluminum ingots. According to Berman, to increase jobs in communities affected by smelters requires expanded manufacture of value-added aluminum products.

So controversial are the promises of development put forward by proponents of new aluminum complexes that communities are rising up to stop the projects. Ravi Rebapregada, coordinator of India's Mines, Minerals, and Communities coalition, has helped organize the *adivasi* (indigenous) population in Orissa state, fighting the Utkal aluminum complex. Community opposition to the Utkal project was violently repressed by police, but it nonetheless succeeded in convincing Norway's Norsk Hydro to withdraw, delaying the project while other corporations discuss investing in Utkal.

### Aluminum's Impacts

The raw material for aluminum is bauxite, an ore found principally in Australia, Guinea, Brazil, Jamaica, China and India. Payal Sampat of the Mineral Policy Center in Washington, DC says that bauxite mining has much in common with the mining industry generally. Ownership is highly concentrated (Alcoa, the newly merged Alcan/Pechiney, and Russian state company Rusal together produce nearly 40% of the world's aluminum). Mining and minerals processing is highly energy-intensive.



### Aluminum, A Major Energy Hog

The aluminum industry is the world's largest industrial consumer of electrical energy. More than half of the world's aluminum is produced using hydroelectricity as the energy source.

Each year, the global aluminum industry consumes at least 250 billion kilowatt hours of electricity, or about 1% of the electrical energy generated globally. Aluminum ingot production constitutes about 7% of all world industrial electricity use. To put this in perspective, in 1990, the world aluminum industry needed almost as much electricity for primary aluminum production as was used in all of Africa.

*Excerpted from Molten Rivers: The Aluminum and Hydroelectric Dams Connection, a new report by Glenn Switkes (contact: glenns@superig.com.br)*

It is well known that the mining industry is a major polluter of the air, land, and water near its facilities, but less widely acknowledged or understood are the health problems experienced by workers and local populations. Aluminum processing, like other mineral activities, generates large quantities of toxic wastes. Sampat of the Mineral Policy Center says, "a disproportionate share of mining's impacts falls on indigenous peoples' lands and poor communities, whose rights to deny mining companies access to their lands are often not acknowledged by national laws."

"There are serious hazards facing aluminum workers," noted Peter Camin, from the German union, which represents aluminum workers. These include heat and steam risks, chemical contamination, and longer-term risks from exposure to fluoride gases. While Brazilian aluminum plants report a low incidence of accidents, testimony given by Brazilian union leaders indicated this might be due to under-reporting by the companies. Reinaldo Damasceno, of the Association of Victims of the Aluminum Industry, has neurological problems, which plant operators deny is caused by his exposure to toxic substances in aluminum plants.

São Luís, where the meeting was held, is a UNESCO World Heritage Site whose historic district of tiled colonial mansions reflects the French and Por-



Molten aluminum.

Photo: Glenn Switkes

tuguese occupation of this seaport in the 17th and 18th centuries. Today, however, the city is dominated by the Alumar aluminum smelter owned by Alcoa and BHP Billiton, and powered by electricity generated by the Amazon's Tucuruí Dam, the largest dam ever built in a tropical rainforest.

Local residents told the international representatives of their active resistance to the aluminum giants. Maria de Jesus Gamboa, known as "Roxinha," is from Igarauá, a community that successfully fought eviction when Alumar tried to expropriate their land for a waste pond. "We fought together as people with a common tradition," she said. In all, 20,000 people were removed from their homes and land to permit Alumar to construct Latin America's largest smelter, and 24,000 were displaced for the dam. Thousands more living downstream lost their livelihoods. José Maria Araújo of Sindmetal, the union representing aluminum workers at Alumar, said the plant's managers have harassed trade unionists trying to organize workers, and denied health effects attributable to fluoride gas and other substances with which workers come into contact. Roberto Cantanhede, representing the National Fishermen's Movement, said that Alumar's deforestation of coastal mangroves and pollution releases into the bay have cut fish and shellfish catches by 90%.

### Trashing the Earth

"The rapid growth in aluminum consumption presents a threat to wild rivers throughout the world," said Jenny Gitlitz of the Container Recycling Institute (CRI). The US is the world's largest consumer of aluminum, she noted, with every American using more than 80 pounds of the material per year. Recycling of aluminum cans declined in the US in 2002 for the fifth consecutive year,

*continued on page 15*

Installing  
an IDE drip  
system.

Photo: IDE



# Creating a True “Trickle-Down Economy”

## Low-Cost Systems Bring Income, Food Security to Rural Poor

by Lori Pottinger

**P**aul Polak thinks big and designs small. He aims to cut rural poverty worldwide, and he's using humble \$1 micro-irrigation kits to do it.

“Water is essential to alleviating poverty,” Polak says. “If you want to do anything about it, you have to start with small farmers and irrigation.”

Unlike the big development agencies, which put their faith in “trickle down” economics fueled by mega-projects, Paul Polak is establishing a new kind of “trickle down” economy, based on individual farmers pulling themselves out of poverty using low-cost tools like micro-drip systems and treadle pumps.

Polak notes that 1.3 billion people in the world are surviving on less than a dollar a day, “about what it costs the average American to subscribe to cable television.” Most of these people earn their living from agriculture, usually on less than two hectares (five acres) of land.

In 1981, Polak launched International Development Enterprises (IDE), a nonprofit group based in Colorado, with the intent of designing technologies that would help the rural poor step out of poverty and hunger. His goal was to design simple, useful, inexpensive tools that could be purchased by poor farmers to improve their yields and allow them to profit from their investment. “Small-scale

needs call for small-scale solutions, not mega-dams and industrial-scale development,” he says.

If the solutions are small-scale, his ambition for them is not: IDE recently announced its goal of helping 30 million families increase their income by US\$500 a year, in the next 15 years. IDE estimates that its efforts have already put \$200 million of additional income into the hands of the rural poor annually.

One of the group's first successes provides a literal as well as figurative way to step out of

poverty. IDE's highly efficient, simple treadle pump costs \$25 installed – vastly cheaper than the next available technology, a diesel pump-and-tubewell system that costs \$200-\$500, and which is uneconomical on small plots. The treadle pump can be manufactured locally in simple metalworking shops, using bamboo or other inexpensive, locally available materials. It is easily and cheaply maintained with standard replacement parts available in local markets. Most importantly, the treadle pump makes use of the only thing poor farmers have in abundance, cheap labor. (And labor-intensive they are: families may have to treadle-pump for 4-6 hours a day during the dry season to irrigate thirsty crops like rice.) On average, IDE says farmers are able to generate more than \$100 per year in extra income using the pump. Independent researchers support this claim, and indicate it might even be an underestimate.

While IDE does not manufacture or sell the tools they help develop, they do help create the market for them through farmer training, on-farm demonstrations, and good old-fashioned advertising – albeit a brand of advertising far removed from television spots and glossy magazines. “In Bangladesh, we've used a three-rickshaw procession to take a treadle pump to local markets,” says Polak. “We'll have a group of troubadours singing songs about the treadle pump, while another person demonstrates it. We also did a feature movie about its use, which has played to over a million people a year there in open-air theaters we set up.”



Photo: IDE

Paul Polak tries out a treadle pump in Bangladesh.

## Poverty Drips Away

Most of the world's poorest farmers live on marginal lands with unreliable rainfall and no access to irrigation. Even those with a ready water source often cannot efficiently bring it to their fields; many bring water to their plants by the bucketful, and water plants by hand. It has been shown that adding even small amounts of water to supplement rainfed crops can lead to dramatic increases in yields. Farmers who can irrigate in the dry season also have a much better chance of making a profit from their crops.

Despite its seeming simplicity, drip irrigation has always been the province of the world's wealthier farmers. While highly water-efficient, it is also expensive, costing upwards of \$1,500 per hectare to install. Polak saw "a market chasm instead of a niche" in the world's millions of poor farmers without irrigation for their crops, and has diligently set out to bridge it with low-cost, simple drip kits. IDE has designed, field-tested and marketed a spectrum of low-cost drip systems to the world's poor farmers, starting with a \$1 drip kit that can irrigate 100 plants or 20 square meters of land. IDE's bigger systems include a 50-liter-tank system that can irrigate up to 100 square meters, and so on up to 1,000 square meters. "You need to break these things into affordable pieces, so the poor can start where they can afford, and add on as they get more money." Polak says a farmer can quickly make \$30 using IDE's \$10 drip system. Rapid quickly payback on the investment is a cornerstone of IDE systems, since poor farmers are very risk-averse.

Not only do these micro-irrigation systems increase yields by up to 40%, and use half as much water as conventional irrigation, but they also save energy. Traditional irrigation systems use pumps to move water, but all of IDE's drip kits rely on gravity. Cisterns or buckets are part of each kit.

IDE products are based on extensive consultation with local farmers. Polak has talked to about 3,000 farmers in the past two decades, in places like Nepal, Bangladesh and Zambia. "All of what we do comes from the farmers themselves," he says. "We go from the grassroots up." Not only do local farmers help IDE design and test products, but local manufacturers produce and sell them. The drip systems, for example, can be made using a \$3,000 plastic extruder. "We don't believe in subsidizing the cost, so these products must be profitable to local manufacturers and dealers." Apparently, they are: in Bangladesh alone, there are now 50 manufacturers of



Photo: IDE

*Simple treadle pumps can help poor farmers increase their income, and their family's food security.*

treadle pumps, more than 2,000 dealers selling them, and perhaps 3,000 well-drillers installing them, Polak says. More than two million treadle pumps have been installed in Asia and Africa to date.

## Rainwater Harvesting

In addition to pumps and drip kits, IDE has also developed rainwater harvesting systems for drinking water, which can store up to 3,500 liters of water. These low-cost systems are based on heavy-duty plastic "cisterns" that are much cheaper than conventional cement storage tanks, yet are sturdy and safe. One of these can supply a family of five with clean water through the dry season in Bangladesh. Rainwater harvesting devices are particularly important for Bangladesh, where millions of people have been exposed to dangerous levels of naturally occurring arsenic through groundwater. IDE has also developed a low-cost arsenic filter for use in these areas.

IDE is also developing a rainwater harvesting system for irrigation uses which is "the equivalent of a dam, but miniaturized to the size of single farm," Polak says – and without any of the environmental impacts. The system is being tested in India's Maharashtra state. "We're talking about storing 20,000 liters for \$40, which can irrigate 100 square meters during the dry season," he says. Farmers can earn \$50 with their first crop with such a system, paying for the drip

system and "dam." Previously, a \$2,000 well was the only other option in that area.

IDE goes beyond simply developing and marketing good technologies for the rural poor: they follow up with trainings and other educational efforts; they help identify high-value crops that are likely to work in particular regions, and they work to develop and sustain markets to supply and maintain the technologies. With some 550 staff members working in eight countries, the group has the ability to check up on the use of its products, and improve them and their use by farmers. While most of their work is concentrated in Asia, IDE office opened an office in Zambia in 1997, and one in Zimbabwe last year.

But Polak knows it will take more than just IDE's efforts to significantly reduce poverty among the rural poor. "A whole new generation of development organizations needs to find ways to help small farmers increase their income from agriculture," he says. "We need more designers to move from designing for the world's richest citizens to designing for its poorest – above all else, the tools that make a difference to small farmers must be designed to be affordable. The new challenge is to the productivity and income of small farmers, and thereby profoundly changing the face of rural poverty." ■

*For more information, visit [www.ide-international.org](http://www.ide-international.org), or write [info@ideorg.org](mailto:info@ideorg.org).*

Rivers continued from page 1

already retreating, from the Alps to Alaska. But they are retreating fastest in the high-altitude regions of Africa, Asia, and Latin America, where most of the world's poor people live and where most of the world's population growth will take place. For a period of time, accelerated glacial melting will produce an increase in river runoff; but then it will be gone. Officials in La Paz, Bolivia, for example, now openly worry about future water shortages because the glaciers that provide the city's water are retreating so quickly. As Robert Gallaire, a hydrologist with a French scientific institute studying the Bolivian glaciers told the New York Times, "The problem is we are using reserves that are being reduced. So we have to ask, what will happen in fifty years? Fifty years, you know, is tomorrow."

Against this backdrop of demographic, consumptive, and climatic pressures, rivers and the panoply of life they sustain would seem doomed. However, disastrous loss of freshwater biodiversity is not yet a foregone conclusion. *Homo sapiens* is among the life-forms that rivers sustain. At some point, the compulsion to save our species will trigger an impulse to save the aquatic ecosystems that life depends upon. The question is, what quality of life will be left when that instinctive impulse kicks us into action? Will the Colorado pike-minnow still ply its ancestral waters? Will the Yangtze River dolphin, which now numbers fewer than 200 individuals, still grace China's largest river? Will salmon still carry out their legendary migrations within the great rivers of northern Europe, New England, and the Pacific Northwest, or will they move only from fish farms to our dinner tables? Will coastal estuaries receive enough fresh water and nutrients to remain productive enough to feed the growing populations that depend upon them? Will legions of filter-feeding mussels still cleanse the river water running by them? Will enough floodplain habitat remain for the feeding and breeding of fish populations that help sustain millions of subsistence dwellers in developing countries, not to mention tropical biodiversity?

Current trends strongly suggest that the answer to all of these questions will be no. We are moving rapidly toward a freshwater world of greater ecological degradation,

species extinction, and loss of natural ecosystem services. This may not be the world we want for ourselves or our descendants, but it is the one that is coming if no course corrections are made.

### An Open Window

We now have a narrow window of opportunity in which to redirect the ecological trajectory of the planet's rivers toward improvement rather than decline. With the scientific tools and innovative policies described in earlier chapters, the time is ripe for mobilizing a global river restoration movement. The good news coming from the restoration efforts now under way around the world is

this: when given a chance, river systems often heal. Reconnect a river with its floodplain, and fish and riparian plant communities will rebound. Remove a dam, and species long gone will return upriver. Release a flood pulse from a reservoir, and key habitat improvements will materialize.

The science supporting river restoration is now strong enough to warrant greater societal investment in rebalancing human and ecosystem water needs. Moreover, river health can often be improved with minimal social or economic disruption.

For this movement to gain steam, governments must act swiftly to enact policies that protect river health even as water continues to be appropriated for human needs. Following South Africa's lead, these policies must call for freshwater reserves that consist of the volume and timing of river flows needed to safeguard ecological health. For their part, water managers must embrace the new philosophy of adaptive management, or learning by doing. Delaying action because of uncertainty is no longer a valid excuse, because through experimentation, monitoring, and periodic resetting of goals, progress can be made even in the face of uncertainty. With species extinctions and other irreversible changes around the corner, it is simply essential to get started.

Ultimately, for these policy and management reforms to have a durable impact, society's relationship to freshwater ecosystems will need to change in several overarching ways. Water affects so many aspects of our lives that a move to live in better balance with it inevitably will involve some fundamental changes in societal priorities and individual choices. First, human communi-



Floating down the river in Brazil.

Photo: Glenn Switkes

ties must learn to integrate better with nature's cycles. *Homo sapiens*, like every other species, is part of nature. But whereas all other life-forms live in synchrony with nature's variability, we actively negate or defy that variability in order to make water supplies reliable for us. Indeed, this is one of the principal aims of modern water engineering. By doing this, however, we reduce the survival chances of many of our earthly companions whose life cycles are keyed to nature's cycles. They need floods to create good habitat. They need water in dry spells as desperately as we do. Once-perennial rivers that now routinely run dry because of heavy irrigation withdrawals will not long support the life that evolved within them. Unless human communities begin to adapt to natural cycles and coexist with aquatic communities, those natural communities will disappear and the ecological work they perform will be lost.

### Living Within Our Means

What this means from a practical standpoint is that instead of planning to make every year as good as it can be for us, we plan instead to share the hardship of water-deficit years and the surplus of water-abundant years with the natural communities around us. In periods of drought, we expect to adjust our water-use practices not just to stretch out the available supply for human uses, but because other species need water too. Rationing or other curbs on water use become not signals of failed water manage-

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# Assessing Options, Meeting Needs

by Patrick McCully

A key “Strategic Priority” of the World Commission on Dams addressed the need to greatly improve the often secretive and corrupt processes which lead to decisions to build large dams. Critics of large dams have long called for water and energy planning to be made more participatory, accountable and comprehensive. A recent workshop showed that at least some of those involved in building and funding large dams agree that past and current planning practices are inadequate and that we must move toward the types of options assessment processes outlined in the WCD’s report.

The workshop was sponsored by the UN Environment Programme’s Dams and Development Project, the body set up to promote discussions on the practical implementation of the WCD’s recommendations. Participants included representatives from NGOs as well as the World Bank and other funding agencies, dam-building companies, utilities and research institutes.

Alessandro Palmieri, Lead Dams Specialist at the World Bank, gave a presentation at the workshop on the Bank’s new “sourcebook” on the topic, titled *Stakeholder Involvement in Options Assessment: Promoting Dialogue in Meeting Water and Energy Needs*. The sourcebook is part of the Bank’s action plan “developed to promote the mainstreaming of the WCD’s core values and strategic priorities

within the Bank.” The sourcebook will be used for training bank staff and borrower country officials.

Much of the language in the Bank’s sourcebook echoes the points made by the WCD and the arguments of dam critics. For example, it states that:

*“concepts of stakeholder involvement and options assessment imply a change in investment patterns for water and energy development. More resources and time will be spent at the upstream end of planning. Benefits such as early elimination of unacceptable projects, improved project portfolios, greater public acceptance, improved access to external financing, and lower overall costs outweigh the incremental time and cost spent prior to decision-making.”*

In the foreword, Bank Vice President Ian Johnson says that “all reasonable options need to be investigated before a decision is made to proceed with a dam, and ... those likely to be affected by such decisions should be encouraged to participate actively in the making of the decisions.”

The credibility of the sourcebook and the Bank’s commitment to participation and transparency is called into question by the inclusion of the Bujagali project in Uganda as a case study representing a good participatory options assessment process. No mention is made of the fact that planning for Bujagali has been mired in corruption, secrecy, repeat-

ed attempts by government and World Bank officials to discredit project critics, and an options assessment process which fully reviewed only large hydro projects and largely ignored apparently cheaper and quicker-to-implement options such as geothermal power.

Other presentations at the workshop described how options assessments can work to promote better alternatives. Ute Collier, who heads up the Dams Initiative for the conservation group WWF, gave a presentation at the workshop on a multidisciplinary options assessment process commissioned by WWF-Poland for an existing and planned dam on the Vistula River. The assessment concluded that the most economically beneficial scenario would be to decommission the existing Wlocawek Dam (which has caused serious downstream erosion problems) and not build the planned Nieszawa Dam. The domestic dam-building lobby strongly opposes decommissioning Wlocawek. According to Collier, the government is likely to decide upon the option ranked second by the assessment team: to rehabilitate Wlocawek but abandon plans for Nieszawa. The study took 18 months and cost \$80,000.

Workshop participants also heard from Bikash Pandey of the nonprofit group Winrock International about the successes of implementing small-scale and decentralized energy options in Nepal. Biogas (for cooking and lighting), small hydro (for both electrical and mechanical power) and solar systems meet the energy needs of more rural Nepalis than the electric grid, he noted. The cost to the government of these decentralized options is only a tenth of the costs of grid expansion. Pandey pointed out that while electricity meets only 1% of Nepal’s energy needs, it receives 30% of development expenditures.

The workshop ended with participants agreeing to the following principles. Options assessments should be:

- driven by an assessment of needs;
- transparent, with explicit assumptions and documented decisions;
- include the full range of alternatives;
- participatory.

Participants expressed the hope that the workshop conclusions would help inform the various national processes established under the Dams and Development Project to discuss the implications of the WCD report. ■

*The workshop proceedings, and the World Bank’s options assessment sourcebook, are available from [www.unep-dams.org](http://www.unep-dams.org).*

## The WCD on Assessing Options

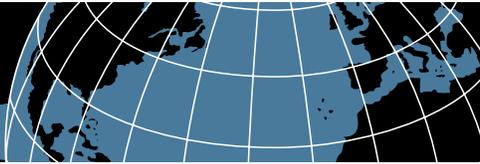
The following are excerpts from the WCD report.

Opponents contend that better, cheaper, more benign options for meeting water and energy needs exist and have been frequently ignored, from small-scale, decentralised water supply and electricity options to large-scale end-use efficiency and demand-side management options. Dams, it is argued, have often been selected over other options that may meet water or energy goals at lower cost or that may offer development benefits that are more sustainable and more equitable.

The Global Review examined the options for meeting energy, water and food needs in today’s circumstances and the barriers and enabling conditions that determine choice or adoption of particular options. Many options currently exist - including demand-side management (DSM), supply efficiency, and new supply options. These can all improve or expand water and energy services and meet evolving development needs across all segments of society.

To explore these alternatives, needs for water, food and energy are assessed and objectives clearly defined. The appropriate development response is identified from a range of possible options. The selection is based on a comprehensive and participatory assessment of the full range of policy, institutional and technical options.

In the assessment process, social and environmental aspects have the same significance as economic and financial factors. The options assessment process continues through all stages of planning, project development and operations.



## UPDATES

**CHINA:** Two prominent engineers have urged the Chinese government to shut down operations of the Sanmenxia Dam on the Yellow River to prevent future flooding disasters in central China, reports the *South China Morning Post*.

Zhang Guangdou, a member of the Chinese Academy of Sciences, and Qian Zhengying, former head of the Ministry of Water Resources, have publicly stated that power generation facilities at Sanmenxia Dam should be suspended and its gates opened to flush out as much water and sediment as possible.

"The people have suffered long enough from the dam," said Zhang.

Both Zhang and Qian have been strong supporters of the Three Gorges Dam on the Yangtze.

The engineers note that the dam has significantly raised the riverbed of tributaries of the Yellow River, which has led to numerous devastating floods that affected more than five million people and caused economic damage of more than US\$1 billion. Sediment beds in tributaries rose an average of 4.5 meters, causing the river's flow rate to drop significantly.

Sediment has also filled up the dam's reservoir, diminishing its electricity-generating capacity. The 106-meter-high dam, completed in 1961, was designed to reduce floods and to generate 120 MW. Ongoing sedimentation problems have left the dam operating as a run-of-river power station generating just 25 MW.

**BRAZIL:** Two decades of efforts to dam the Xingu River in the Amazon have taken a new turn with the government's admission that Belo Monte, the first dam being planned for the Xingu, will not be capable of generating the 11,182 megawatts projected in project feasibility studies. "We will begin feasibility and environmental studies all over again," said Mines and Energy Minister Dilma Rousseff, acknowledging that criticisms of the Belo Monte had been well-founded. The new studies are expected to reduce Belo Monte's installed capacity to 5,500-7,700MW.

The Brazilian government plans to build Belo Monte in a partnership between state companies and a consortium of construction companies, equipment manufacturers (reportedly including Alstom and Siemens), and electro-intensive industries including aluminum manufacturers. At a meeting of the Brazilian NGO Energy Work Group, dissatisfaction continued regarding the government's contention that, by reducing the number of turbines in the powerhouse, environmental and social impacts will be minimized. Independent analyses still point to the necessity of an upstream dam storing a greater volume of water to permit Belo Monte to generate electricity during the dry season. Such a dam would flood thousands of square kilometers of the rainforest, and have serious impacts on indigenous reserves.

**TURKEY:** A study by government inspectors reveals that the private sector has built numerous hydropower dams on rivers that do not generate enough water to sustain them. The study, by Turkey's State Supervision Agency, stated, "The calculation of water flows in many hydroelectric power plants was not realistic." This means many of the country's 17 private hydro dams will never reach the production capacity upon which their contracts are based. In one case, a dam will never generate more than a third of the electricity it was supposed to. Under existing contracts, the government is still obliged to pay for power that is not generated.

Turkey has 28 private-sector power projects, whose contracts require the government to buy the power at pre-set prices for 20 years. *The Financial Times* reports that many of these projects' annual return is more than 300%. The government study reports that these unfair contracts are costing Turkey US\$7 billion a year. Some of the companies involved in this scandal include the US-based Enron and Bechtel; the UK-based Midlands Electricity; and Japan's Marubeni. The government has threatened to seize some of the projects, which could bring severe penalties to Turkey. "As a first step, we will try to renegotiate contracts, and if this fails, we will consider buyouts, arbitration and contract cancellation," the nation's energy minister said. *Source: Financial Times*

**US:** A new federal court order will restrict the use of 43 pesticides near salmon-supporting creeks and rivers in Washington, Oregon, and California. The regulations call for buffer zones along streams that are used by threatened or endangered salmon or steelhead. The order is in response to a lawsuit filed by a coalition of environmental and fishing groups, represented by Earthjustice.

The order requires 20-yard no-spray buffers and 100-yard aerial-spray buffers. The buffers will remain in place until the US Environmental Protection Agency (EPA) reviews the pesticides for their risks to endangered salmon species. More than 25 salmon species in this area have been listed under the Endangered Species Act. Dams and widespread habitat loss are considered the prime reasons for their decline, but the impact of agricultural chemical poisoning has created new obstacles for their recovery.

Fish are particularly vulnerable to pesticide exposure because they absorb pesticides through their skin and ingest them in their diet. Pesticides can interfere with salmon's ability to transition from freshwater to seawater, impair swimming ability, and cause abnormal sexual development or skeletal deformities. Pesticides also change the aquatic environment, reducing the food supply and eliminating the vegetative cover young salmon need. Recent research indicates that even low levels of pesticides can damage salmon's ability to smell, which can impair their ability to detect predators, spawn and mate.

**US:** A new report by the US Fish and Wildlife Service has confirmed that low water flows were a prime culprit in a huge 2002 salmon kill on the Klamath River, but the federal agency that controls water levels on the river stated the report would not necessarily result in more downstream releases.

The new report "cites a multitude of factors, not an obvious single explanation, and I don't see where it says we should increase flows down the Klamath," said Jeff McCracken, a spokesman for the US Bureau of Reclamation, the agency which controls the river's flow.

The report notes that crowded conditions in the river and abnormally warm water contributed to the kill, which left 34,000 chinook and endangered coho dead. But the study identified extremely low flows as a major factor in the kill. Downstream flows in the summer of 2002 were the fifth-lowest in the past 25 years.

"There are some long-term approaches we can take to solve this problem, such as restoring wetlands and buying water rights in the farmlands of the Upper (Klamath) Basin," said Glenn Spain of the Pacific Coast Federation of Fishermen's Associations. "But the one thing we can do immediately is put more water down the river. Fish and Wildlife is finally saying what we said all along – fish need water."

The river's low flows are a consequence of the federal Klamath Project, whose dams and canals deliver water to about 1,600 farmers cultivating some 200,000 acres in the Upper Klamath Basin. Farmers staged angry protests when the Bureau of Reclamation curtailed their water deliveries in 2001 to comply with the Endangered Species Act.

Since then, the bureau has significantly increased deliveries to farmers, citing a National Research Council report that found no clear correlation between fish mortality and water levels in the Klamath system.

Source: *San Francisco Chronicle*

## A BETTER WAY

**GERMANY:** One year after disastrous floods along the Elbe River caused billions of dollars in damage, German Federal Environment Minister Jürgen Trittin has drafted a law to improve preventive flood management. "We will give our rivers more room again; otherwise they will take it themselves," Trittin said, adding that it is essential to end the practice of building residential areas and industrial facilities in floodplains.

In future, there will be a nationwide requirement for the designation of flood zones on the basis of so-called "100-year flood levels." The provinces will be given five years to designate these zones. Areas below dams will be considered flood-prone zones. "The large number of dam failures along the rivers Elbe and Mulde have shown that dams do not provide absolute protection," said Trittin.

The Act will generally prohibit designation of housing and industrial developments in flood zones. Trittin noted that less than a year after the great flood, a number of municipalities were already planning new housing developments in river plains again. "Whoever still wants to build in a flood zone has not understood a thing and cannot expect our society to help him out when the damage is done," he said.

**EFFICIENCY:** The California Energy Commission has adopted new building standards that could cut the state's peak energy use in

the first year by enough electricity to power 180,000 homes, the *Sacramento Bee* reports.

The rules, which will take effect in October 2005, will apply to new construction and renovations of homes and commercial buildings. Many of the new standards are aimed at improving the efficiency of heating, air conditioning, ventilation and lighting systems. The new rules drew support from various manufacturer and building industry organizations, as well as the group Natural Resources Defense Council (NRDC), which helped draft the standards. An NRDC spokesperson said the new rules will cut energy use to heat, cool and light newly constructed buildings in California by 10%.

The energy commission says the new rules will increase the cost of building a typical 2,200-square-foot house by \$500-\$1,760, depending on the climate. The commission also said the estimated energy cost savings over the life of the house would range from \$1,540 to \$3,700, or more than double the cost of the energy-saving upgrades.

**SOLAR:** Scientists are close to making a new class of solar cells that, while less efficient than conventional ones, are vastly cheaper and more versatile. The new photovoltaics are made of low-cost "organic" materials (those with carbon-based molecules), rather than conventional inorganic, silicon-based materials. The efficiency rate of the new chips is expected to be about 10%, compared to 24% for silicon solar cells, but the cost of their electricity could be up to 20 times cheaper than conventional solar cells.

The materials are ultra-thin, flexible and can be applied to large surfaces. "You could, for example, have a sheet of solar cells that you unroll and put on a roof," said a Princeton electrical engineer working on the cell research. They could also be sprayed onto windows and other surfaces.

At least one solar-chip manufacturer is planning to produce prototypes of these new cells next year. The French-Italian company STMicroelectronics said that over a typical 20-year lifespan of a solar cell, a single produced watt should cost as little as \$0.20, compared with the current \$4. Energy from such cells would be cheaper than fossil fuels.

**FUEL CELLS:** The auto company Honda and fuel cell manufacturer Plug Power Inc. unveiled the world's first home energy station on Oct. 6. The station converts natural gas into hydrogen to fuel a car and produce electricity and hot water for the home. The unit can also export electricity to the grid, but requires no electricity itself. The Home

Energy Station can produce enough hydrogen to fill one fuel cell vehicle every day.

Plug Power and Honda intend to extend their collaboration into 2004 to improve the design and conduct further testing.

Fuel cell vehicles have low to no emissions, depending on the fuel used to make hydrogen, and are very efficient.

## UNSAFE DAMS

**US:** A new report by the Association of State Dam Safety Officials (ASDSO) estimates the cost of rehabilitating unsafe non-federal US dams to be \$36.2 billion. The committee's report, "The Cost of Rehabilitating Our Nation's Dams," states that almost one-third of this amount is needed for the nation's most critical dams, those whose failure would cause loss of human life. The states currently regulate more than 10,000 of these "high-hazard-potential" structures.

ASDSO reports that in the past two years, the US has experienced at least 21 dam failures. The May 2003 failure of Silver Lake Dam, in Michigan's Upper Peninsula, caused the failure of a downstream dam and the evacuation of more than 1,800 people. The failures resulted in more than \$100 million in damage. Also in 2003, several dams failed in North Carolina, causing the evacuation of approximately 75 homes and damages estimated at \$12 million. The state is spending nearly \$5 million to rebuild the Hope Mills Dam.

Well over 50% of US dams are privately owned; state and local governments, federal agencies and utilities own the remainder. Funding programs for dam repairs now exist in fewer than a dozen states.

The ASDSO committee's two-year study considered the cost of rehabilitation (whether repair, replacement or removal) and the cost of increasing storage capacity or structural upgrades.

The committee has recommended the creation of a national dam rehabilitation loan program. ASDSO has worked with lawmakers to draft legislation that provides funding for repairs to high-hazard-potential dams and is currently seeking a sponsor for the legislation.

"Congress just approved a bill that allocates \$18.6 billion toward infrastructure investments in Iraq, including \$125 million for dam construction and repair," commented ASDSO's Brad Iarossi. "Is America's infrastructure less of a priority? Our lawmakers should also be concerned with the poor condition of US infrastructure, which currently threatens our safety and well-being."

## Twelve Reasons to Exclude Large Hydro from Renewables Initiatives

(14-page booklet).

Co-published by IRN and 12 other organizations, 2003. Available at IRN's website: [www.irn.org](http://www.irn.org).

With big dams back in favor in some quarters, the industry is now pressing to get large hydropower projects included in various international initiatives to promote the use of renewable energy and reduce climate change. If successful, this effort would vastly reduce funds available for truly renewable technologies (wind, solar, geothermal, and marine energy). This report cites large hydro's negative impacts on people, ecosystems, energy security, and efforts to adjust to climate change as compelling evidence that an expansion of large hydro will lead to set-backs, not advances, in efforts to eradicate poverty and reduce the environmental impacts of energy production.

## Waste Not, Want Not: The Potential for Urban Water Conservation in California,

by Peter Gleick et al. Published by the Pacific Institute of Oakland, California, 2003. Full report available at [http://www.pacinst.org/reports/urban\\_usage](http://www.pacinst.org/reports/urban_usage)

"The largest, least expensive, and most environmentally sound source of water to meet California's future needs is the water currently being wasted in every sector of our economy." So begins this well-researched, eye-opening new report on doing more with less water in the sixth largest economy in the world.

California can save one-third of its current urban water use with cost-effective, readily available solutions, according to this report, without resorting to brown lawns and shared showers. These water-saving measures would eliminate the need for new dams and other urban water supply projects

for the next three decades and cost less than new supply – without the social, environmental, and economic impacts that major water projects bring.

The authors detail plans for great water savings in many areas. For example, replacing inefficient toilets, home washing machines, showerheads and dishwashers and repairing leaks in residences would save 893,000 acre-feet a year – enough for more than 22 million people, if used efficiently. "This would have the effect of reducing current indoor residential use, on average, from around 60 gallons per capita per day to around 37 gallons per capita per day," the authors note. Leaks currently account for 12% of the state's urban water use.

The potential for water savings in traditional heavy industries are also analyzed. Petroleum refining, for example, could potentially save nearly three-quarters of its total current water use by using recycled and reclaimed water. The paper and pulp industry could save an estimated 40% of the water it now uses, while commercial laundries could cut their water use in half, mostly by converting to more efficient commercial washers.

The authors note that "cutting our use of water brings with it several significant 'co-benefits' – from decreased sewage bills and less polluted landscape runoff to a decrease in energy consumption and improvements in air quality." It can also reduce statewide strife over water use among different users. They state that it is "essential that the deadlock over California water policy be broken. The best way to do this is through reducing waste in the system, using proper pricing and economics, educating the public, and improving water efficiency and conservation efforts."

Pacific Institute also intends to examine California's agriculture sector, which uses 80% of the state's water, in a future study.

## Solar Thermal Power 2020: Exploiting the Heat from the Sun to Combat Climate Change,

by Rainer Aringhoff et al. Published by Greenpeace International and the European Solar Thermal Power Industry Association, The Netherlands, 2003. Full report available at: <http://archive.greenpeace.org/docs/SolarThermalPower.pdf>

With the right market conditions, solar thermal power is capable of supplying clean electricity to more than 100 million people living in the sunniest parts of the world within two decades, according to this new report. "The vision is clear: solar thermal power plants can become the offshore wind farms of the desert – exploiting the heat from the sun to combat climate change," it states.

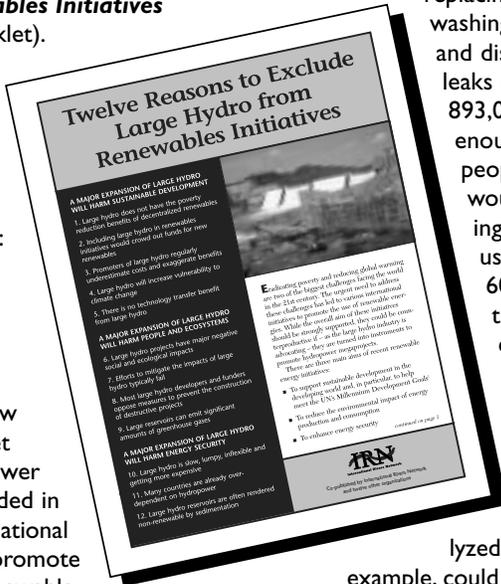
Solar thermal power plants produce electricity by concentrating solar radiation and converting it to steam to drive turbines or engines. This report describes in detail how such systems work, their costs, and the factors affecting the market for solar-thermal technologies.

The cost of solar thermal is still high, but the authors note that prices will drop dramatically with the mass production and economies of scale envisioned in the report. Expansion in the solar thermal power industry as described in the report would result in the creation of 200,000 jobs worldwide, a huge reduction in greenhouse gases, and reliable power.

## Struggling to Be Heard: Democratizing the World Bank and IMF,

by Christian Aid. 2003. Full report available at: <http://www.christian-aid.org.uk/indepth/>

"The World Bank and the IMF call for democracy, openness and accountability in the developing countries where they work. But their own activities fall far short of such an ideal." So states this 16-page critique of the World Bank Group's system of governance describes how the way the institutions are run affect their ability to reduce poverty in developing nations. The report notes that wealthy countries control decision-making for the institutions, and that decision-making is often secretive. "Poor countries must have a bigger say in how they are run," the authors state, calling for more executive directors from poor countries, and more transparency on loans and other decision-making at the Bank. The report gives examples of how the current system at the institutions has led to ineffective development schemes, harsh policy changes in poor nations which have worsened the lives of the poor, and undemocratic decision-making emanating from Washington instead of from developing countries' own governments.



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## Aluminum continued from page 7

with more than half the cans purchased simply discarded. Close to 90% of primary aluminum produced worldwide is not recycled. More than 50 billion beverage cans went unrecycled last year in the US alone, the equivalent of several large aluminum smelters' annual production.

But aluminum recycling makes good economic sense. Manufacturing a can from recycled aluminum uses only 5% of the energy required to fabricate new aluminum from bauxite ore, thus avoiding the need for new hydroelectric dams or coal-fired power plants and the serious impacts they cause. Laws providing cash incentives for aluminum recycling appear to be a key factor in encouraging recycling of cans. In states with deposits on cans, recycling of aluminum cans exceeds 70%, while in non-deposit states, only 29% of cans are recycled, showing that even a small cash incentive provides a huge impetus for greater consumer responsibility. Germany recently implemented a new national deposit law, and other European countries provide diverse incentives for recycling.

Cans and packaging represent only one area for potential increases in aluminum recycling. The largest use of aluminum is currently in vehicles and other uses by the transportation industry. In this area, increases in the amount of secondary aluminum used in vehicle fabrication, for example, could significantly increase the secondary aluminum market.

Recognizing its potential vulnerability as a target for consumer action, the aluminum industry has tried to present itself as a "green" industry, advertising the fact that aluminum is a material that can be recycled without losing its original properties, as compared to plastic or paper, which decline in quality when recycled. The industry counters the high energy requirements of aluminum production and the industry's significant emissions of greenhouse gases by noting that aluminum vehicles are lighter and burn less fuel than those made with more steel. Despite that fact, there is little evidence that the aluminum industry has actively promoted recycling, probably due to

its reluctance to further contribute to the already existing glut of aluminum on the world market.

## Moving ahead

An international network to promote collaboration on issues concerning the aluminum production chain has been launched. Mining activists will bring in more organizations from already-existing networks, and utilize the network to disseminate information on campaigns globally. Dam fighters will also collaborate with the diverse actors present to construct a "toolbox" to orient communities confronting the aluminum industry. Labor unions will take the lead in sharing information on companies and on health risks in discussions with their union colleagues from various countries. And a concerted effort will be made to reach consumers with a picture of the hidden costs of the aluminum can, aluminum foil and other apparently "throw-away" products, which today are borne in large part by communities, workers, and ecosystems worldwide. ■

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## Rivers continued from page 10

ment but of the desire to coexist with the life around us. Of course, such a policy will result in short-term economic losses in some years; but the benefit will be healthier and more resilient ecosystems contributing valuable goods and services to the economy over the long term.

Second, we will need to reduce human pressures on the aquatic environment by slowing growth in population and consumption, and by boosting water productivity. Populations continue to grow rapidly in some of the most water-stressed regions of the world, including parts of western and south-central Asia, much of Africa, and the southwestern United States. Currently, about 77 million people are being added to the global population each year, the equivalent of adding another Germany.

Reduced population growth rates, both globally and regionally, are critical to meeting human and ecosystem needs for water. At the same time, reducing per capita use of both water and energy, particularly among the top 2 billion or so consumers, would reduce the number and size of dams and reservoirs required, and provide water managers greater flexibility in satisfying environmental flow requirements. Raising water productivity – the output derived per liter of water extracted from the natural environment – is critical to remaining within any sustainability boundary established to protect

river health. Higher water productivity in the global food system is particularly important. Nearly 70% of all the water withdrawn from freshwater ecosystems goes to irrigated agriculture, yet drip irrigation – which often doubles yield per liter of water compared with conventional irrigation methods – accounts for only 1% of world irrigated area.

At the individual level, dietary choices make a large difference on per capita human impact on rivers and aquifers. A typical American diet requires about 1,970 cubic meters of water per year to produce, while an equally nutritious vegetarian diet takes only 950 cubic meters. A large-scale shift from animal to vegetable protein could save large quantities of water – indeed, two people could be fed instead of one.

Third, the globalized trend toward the commodification and privatization of water requires a strong reaffirmation that water is a public trust to be preserved for the common good of this generation and those to come. The relatively recent and quickly expanding search for profits from water ownership and management poses a large threat to ecosystem health and species preservation. Those aimed at profiting from water have little incentive to conserve it or to protect its ecological functions. With no "world ecosystem organization" to match the powers of the World Trade Organization, this protective action may need to come in the form of an

international freshwater convention, comparable in scope to existing UN conventions on climate change and biodiversity. A principal aim of such a convention would be for signatories to agree to establish water allocations specifically to sustain ecosystem health – and to give these allocations priority over nonessential human uses of water.

Lastly, an ethic of stewardship toward fresh water and its dependent species requires that we err on the side of allocating too much water to ecosystems rather than too little. Each habitat and species in the natural world is a life-support component, performing tasks we may not be aware of or know the value of. For our own self-preservation, it makes sense to conserve all the components unless we can say with certainty that a particular piece can be eliminated without causing serious harm. With so many components already gone or at risk, there is a premium now on preserving those that remain. Most deeply, an ethic of stewardship is about respecting the beauty and mystery of a natural world we did not create and cannot fully understand, but over which we have acquired dominance. It is about adding a healthy dose of humility as an antidote to our past hubris. And it is about applying the best of our science, policy, and technology not to further manipulate nature but to better adapt ourselves to its time-tested, life-sustaining cycles. ■

# Scientists Working to Protect Waterways Get Bush-whacked

It should come as no surprise that healthy rivers and waterways are not the top priority of the Bush administration, but recent events show just how far it will go to protect special interests over a healthy environment.

In early November, a team of scientists was fired from the job just weeks before finishing a major report on the ecosystem of the Missouri, the nation's longest river. According to the online environmental magazine Grist, the report was to have argued for more natural flows for the Missouri (particularly, the release of more water from hydroelectric dams in the spring and less in summer) as part of a plan to prevent extinction of endangered fish and fowl, and to reduce the risk of future flooding. The team's findings were based on more than 10 years of research and were confirmed by independent peer review and the National Academy of Sciences.

But the Army Corps has resisted making changes in its management of the Missouri, which it says would economically inconvenience dam owners and the barge industry. Now the Bush administration is seeking a new "biological opinion" from a hastily appointed team of scientists. The new team

was given a few weeks to determine if the Army Corps can avoid making flow changes. River groups were outraged. "In a month's time, a group of people that knows nothing about the Missouri are supposed to write a credible biological opinion? Give me a break," said Chad Smith of American Rivers. The fish and wildlife agencies of all seven states along the river have also written in support of the original team's findings.

A scientist on the disbanded team who wished to remain anonymous told Grist, "What concerns me is not just that the officials seem to be looking for a predetermined answer [on how to manage river flow], but that the replacement scientists know almost nothing about the Missouri River – whereas our team has worked in this basin for years."

Around the same time as the Missouri incident, an Environmental Protection Agency biologist in Florida resigned in protest for the agency's acceptance of an industry-funded study that concludes wetlands discharge more pollution than they absorb – a reversal of the body of science that shows wetlands purify water. Bruce Boler quit his job of assessing environmental impacts from proposed developments in wetlands areas of fast-growing

southwest Florida after a Bush-appointed EPA regional administrator accepted the findings of the study, which was financed by a coalition of developers who want to build golf courses and homes on wetlands. In his resignation letter, Boler said, "Ultimately, the politics in Southwest Florida have proven to be stronger than the science, as the [developer-funded study] has been adopted by agencies and is being used now to push through many projects that EPA had opposed."

According to Jeff Ruch, executive director of Public Employees for Environmental Responsibility, the rate of replacing scientists in government agencies has been unusually high during the Bush administration. "There is always one major development or another that can't go forward without scientific evaluation," said Ruch, "and increasingly the scientific expert on which those developments hinge is twisting in the wind. If the scientist gives the inconvenient answer they commit career suicide, and if they give the convenient answer they get promoted." ■

*This story is based on articles by Amanda Griscom which appeared in Grist. See <http://www.gristmagazine.com>*

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