May 15, 2003 *(New York Times)*

Commercial Fleets Reduced Big Fish by 90%, Study Says

By ANDREW C. REVKIN

In just 50 years, the global spread of industrial-scale commercial fishing has cut by 90 percent the oceans' population of large predatory fishes, from majestic giants like blue marlin to staples like cod, a new study has found.

Oceanographers not connected with the study say it provides the best evidence yet that recent fish harvests have been sustained at high levels only because fleets have sought and heavily exploited ever more distant fish populations.

Other studies had shown such trends for individual species and some coastal fisheries, but experts said this was the first systematic study to measure the effect throughout the oceans.

The study is to appear on Thursday in the journal Nature and is online at www.nature.com.

The authors, from Dalhousie University in Halifax, Nova Scotia, said they hoped the findings would spur countries to honor a declaration most signed last summer at the World Summit on Sustainable Development in Johannesburg, which called for restoring stocks by 2015.

American fisheries officials and representatives of the fishing industry said that declines in fish stocks were inevitable but that progress was being made in stemming damage to the most depleted stocks.

The study, drawing on decades of data from fishing fleets and research boats, paints a 50-year portrait of fish populations under siege as advances like sonar and satellite positioning systems allowed fleets to home in on pockets of abundance.

Even as sought-after species like tuna and swordfish declined, many other less popular fishes also dropped enormously in numbers as they were caught unintentionally on long lines of baited hooks or in bottom-scouring trawls.

"With all this technology together, the fish hardly have a chance," said the lead author, Dr. Ransom A. Myers, who spent 10 years combing archives of information from Japanese long-line fleets, research trawling expeditions and other sources.

But representatives of the seafood industry called the study unnecessarily alarmist.

Glenn R. Delaney, a consultant to American fishing companies and a government-appointed member of the International Commission for the Conservation of Atlantic Tunas, said some fleets had overfished in the past and some continued to do so, particularly rogue vessels connected mainly to Taiwanese companies. But he said that major ocean fisheries were being managed better now.

The study was financed mainly by the Pew Charitable Trusts, a foundation that has long promoted efforts to alert the public to problems with the oceans. It was extensively reviewed by experts from the industry and other institutions before appearing in Nature, the authors said.

The authors and other experts said recent improvements in stocks of some species, like swordfish, were creditable but reflected only a tiny increase in populations that remained the dimmest shadow of what they were two generations ago.

This level of depletion not only threatens the livelihood of fishers and an important source of protein, but could also unbalance marine ecosystems, experts and the study's authors said.

In some places, the study found that when top predators were removed, competing species thrived and filled the gap in the food web. When cod declined in the Grand Banks east of Canada in the 1950's, flatfish numbers soared, and when populations of blue marlin plunged in the tropical Atlantic as they were caught on tuna hooks, sailfish and then swordfish became abundant.

But in each case, the statistics showed, the replacement species were quickly decimated by overfishing or by accidental catches. That left the oceans largely bereft of big predators as a whole.

One remarkable aspect of the new study is the 50-year statistical portrait it paints that reveals not just the extent of the damage, but also the pattern, with charts showing year by year how, as oceangoing fleets fanned out, catches boomed each time they reached new waters, then plummeted in their wake.

In almost all exploited areas, it generally took just 10 or 15 years for populations to crash. One measure was fish caught per 100 hooks on the Japanese lines. The study said the rate went from 10 fish per 100 hooks to 1 or less in that period.

"This shows that the reason we've had so much tuna and swordfish, the only reason this has been sustained, is because boats kept going farther and farther away," said Dr. Jeremy B. C. Jackson, a professor at the Scripps Institution of Oceanography. Dr. Jackson has conducted other studies showing declines and ecological effects in coastal waters but was not involved in the new work.

"The problem now is there's no place left to go," he said. "There are a lot of people out there willing to fish the last fish. But that's just not going to work."

One of the biggest concerns is the potential effect on global ecosystems, said Dr. Boris Worm, the second author of the study. He is affiliated with Dalhousie and the University of Kiel in Germany.

"You can't cut off the head of an ecosystem and expect it to behave the same way," he said. "From all we've studied in parts of the ocean, you can end up with things being less stable, less predictable, and maybe less hospitable."

He said that for most fish species, recovery was possible, even from such low numbers.

"On land, we did it with buffalo," Dr. Worm said.

"They went from 30 million to a thousand," he added, "and we saved them because we wanted to. With fish we haven't thought the same way yet."

There are already efforts underway to curb overfishing, create reserves that serve as nurseries for valued species and encourage consumers to avoid the most endangered fishes.

Fishing industry representatives also note that tuna and swordfish populations are stabilizing in many places. But the authors of the study and other experts note that most of these efforts are voluntary and grossly insufficient.

February 19, 2001 *(New York Times)*

Scientists Call for Ocean Parks

By THE ASSOCIATED PRESS

SAN FRANCISCO -- A worldwide network of no-fishing zones may be the last, best hope of replenishing the Earth's depleted stocks of fish and other marine species, an international team of scientists reports.

Fish, lobster and other species recover in only a few years given sanctuaries free of the hooks and nets of commercial and sports fishermen, the researchers say.

In a report released Saturday at the national meeting of the American Association for the Advancement of Science, they urged creation of the network of marine parks where all sea animals and plants would be protected.

Just as national parks provide safe haven for threatened animals on land, marine parks could be the salvation for vanishing ocean life, the study said.

``The oceans are more vulnerable than we realized,'' said Jane Lubchenco, an Oregon State University marine scientist. ``We know now that the present methods are inadequate to protect the oceans.''

Overfishing, pushed by a hungry world's demand for seafood, has moved species of fish toward extinction, the scientists said, and permanent marine parks may be the only answer to save them.

``The seas are increasingly in serious trouble,'' said Stephen Palumbi of Harvard University. He said dying coral reefs, toxic algal blooms, massive fish kills and the collapse of fisheries are symptoms of fundamental changes in ocean life that are caused, in part, by overfishing.

In heavily exploited waters, the fish simply cannot repopulate fast enough to keep up with the harvest. Marine parks would give them a chance, the scientists said.

Today, less than 1 percent of the world's waters are protected in marine reserves. But the study showed that even these limited areas have had a dramatic effect on the recovery of sea life recovery.

The study was produced by the National Center for Ecological Analysis and Synthesis and endorsed by 150 of the world's top marine scientists.

President Clinton in May signed an executive order calling for a national system of marine protected areas, but the proposal met with criticism from lawmakers and the fishing industry. They contended there was little scientific evidence showing the value of marine sanctuaries, Lubchenco said.

The new study, she said, now provides that evidence.

The study of 89 marine reserves around the world showed that, given the chance, fish and other marine life quickly restore themselves where they are protected. The marine species then fan out, reseeding adjacent waters.

``We now have strong evidence that reserves work,'' said Robert Warner, a professor at the University of California, Santa Barbara. Within and around marine parks, he said, fish population doubles, fish size grows by 30 percent and reproduction triples.

``It all happens within two to four years and it lasts for decades,'' he said.

Palumbi said that unlike terrestrial parks, the benefits of a marine sanctuary spread far behind their boundaries.

``Most marines species start as tiny eggs or larvae that drift and may mature miles away from their parents,'' Palumbi said. Some drift up to 60 miles in each generation, starting new populations in increasingly distant waters.

In places where marine reserves have been tried, said Callum Roberts of the University of York in England, fish populations have exploded within the reserves and quickly enriched the surrounding ocean.

The result has been a revival of commercial fishing in some areas where fish were once scarce.

When snapper and lobster populations in coastal waters of New Zealand crashed, the fishing industry there went into a depression.

Roberts said that after a series of marine reserves was created in the 1970s, the snapper population in a few years was 40 times higher inside the reserves and lobsters were increasing at the rate of 5 percent to 11 percent a year. Outside the reserves, the fishing industry now thrives.

``Fishers in New Zealand now ring the reserves with their traps,'' Roberts.

In reserves around the Caribbean island of St. Lucia, fish populations tripled in three years and doubled in the surrounding waters, benefiting commercial fisheries.

When the scallop population crashed in the Georges Bank, a fishing area in the North Atlantic, a 6,500 square mile area was closed to fishing. Roberts said that in five years, the scallop population inside the reserve was 14 times greater than in unprotected waters. Fishing boats now concentrate on the borders of the reserve, he said.

``There are still some people who believe we can continue with business as usual,'' Roberts said. But he said some fisheries are now at a ``crisis'' stage and some species may not recover without marine reserves.

``We are running out of time,'' he said.

January 3, 2005 (*New York Times)*

With Geopolitics, Cheap Oil Recedes Into Past

By JAD MOUAWAD

IT was a year that people in the oil markets are unlikely to forget - a year that prices set records, forecasts lost touch with reality, and almost everything that could go wrong, did. It was also a year that politics returned to the oil market.

And the trend is likely to continue this year. While oil prices have declined since October, many of the issues that have vexed the oil industry in 2004 are expected to recur. Cheap oil increasingly looks like a thing of the past.

Through the 1990's, prices were stable, supplies were secure and there was plenty of extra capacity to keep energy costs low and world growth buzzing. At an average of $20 a barrel, oil was viewed as just another commodity.

But then came ethnic and labor troubles in Nigeria; chaos and protests in Venezuela before President Hugo Chávez won a referendum allowing him to stay in power; hardball energy politics in Russia; and the continuing insurgency in Iraq.

While supplies of oil to the world markets were rarely interrupted, the uncertainties created by these events raised crude oil prices in New York by two-thirds this year, to a high of more than $55 a barrel in October. And as energy costs surged, many analysts, traders and politicians woke up to the reality that oil was different from cocoa or coffee.

"Oil is a political commodity," said Robert Mabro, president of the Oxford Institute for Energy Studies, one of the world's foremost energy experts. "Geopolitics is the most fundamental issue if you're looking at oil markets. People seem to have forgotten that since the 1980's."

Of course, this is not the first time that oil and politics have mixed.

Decades ago, militant governments in Iran and Libya, for example, nationalized their oil sectors, forcing American and European companies out and taking charge of their natural resources. Then came the oil embargo and the price shocks of 1973-74 and 1978-81, with long lines for gasoline and steep rises in inflation.

But for the most part, politics had dropped off the energy map since then. In the 1980's, energy experts largely discounted a war between two of the Persian Gulf's top oil producers, Iran and Iraq, because Saudi Arabia and some other OPEC nations could simply crank up their production to make up for losses.

Even the invasion of Kuwait by Iraq in the summer of 1990, and the subsequent embargo on their oil exports, roiled energy markets for only a few weeks.

But in recent years, the oil industry has undergone a fundamental change. While demand has steadily increased each year, the industry's exploration efforts have not kept pace in new discoveries.

Now that worldwide production is running at full speed to meet increased demand, there is no cushion left in the system to weather a potential blow to producers like Iraq, Venezuela, Iran, Russia or Nigeria.

So, once again for oil markets, politics matters.

For instance, said Amy Myers Jaffe, the associate director of Rice University's energy program, Saudi Arabia's oil industry is no longer seen as being impenetrable to terrorist attacks; tensions in

the Persian Gulf could swell over Iran's nuclear program; Nigerian factions may erupt in violence; and the fighting in Iraq goes on.

"All kinds of things can affect this market," Ms. Jaffe said, "especially when you're in a razor-thin situation. The only thing that could dramatically alter the outlook is a major economic recession."

The heightened geopolitical risk has translated into higher prices, something analysts call a "risk premium." Crude oil prices have averaged $30 a barrel since 2000, but last year crude oil in New York climbed to an average of $41 a barrel. While energy prices are high, adjusted for inflation they are below the level in March 1981, when crude oil approached $70 a barrel in today's dollars. Still, analysts do not expect prices to fall anytime soon.

High world prices since mid-2002 have helped sustain the economic recovery of Russia, which is raising output, according to the Energy Information Agency of the Department of Energy.

The former Soviet Union, of which Russia is by far the biggest country, is the world's largest producer, the agency says, followed by Saudi Arabia and the United States. The biggest consumers are the United States, which imports over half its needs; China; Japan; and the former Soviet Union, which uses about a third as much as it produces. Leo Drollas, chief economist for the Center for Global Energy Studies in London, expects oil prices to be higher in 2005, on average, than they have been this year. The institute was founded in 1990 by Sheik Ahmed Zaki Yamani, the former Saudi oil minister.

Even oil companies, which are usually extremely conservative about their price outlook, are coming around to that realization. Lord Browne, the chief executiv e of BP, now sees a new bottom of $30 a barrel for the next few years.

"There is something fundamental holding prices up, whether that's at $45, $40 or $35 a barrel," Mr. Mabro of the Oxford Institute said. "And politics won't improve things. Except if you believe a miracle is going to happen in Iraq."

January 3, 2005 (*New York Times)*

Production Trends Point to Reliance on Imported Oil

By JAD MOUAWAD

THE world's daily oil consumption is expected to climb to 121 million barrels in 2030, from about 82 million barrels in 2004, according to the International Energy Agency.

Where will that oil come from?

Despite producing at a record level of 30 million barrels a day, OPEC now accounts for only a third of the world's oil production. But that market share is expected to increase significantly, reaching more than 50 percent in 2030, as countries like Saudi Arabia, Kuwait and Iran, which have ample reserves, increase their investments and raise production.

But for many other producing countries, from Norway to Mexico, the picture is quite different. New discoveries are too few and too small to offset declining output at mature and aging fields.

In the North Sea, for example, production is expected to fall almost by half, to three million barrels a day, in 2020.

Russia, which has been highly successful at increasing its production from its post-Soviet low of six million barrels a day, is expected to reach a plateau of about 11 million barrels by the end of the decade.

For the world's largest consumer, the United States, the picture is also telling. Domestic oil production has been declining since the early 1970's. Now, the country's output of 8.8 million barrels a day can meet only a little more than 40 percent of Americans' daily consumption.

With regions like Alaska and the Gulf of Mexico gradually drying up and with consumption still rising, the United States' reliance on imported crude oil will grow in years to come.

November 16, 2004 *(Wall Street Journal)*

Global Surge in Use of Coal Alters Energy Equation

Shift Offers a Way to Slow Rise in Demand For Oil; Worries on Global Warming

By PATRICK BARTA in Bangkok, Thailand, and REBECCA SMITH in San Francisco
Staff Reporters of THE WALL STREET JOURNAL

A world-wide surge in the mining and use of coal is helping offset some of the economic strains of rising oil demand and marks an important shift in energy consumption with long-term consequences for the global energy equation and the environment.

The trend is especially notable in the two countries that are the biggest new sources of global energy demand: China and India. These nations have enormous coal reserves but not nearly enough oil and gas.

By some measures, world-wide coal consumption has been rising faster than the use of any other source of energy, including crude oil, natural gas, hydroelectricity and nuclear power. Last year, world coal consumption rose 6.9%, compared with 2.1% for oil, according to BP PLC, the global energy company.

This year, coal production in the U.S. is expected to climb to a record of over 1.2 billion tons, an increase of more than 3.7% from 2003. About 90% of the coal mined in the U.S. is used to produce electricity, and coal produces about half the U.S.'s electricity needs. In China, coal production is expected to grow about 200 million tons, or 11.8%, this year to 1.9 billion tons.

Coal is primarily used around the world to generate electricity and for steel production. But electricity plants can also run on other fuels, including natural gas or petroleum-based fuels. Indeed, most developed countries have tried to move away from using coal, but those efforts are in many ways offset as developing countries like China continue to choose coal for their newest facilities.

Coal use has surged for several reasons. It's easily transported on barges or trains. In many cases, power plants are located close to the mines, reducing the plants' cost of operation. And, the world still has huge untapped coal reserves that can be developed at a low cost, unlike oil. Although strong demand has caused coal prices to shoot up more than 80% in the past year, to more than $50 a ton, it's still an economical power generator. It costs $3 to generate a million British thermal units, or BTUs, of power from coal, compared with more than $7 for natural gas and just over $8 for oil, according to the U.S. Energy Information Administration. In basic power generation, the heat produced by burning coal drives equipment that creates electricity.

With the high demand and heftier price, coal-mining companies are ramping up production, even as many oil giants hold back on new drilling. Peabody Energy Corp., based in St. Louis, the largest U.S. coal producer, plans to double its annual production to 400 million tons by 2010. China's largest coal miner, Shenhua Group, is planning to double its production to 200 million tons in the period. Production also is shooting up in Colombia, Australia and Indonesia.

The activity is increasing the odds that coal will play a bigger role in the world's energy mix in the next decade than many analysts expected.

"We lived in a period of plentiful energy, and now we're entering a period of tighter supplies. ... Coal will fill some of that gap," says Gerard McCloskey, a coal-industry consultant and editor of a trade newsletter in London.

To be sure, coal never went away. It has been an important part of the energy equation in the U.S. since the 1800s. The United Kingdom, which closed much of its coal industry in recent decades, derives about 18% of its energy from coal. World-wide, coal contributed 26% of energy

needs last year, compared with 37% for oil and 24% for natural gas, with the balance coming from a mix of hydroelectric and nuclear power.

Coal's importance is rising as developing countries look for the least-expensive options to fuel their booming economies. By helping countries like China and India power everything from factories to air-conditioning units, continued heavy use of coal could curtail some of their need for oil or natural gas. This could prevent oil and gas prices from soaring even higher.

If China "started to use oil to generate electric power, we'd really be in trouble" in terms of supply shortfalls, says Pietro Nivola, an energy expert at the Brookings Institution in Washington.

Largely because of inexpensive coal-based energy, aluminum giant Alcoa Inc. is expanding a 52-year-old aluminum smelter in Rockdale, Texas, that was to be closed just a couple of years ago.

"We had the intention to shut this facility down and sell the power," said Kevin Lowery, a spokesman for Alcoa, based in Pittsburgh. "But the economics tell you that you don't need to do that."

For all the upside, many experts believe that burning more coal could worsen the planet's environmental problems. Coal-related emissions are blamed for a rise in respiratory illness, mercury poisoning and other dire health consequences. Such emissions are believed to contribute to global warming.

In the U.S., big coal-burning utilities are spending billions of dollars in the next few years to clean up emissions from power plants. Southern Co., which is the dominant utility in a four-state region including Georgia, has budgeted $5 billion for scrubbers and other equipment that reduce nitrous oxides, sulfur oxides and toxic mercury, which can travel thousands of miles.

The environmental hazards are greater for China and India, which are expected to make up two-thirds of global coal demand through 2030. China has seven of the world's 10 most-polluted cities, largely owing to fumes from coal.

Some of the countries' biggest producers are making sizable investments to upgrade facilities and experiment with clean-coal technologies. Beijing's Shenhua Group has completed a $6 billion overhaul of its coal-mining operations that use mine-monitoring equipment from Rockwell Automation Inc. of Milwaukee to boost efficiency.

But China's coal sector is highly fragmented, and many of its smaller producers are unable, or unwilling, to make such investments. "The leading edge of the industry in China is absolutely world-class," says an executive at a Western coal company operating in China. "The trailing end is Dickensian."

Chinese officials, aware of the environmental concerns, have outlined numerous policies to reduce the impact of coal-burning plants. These include requiring all new plants to install desulphurization equipment and providing incentives to scrub emissions.

Even so, sulphur-dioxide emissions climbed last year after signs of improvement in recent years. Some of the pollution appears to be wafting off to other countries, and may be creating problems as far away as the U.S. In addition to such air pollutants, coal-fired power plants also emit carbon dioxide, the chief suspected global-warming gas.

The U.S. has rejected the Kyoto Protocol, the international treaty that will curb global-warming emissions, and the pact doesn't cover developing nations like China and India. Coming international negotiations, however, are likely to focus on producing a successor agreement to Kyoto that would include the U.S., China and India, in the belief that any accord that doesn't include these major emitters won't do much to curb global warming.

Pollution "is a global problem and it should be addressed by global solutions," says Fatih Birol, the chief economist of the International Energy Agency in Paris.

Part of the problem is that demand in China appears to be growing faster than regulators' ability to police emissions. A few years ago, when demand wasn't so strong, the Chinese government moved to shut thousands of substandard coal operations. Chinese coal production tumbled by more than 25% to about 500 million tons of oil equivalent in 2000, according to BP data.

Then China's economy took flight. By 2003, Chinese coal production had soared to 842 million tons of oil equivalent. If recent trends hold, production could rise to nearly one billion tons of oil equivalent this year.

Chinese officials have announced ambitious plans to diversify the country's energy supply, quadrupling its nuclear-power generation capacity by 2020 and adding numerous terminals to process imported liquefied natural gas. Chinese officials say these and other investments should reduce coal's share of the country's power needs to about 54% from 67% currently, while natural gas will increase to 10% from 3% now.

But many independent economists doubt that coal's share in China will decline significantly, given that coal is inexpensive and plentiful. Most of China's new power plants are coal-fired, and will be around for decades. Adding more nuclear, gas and hydroelectric facilities will involve massive investments that could make the power they generate more expensive, limiting its attractiveness. In the U.S. and Europe, however, the cost of cleaning up coal plants and the anticipated cost of carbon capture, as well as a run-up in natural-gas costs, are making nuclear power more competitive.

China's coal dependence may decrease in percentage terms over the next several decades, "but not as much as some people would think," says Anthony Cordesman, an energy expert at the Center for Strategic and International Studies, a Washington think tank.

---- Paul Glader in Pittsburgh and Jeffrey Ball in Dallas contributed to this article.

December 14, 2003 *(New York Times)*

Bush's Energy Policy Lives Where the Deer and the Antelope Play

By FELICITY BARRINGER

PINEDALE, Wyo. — A herd of 100 pronghorn antelopes were trotting over a ridge here, then meandered to a halt and foraged meditatively a few hundred yards from a natural gas wellhead and its squat companion tanks, filled with the petroleum byproducts of the drilling.

The pronghorns were stragglers in the winter migration of antelopes across the Upper Green River Valley, a landscape that has been tied to this ancient pattern for millenniums and is now being remade by the nation's thirst for clean-burning, environmentally friendly natural gas. Energy companies eager to slake that thirst while prices are high are accelerating the makeover of the longest wildlife migration route in the continental United States.

Whether this harms the wildlife in the Greater Yellowstone ecosystem or affects the air or water in the Wind River Mountains is unclear. But it is clear that here in the Upper Green, as the area is called, the Bush administration's energy policies have come to life. The antelopes' migration route and the winter range of thousands of mule deer lie atop an estimated 7 trillion to 10 trillion cubic feet of natural gas — more than 4 percent of the nation's reserves, according to Don J. Likwartz, Wyoming's oil and gas supervisor.

As twilight settles in above the gas fields and darkening bands of red climb up the granite flanks of the nearby Wind River Mountains, some 20 drilling rigs light up.

In the past three years, more than 575 wells have been drilled to tap two rich deposits, and at least 1,500 more are likely to follow, said Priscilla Mecham, the senior Interior Department official in the area. Mr. Likwartz says he thinks that figure is low; he said EnCana Oil and Gas (USA), the Canadian company that is the largest leaseholder in the area, and other companies like Ultra Petroleum and Shell Exploration and Production, are seeking to allow drilling at as many as 3,100 more wells, filling in an area already laced with 747 miles of new gas-related dirt roads.

Since most of the land involved is owned by the federal government, the preliminary decisions mediating this natural gas rush fall to Ms. Mecham, who directs the local office of the Bureau of Land Management.

The push to drill started before the Bush administration came into office, but in recent months oil and gas issues have become almost the only items on her agenda, Ms. Mecham said. Some 22 months ago, the Interior Department designated the Pinedale office as one of 21 around the country whose planning work was "high priority."

And while the economic incentives in the stalled energy legislation backed by the Bush administration would have increased the profits of the companies at work here, they would have had less impact on Pinedale drilling than the decisions that emerge from the low-slung Bureau of Land Management building at the south end of town.

The Interior Department will determine how much gas can be extracted, sold and sent to homes and businesses on the West Coast, and how quickly. "It's a fantastic challenge," Ms. Mecham said. "We have world-class oil and gas resources, world-class wildlife resources and world-class scenic resources."

Such decisions preoccupy Ms. Mecham, an archaeologist who has worked for the land agency for a quarter-century. Above all, there is the new land-use plan, which she hopes to send to her supervisors in Cheyenne at the end of the month.

The plan could force staged development of the gas fields, or allow the maximum number of wells in the minimum feasible time. It is likely to indicate how many wells must be clustered on a single

pad. The more wells drilled from one location, minimizing surface impact, the greater the need to drill horizontally.

Jeff Johnson, EnCana's production team leader in the area, said that this "directional drilling" technique, favored by environmentalists, added $200,000 to the average $1.8 million cost of drilling a vertical well.

While Ms. Mecham's staff has been working on that master plan, it has also been making daily decisions on drilling activity in the two gas-rich areas southwest of town. One, 46 square miles of the high desert called Jonah after a nearby gulch, has become a booming industrial-energy park.

Just to the north lies a rich but less developed area called the Pinedale Anticline, a name that refers to the geological equivalent of an underground hill, where the gas is stored. It covers nearly 310 square miles, including a long mesa that is a crucial section of the migration corridor for pronghorns and mule deer. There are more than 60 new wells on the Anticline. A tenfold increase is contemplated.

The transformation of Sublette County (a region so rural that it does not have a single stop sign) came as economics, chemistry and politics collided here. From January 2002 to July 2003, the price of natural gas doubled. What had become economical in the late 1990's became highly profitable.

For example, Ultra Petroleum reported profit margins of more than 20 percent from Pinedale-area gas in 2002, when it sold gas for an average price of $2.18. In the first nine months of this year, Ultra produced 70 percent more gas and sold it for $3.99, tripling its revenues, compared with the first nine months of 2002.

Since 1998, the number of applications for drilling permits has increased fourfold, to 300, Ms. Mecham said.

The pressure to award new mineral leases beyond the Jonah field and the Pinedale Anticline has been so intense that a tract of land in a narrow section of the wildlife migration corridor, for which the Wyoming Game and Fish Department had sought protection, was auctioned to an energy company in August 2002. Ms. Mecham and one of her superiors in Cheyenne called the offer, which was quickly rescinded, "an administrative error."

Many mineral leases in the Pinedale area come with stipulations that put seasonal bans on drilling in the deer and antelope winter ranges, or halt drilling if strutting sage grouse appear at a mating site. Industry requests for exceptions — most lasting less than two weeks — are almost always granted now.

The conflicts between energy interests and those of wildlife advocates like Linda F. Baker of the Upper Green River Valley Coalition are sharp. But the two sides try to acknowledge each other's concerns.

Dru Bower, a spokeswoman for the Petroleum Association of Wyoming, said that she had persuaded her members to forgo drilling on a wide swath of Trapper's Point, one of the narrowest sections of the wildlife migration route. And Mr. Johnson said EnCana has offered $10 million to set aside unspoiled acreage.

Ms. Baker, who said she understood the need to harvest some natural gas, welcomed these proposals as "first steps" — but said far more needed to be done to ensure that the wildlife and the air are unharmed.

She and other wildlife advocates balk at the notion that an entire field must be drilled quickly, when staged development, tract by tract, is possible. But industry officials say that would be less efficient and less safe.

"It's so easy to put a monetary value on natural gas, because it has a price," Ms. Baker said. "It's much harder to do that with mule deer or pronghorn."

October 17, 2004 *(New York Times & International Herald Tribune)*

Nuclear Energy Is Making a Global Comeback

By KATRIN BENNHOLD,

PARIS, Oct. 17 — With uncertainties increasing about supplies of natural gas and oil, nuclear energy is making a powerful global comeback, prompting concerns about atomic terrorism in the post-Sept. 11 era.

A number of countries around the world, from China to Finland and the United States, are gearing up to build new reactors as demand for electricity grows. Governments are also viewing nuclear power as a way to curb emissions of greenhouse gases, given intensifying concern over global warming.

But the prospect of an atomic renaissance is raising the uncomfortable question of whether an expansion of nuclear power is compatible with the fight against terrorism and the proliferation of weapons of mass destruction.

`'Neither politics nor technology has an answer to this question right now," Gerard Stoudman, director of the Geneva Center for Security Policy, said in an interview at a recent international conference on homeland security.

"It's really bad timing," said Alain Marsaud, president of the domestic security group in the French Parliament.

"We're coming to the end of the economic use of fossil fuels at a time when terrorists are trying to get their hands on nuclear material or target nuclear infrastructure," Mr. Marsaud said in an interview at the conference, which was held in Geneva. "If the world is condemned to use more nuclear power it will be a real challenge."

With 439 reactors operating in 31 countries around the world, nuclear power accounts for about 16 percent of global power production today, according to the International Atomic Energy Agency. And with demand for electricity expected to increase almost fivefold over the next five decades, the agency says reactor capacity could quadruple by 2050.

The Far East is projected to lead the worldwide growth over the next two decades, more than doubling its output.

Experts at the United Nations energy agency cite three risks in the expansion of nuclear power: theft by terrorists of weapons-grade plutonium stripped out from radioactive waste during reprocessing; an attack on a nuclear installation or transport convoy; and, as suspected with Iran and North Korea, an attempt by countries developing a nuclear power sector to build weapons with the same technology.

"If you have more nuclear material in the world, you have a higher proliferation risk — it's a truism," said Alan McDonald, a nuclear expert at the agency. But with demand for electricity increasing across the globe, he added, nuclear energy remains important despite the risks.

Signaling the nuclear revival, 31 reactors are under construction worldwide. China plans to add 32 nuclear power plants to its existing 11 by 2020, while India with currently 14 plants aims to triple its reactor capacity over the next eight years.

Japan, South Korea, Ukraine, Romania and Argentina are all in the process of adding to nuclear capacity as well.

Finland recently commissioned the first new plant in Western Europe since 1999. France — the biggest per-capita user of nuclear energy in the world — is planning to build one shortly (the site has yet to be chosen), and British officials are softening their language on nuclear energy.

Loyola de Palacio, the European Union's departing energy commissioner, said last month that the E.U. would have to retain the option of building up its nuclear capacity. "With the challenge of climate change, the E.U. cannot avoid nuclear energy for the foreseeable future," she said.

Even in the United States, where no new reactor has been built since the partial meltdown in 1979 at Three Mile Island, in Pennsylvania, the nuclear industry is stirring — not least because of encouraging noises from the Bush administration.

Twenty-six plants in the United States have received 20-year extensions of their operating licenses and 18 others have applied for extensions at the Nuclear Regulatory Commission, after the administration streamlined the relicensing process.

Three plant operators, Exelon, Dominion and Energy, have asked the commission to approve sites for future reactors, although no concrete plans for building them have been announced yet. And Westinghouse, architect of nearly half of the world's nuclear power plants, had its design for a plant known as the "advanced reactor" approved by the commission on Sept. 13.

The industry, said Steve Kerekes, a spokesman for the Nuclear Energy Institute, America's nuclear industry group, is at the starting gate.

"We are positioning ourselves for the fact that over the next decade our country will need a lot more electricity," Mr. Kerekes said. The goal for the industry, he said, is to raise its share of American electricity generation from the current 20 percent to 24 percent over the next 15 years. If natural gas prices keep rising, it will become economical to pay the hefty price — about $3 billion each — of building new nuclear plants, he said.

The risk of terrorists targeting nuclear infrastructure was made plain on Sept. 11, 2001. Since then, Western policy makers, from President Bush to the European Union's security chief, Javier Solana, have explicitly made the fight against nuclear terrorism a priority. Mr. Bush has said that Americans' "highest priority is to keep terrorists from acquiring weapons of mass destruction." His Democratic challenger in next month's presidential election, Senator John Kerry, put it this way in a speech in June: "No material. No bomb. No terrorism."

At nuclear plants in many countries, 9/11 has led to stricter security requirements. In the United States since the terror attacks, plant owners will have spent an extra $1 billion by the end of this year on more restrictive access controls, heavily armed guards, additional training for their security personnel and vehicle checks in an enlarged parameter around the reactors to avoid truck bombs.

According to Wolfgang Kröger, a nuclear engineer and vice president of the International Risk and Governance Council, an independent foundation with headquarters in Geneva, the danger of terrorists targeting nuclear infrastructure or transport vehicles has been played up by opponents.

"There are a lot of much simpler ways to do damage and kill people," he argues.

But with most of the projected growth in nuclear power taking place in the developing world, where safety measures may not match the same standards, concerns are growing.

Perhaps the greatest worry circulating in national defense departments and the North Atlantic Treaty Organization in Brussels is the development of nuclear weapons on the back of civilian energy programs.

This dilemma goes to the heart of the Nuclear Nonproliferation Treaty, of which the International Atomic Energy Agency is the guardian. In addition to nuclear disarmament, the treaty commits its 184 signatories to police and control the proliferation of nuclear material and at the same time obliges nuclear powers to offer nuclear technology to others for electricity generation.

But as one senior diplomat at NATO put it: "You cannot artificially separate the civilian from the military aspect — everyone here is aware of that. As such, you also cannot separate the debate on nuclear proliferation from the debate on alternative sources of energy."

Every state that has sought to develop a nuclear weapons program since the Nuclear Nonproliferation Treaty came into effect in 1970 has done so on the back of civilian power or nuclear research programs — from Israel to India and Pakistan and, according to its government, North Korea.

The motivation for building nuclear weapons has increased with the spread of nuclear power, as countries view neighbors' stockpiles of civilian material with suspicion. To justify its weapons program, North Korea cites the five tons of radioactive material now stockpiled in Japan.

The International Atomic Energy Agency wants to curb proliferation by securing the nuclear fuel cycle with a process called fuel leasing, Mr. McDonald said. Rather than exporting enrichment or reprocessing technology to newcomers, the agency maintains, nuclear powers should export lightly enriched uranium, which cannot be used to make a bomb, and subsequently take back the radioactive waste, which contains plutonium.

But opponents say the proposal is flawed for two reasons: It would lead to the regular transport of radioactive material across the globe, potentially tempting terrorists. And it risks meeting public opposition in Europe, where the issue of radioactive waste has been one of the main reasons for public skepticism toward nuclear energy.

"These solutions don't stand up in the real world," said Mike Townsley, director of communications for Greenpeace International. "You'd get shipments crisscrossing the planet every week, and I think you'll find that people in the U.K. or Russia would not tolerate an influx of radioactive waste."

Instead, Mr. Townsley argues, a combination of energy efficiency measures and more research and development in renewable energy sources, such as wind and solar power, should be used to phase out nuclear technology once and for all.

Hermann Scheer, chairman of the world council on renewable energy and a German member of Parliament, agrees. Noting that Germany plans to close its last nuclear plant by 2021 and is gradually increasing energy production from renewable sources, Mr. Scheer argues that nuclear energy is not a necessary evil.

"We can do without it but you need the political will," he said.

According to Mr. Scheer, the death of nuclear technology may come from an unexpected direction: uranium reserves risk running out as early as 2050, he says, and sooner if reactor capacity is expanded as dramatically as forecast.

"But that leaves five decades of terrorism and nuclear energy going hand in hand," he said. "We shouldn't take that risk."

May 29, 2004 *(New York Times)*

A Different Era for the Alternative Energy Business

By BARNABY J. FEDER

Sales of solar power equipment are hot. Wind energy projects are sprouting up across the landscape. Methane that builds up in the garbage in landfills is being sold in growing quantities to generate power.

Alternative energy - solar, wind, geothermal and a grab bag of other sources - is doing better than ever. But the main reason is not the increase in oil and natural gas prices.

When the cost of fossil fuels rose and fell in past years, the fate of many alternative energy projects rose and fell with them. But that is no longer true. Indeed, even if prices eventually recede from their current level of about $40 a barrel to something in the $30 to $35 range, as many expect, analysts predict that most renewable energy projects will not suffer as badly as they once did.

"We're in a very different era from the late 1970's," said Dan Reicher, who served as the top energy official responsible for alternative and renewable energy sources under President Bill Clinton. "The technologies have improved dramatically and come way down in price."

While alternative energy sources may be growing rapidly, they are starting from such a small base that their overall role in the energy supply remains small, because alternatives still remain more expensive than energy produced from fossil fuel.

The Government's Energy Information Agency said recently that production from renewable energy sources in the United States was 15.5 percent higher in the first two months of this year than the same period in 2003. But the agency estimates that renewables accounted for just 6.4 percent of domestic energy consumption last year and that their contribution will climb to 6.7 percent this year.

This modest increase is reason for optimism, proponents say. Even before oil prices took off, they note, the outlook for solar energy was brightening, with worldwide annual revenue from equipment and installation expected to climb from $4.7 billion last year to $30.8 billion in 2013, according to Clean Edge, a market research firm in San Francisco. Similarly, after a record expansion last year, permits for new wind energy projects in the United States are piling up as investors wait anxiously for Washington to renew tax credits that make them more profitable.

Geothermal energy is also getting more interest. In Idaho, Carl F. Austin, a veteran of 40 years in geothermal energy, is feeling good about his chances for raising money for what he hopes will be that state's first geothermal power project.

"Conditions are the best I've ever seen," Mr. Austin said, "and every prediction is that it's going to get better."

Experts debate just how competitive alternative energy sources are versus fossil fuels, though there is no dispute that over all the price gap has narrowed as oil and natural gas prices have soared and new technologies have made alternative sources more efficient.

The cost of wind power varies widely with the quality of the windmill site, but prime locations in the United States generate electricity at well under 5 cents a kilowatt-hour, making them cheaper than natural-gas-fired plants at current gas prices. But to compete with coal, wind power generally needs subsidies like the tax credit of 1.8 cents a kilowatt-hour that lapsed at the end of last year.

Electricity-generating solar panels, which were invented 50 years ago and cost $100 a watt in 1976 now sell for less than $3 a watt, and are expected to continue declining 5 percent annually in cost even if there are no technology breakthroughs.

For now, solar energy technology is approximately 10 times as expensive as traditional fossil fuel systems for generating large amounts of electricity, according to a recent estimate by the Sandia National Laboratories. But solar is already a cheaper alternative for powering sites that are long distances from the power grid.

The public reaction to recent price spikes in oil prices could help alternative energy by putting pressure on politicians to maintain or even increase the vast range of tax credits, grants, loan guarantees and other subsidies that stimulate investment in alternatives.

Still, while the rise in prices certainly brightens the profit potential for many alternative energy investments, the increase is too recent - and too many investors are convinced it will not last - to account for why the sector is thriving.

Far more important these days is that the new technologies are now seen as essential to meeting crucial environmental goals.

Traditional fossil fuels like coal, oil and natural gas are major contributors to air pollution and the buildup of climate-changing gases in the atmosphere. Their environmental cost is not fully included in current prices but regulations intended to limit the damage have restricted their growth prospects.

Thus, although coal prices remain relatively low, Mr. Austin figures his geothermal project is unlikely to face competition from new coal plants unless somebody comes up with an unexpected technology breakthrough that minimizes coal's environmental impact without driving up its cost.

Some technologies, like fuel cells, normally use conventional energy sources but are viewed as alternatives because they deliver small quantities of clean electricity and heat at distributed sites instead of in central power plants. But many of the alternatives use renewable resources like the sun and wind.

Another factor favoring alternative fuels over time is that the most accessible deposits of fossil fuel are being rapidly depleted. Increased costs to recover remaining supplies are inevitable, energy experts say. That leaves innovations in how the fuels are converted to energy as the only barrier to rising prices over the long term.

At the same time, alternative energy sources are being viewed more and more as a worthwhile insurance policy against the risk of depending on the Middle East and other unstable regions for the bulk of the world's oil and gas supply.

"Businesses are fundamentally shifting the way they look at energy," said R. Neal Elliot, an industrial energy efficiency expert at the American Council for an Energy-Efficient Economy, a nonprofit policy analysis group based in Washington.

In the 1970's and 1980's, risk management meant investing in boilers that could burn different fuels and buying futures contracts that guaranteed access to crucial fossil fuels at an acceptable price, Mr. Elliot said. Now it means stepping up investment in products and processes that cut energy use and adding alternative sources of energy.

Hence the appeal of projects like the pipeline and gas processing operation near Spartanburg, S.C., that provides BMW's automobile factory there with power and heat extracted from waste methane. The methane is drawn from a landfill nearly 10 miles away that is owned by Waste Management, based in Houston.

The project began operation last year. It was built and is operated by Ameresco, an energy management company from Framingham, Mass., that is charging BMW a fixed price over the next 20 years for the electricity and heat.

The BMW factory gets more than a quarter of its electricity and 10 percent of its useful heat from the methane.

Waste Management, meanwhile, has decided the methane from decomposing garbage in its many landfills is a major business opportunity. It is looking to build and operate electricity generating plants or methane supply operations at as many of its landfills as possible, according to Paul A. Pabor, who became the company's first vice president for renewable energy in January.

Thirty-one projects have been completed and eight new ones are in development, Mr. Pabor said.

Today's oil and natural gas prices are largely irrelevant to Waste Management's profit calculations.

Indeed, the major projects and investments unfolding today are primarily the legacy of past alarms, including the California electricity shortages of 2001, the start of the war in Iraq in early 2003 and last summer's blackout in the northeastern United States and Canada.

"Any successes for alternative energy because of today's prices won't be under the Christmas tree this year," said Tim Woodward, managing director at Nth Power, a venture capital company in San Francisco that invests in a wide range of energy technology start-ups. "They could show up in 2005."

October 14, 2004

Not Just Tilting Anymore

Higher Fuel Costs, Tax Credits, Better Technology Whip Up Hopes for Wind Power Again

By REBECCA SMITH
Staff Reporter of THE WALL STREET JOURNAL

Arden and Muriel Bergan watched intently as workmen installed wind turbines on their Iowa farm two years ago, as a whipping wind made it difficult to align the 87-foot blades with bolt holes at the top of a 327-foot tower. "It was a regular circus act," Mr. Bergan says.

Getting circumstances to line up for the wind industry has been equally daunting over the years. With bigger, better turbines that produce electricity at competitive prices, the industry should be enjoying an unprecedented boom. Yet each time it gains momentum, something comes along to thwart progress, with the most recent hiccup being the expiration of a federal tax credit at the end of 2003 that stalled $2 billion of projects.

A bill re-establishing the tax credit passed both houses of Congress in late September, however, and President Bush signed the measure earlier this month, providing a 1.8-cent credit for each kilowatt hour of electricity produced by qualifying turbines built by the end of 2005 for a 10-year period. Many industry watchers believe the tax credit could stimulate the growth that's been predicted, for years, but never fulfilled.

Better technology and government stimulus, along with high prices for competing types of power generation, are driving renewed optimism about wind power. With prices for the fossil fuels used in conventional power plants hovering near record levels, wind power is the cheapest source of energy that can be built now. Newly built wind farms are "beating the socks off of any other new source of generation," says Ryan Wiser, an energy economist at the Department of Energy's Lawrence Berkeley National Laboratory in California.

A modern wind turbine can produce electricity for about 2.5 cents to four cents a kilowatt hour, including government subsidies, so the biggest turbines compete effectively against modern natural-gas-fired power plants, though they won't run as many hours of the day due to the variability of wind. Assuming natural gas at $6 per million British thermal units, a kilowatt hour of electricity from a newly built gas-fired plant costs at least 5.5 cents a kilowatt hour, including both fuel and capital costs. Natural-gas plants have led the sector in recent years because they can be constructed quickly, are clean burning and operate reliably.

Costs have come down for wind power while they have been pushed up for gas-fired plants by higher natural-gas prices. High oil prices have had less effect on the power industry than in the past because many generators shifted to other fuels as a result of the oil shocks of the 1970s.

Demand for wind power also is being driven by state laws that require utilities to obtain set percentages of their electricity from renewable sources by certain target dates. The amounts and deadlines vary, but 17 states now have such laws in place, with New York being the latest addition. Some states, like Wisconsin, already have met their initial targets and are considering raising the goals.

If the states achieve their targets, as much as 22,000 megawatts of renewable energy could be created in the next decade, doubling today's installed base from such things as solar, wind, biomass and small hydroelectric projects. Wind-power capacity has tripled since 1998 to about 6,400 megawatts and the cost of its electric output has fallen about 90% since the early 1980s. Lawrence Berkeley's Mr. Wiser says that if the nation eventually garners 15% to 20% of its power from renewable sources, up from about 2% today, "it might produce a 10% reduction in the price of natural gas" as demand for gas moderates, saving consumers billions of dollars a year.

The price-hedging potential of renewable power is a plus that is cited by promoters of a contentious wind project on Massachussetts' Nantucket Sound. The Cape Wind Project, the first offshore U.S. project, would be capable of generating more than 400 megawatts of electricity from 130 turbines, or enough to meet most of Cape Cod's electricity needs. It would take pressure off natural-gas usage, which has become a worry in New England since the region now relies on the fuel for 40% of its power generation, up from less than 2% in 1980.

But in Massachusetts, as in some other places, resistance to wind turbines has surfaced. One reason is that the turbines have gotten so big -- some as tall as 30-story buildings -- that they dominate the horizon, creating conflict with those who dislike the visual impact.

Another potential hitch is that the best places for turbines are where the sustained winds are greatest, and that is often far from cities in sparsely populated parts of the Great Plains or in coastal areas that frequently are poorly served by high-voltage transmission lines. So getting the electricity to users poses a challenge, as well.

Picture caption: Giant wind turbines are boosting the output from wind farms and driving down wind-energy costs. California and Texas lead the nation with the most wind-power output followed by Iowa and Minnesota and states on the Great Plains.

Nevertheless, several utilities are pressing ahead. Early wind turbines were inefficient and susceptible to breakdowns. Today's machines have advanced fiberglass composite blades that harness more energy, plus sophisticated computer controls that let them operate at variable speeds, increasing power production. "We've also gotten better at measuring the wind and figuring out where to put the turbines," adds James Johnson, a senior engineer at the National Wind Technology Center in Golden, Colo.

Another plus: Because the machines stand higher off the ground, blades can be longer and spin in a bigger arc. That means the tips appear to move more slowly and are easier to see, allowing birds to take evasive action. The problem of killing birds plagued the industry in its early days.

Utilities are ramping up their wind-power efforts. In Oregon, Scottish Power PLC's PacifiCorp utility recently was swamped with bids for 6,000 megawatts of renewable-energy capacity, most of it for wind and geothermal projects. PPM Energy, an affiliate of PacifiCorp. and the second-biggest wind-power developer in the U.S., now has contracts with 18 utilities to supply them with wind power.

In Washington, Puget Energy Inc.'s Puget Sound Energy in September said it intends to buy the entire output of a new wind farm that Zilkha Renewable Energy of Houston hopes to build on rangeland near Ellensburg in eastern Washington. The Wild Horse project is expected to include more than 100 turbines producing 165 megawatts of power, enough to power 40,000 homes. If built, it would be Kittitas County's biggest taxpayer, contributing more revenue than the next 10 biggest taxpayers combined.

Wayne Brunetti, chief executive of Xcel Energy Inc. in Minneapolis, says the company is a strong believer in wind power, with more than 800 megawatts under contract now and plans to boost that amount to 2,500 megawatts within the next 10 years. He wants to use wind power to take pressure off fossil-fuel plants, cutting the multistate utility company's emissions of pollutants.

In many rural areas, wind power is regarded as an unabashed windfall. The four turbines on the Bergan farm in Iowa, for example, produce a total of $9,600 a year in profit for the couple. That's a lot of money in a community where the median household income in 2000 was $35,000 and where the median-price home sold for $45,000.

Mr. Bergan's neighbor, Eliot Evans, has five turbines on his farm and says it "pencils out a lot better to have turbines than soybeans or corn," especially with row-crop prices "pretty low lately."

Passersby sometimes pull off the nearby interstate highway and admire the community's cluster of 89 turbines "spinning like crazy, minting money for us," he says.

In southeastern Colorado, ranchers are coming to rely on income from turbines to make up for the fact that they have been forced to cull their cattle herds because of a four-year drought. The Emick family -- parents Robert and Helen and their eight grown children -- signed a deal with Scottish Power's PPM unit about a year ago and now have 98 turbines scattered across 12,000 acres of rangeland near the county seat of Lamar. Greg Emick, the oldest son, says that "income from turbines will be as much as from cattle this year." He says the clan lost 65 acres to the turbine pads "or about as much land as it takes to support a cow and a calf out here," but it expects to receive royalty payments of $200,000 to $500,000 a year from the turbines.

Prowers County Assessor Andy Wyatt says wind turbines have boosted property-tax receipts by 35%. Adds Cheryl Sanchez, president of the Lamar Chamber of Commerce, "Ladies out here were always upset because the wind messed up their hair, but now we're getting something good from the wind."

February 6, 2004 *(New York Times)*

Report Questions Bush Plan for Hydrogen-Fueled Cars

By MATTHEW L. WALD

WASHINGTON, Feb. 5 — President Bush's plan for cars running on clean, efficient hydrogen fuel cells is decades away from commercial reality, according to a report by the National Academy of Sciences.

Promoting the technology in his State of the Union address a year ago, Mr. Bush said a hydrogen car might be available as the first vehicle for a child born in 2003. On Monday, the Energy Department included $318 million for both fuel cells and hydrogen production in its 2005 budget. "Hydrogen is the next frontier; a hydrogen economy is where the world is headed," said Spencer Abraham, the secretary of energy.

The Bush administration anticipates mass production of hydrogen cars by 2020. But the academy study, released Wednesday, said some of the Energy Department's goals were "unrealistically aggressive."

Fuel cells produce electricity by putting hydrogen through a chemical process, rather than burning, and their exhaust consists solely of water and heat. Some scientists think they have great promise, not only because they are clean, but also because the hydrogen can be produced from solar or wind power, thus reducing oil imports and the emission of gases that cause global warming.

But the least-expensive methods of hydrogen production use fuels like coal or natural gas, and those create pollution, experts say. Hydrogen is also difficult to ship and store. In addition, power from fuel cells is far more costly than the same amount of power from a gasoline engine.

"Real revolutions have to occur before this is going to become a large-scale reality," said one of the report's authors, Dr. Antonia V. Herzog, a staff scientist at the Natural Resources Defense Council. "It very possibly could happen, but it's not a sure thing."

The report said battery-powered cars or hybrid cars, which use gasoline and electric motors, could turn out to be better choices. And over the next 25 years, the effects of hydrogen cars on oil imports and global-warming gas emissions "are likely to be minor," the report said.

A second pessimistic assessment came from Joseph J. Romm, the chief Energy Department official in charge of conservation and alternative energy in the Clinton administration. His book "The Hype About Hydrogen" will be published this spring.

"Fuel-cell cars will not be environmentally desirable for decades, because there are better uses for the fuels you can make the hydrogen out of," Mr. Romm said in a telephone interview.

Most hydrogen produced today is made from natural gas, he said, and using that gas to make electricity, and thus replace coal-based electric plants, would do more for the environment than using the gas to make hydrogen to replace gasoline. He said society would get more energy from a cubic foot of natural gas burned in a modern gas-powered electric plant than if it was converted to hydrogen.

Mr. Romm also said there is currently no way to deliver the hydrogen to vehicles. "People who want to build `hydrogen highways' and drive a hydrogen car in 10 or 15 years on a mass scale, are just kidding themselves," he said.

The Bush administration has shifted emphasis from a Clinton-era program to develop hybrid cars into a far more ambitious, long-term project to commercialize fuel cells.

Mr. Abraham, the energy secretary, said he had recently been host of a meeting of energy ministers from around the world, and they agreed that fuel cells offered promise for reducing pollution and dependence on imported energy. "I see it as not only a wise investment for America," Mr. Abraham said, "but really where the world is heading."

February 1, 2005 *(New York Times)*

Deciding How Much Global Warming Is Too Much

By ANDREW C. REVKIN

Under the first treaty addressing global warming, 193 countries, including the United States, pledged to avoid "dangerous" human interference with the climate.

There was one small problem with that treaty, enacted 11 years ago. No one defined dangerous. With no clear goal, smokestack and tailpipe emissions of gases linked to rising temperatures relentlessly climbed.

On Feb. 16, a stricter addendum to that treaty, the Kyoto Protocol, enters into force, requiring participating industrialized countries to cut such emissions.

But its targets and timetable were negotiated with no agreement on what amount of cuts would lead the world toward climatic stability. The arbitrary terms were cited by President Bush when he rejected the Kyoto pact in 2001, leaving the world's biggest source of such gases on the sidelines.

After a decade of cautious circling, some scientists and policy makers are now trying to agree on how much warming is too much.

One possible step toward clarity comes today, as 200 experts from around the world meet at the invitation of Prime Minister Tony Blair in Exeter for three days of talks on defining "dangerous climate change" and how to avoid it.

The researcher running the meeting, Dennis A. Tirpak, formerly of the Environmental Protection Agency, said that experts always realized it would take a long time for science's projections to be absorbed by society, but few thought it would take this long.

"I've always been a believer that science and truth will win out in the end," he said. "But I have a sense we might be running out of time."

It has taken this long not just because the "dangerous" question is complicated, but because it holds dangers in and of itself. If scientists offer answers, as some have in recent days, they can be criticized for playing down uncertainties and intruding into the policy arena. If a pol itician answers, that creates a yardstick for measuring later progress or failure.

It is much easier for everyone simply to call for more research.

But some experts now say that by the time clear evidence is at hand, calamity later in the century will be unavoidable. They say fresh findings show that potentially enormous environmental changes lie ahead.

"I think that the scientific evidence now warrants a new sense of urgency," said Dr. James E. Hansen, a climate scientist and director of NASA's Goddard Institute for Space Studies.

A particular concern is the Arctic. An eight-nation, four-year study concluded in November that accumulating carbon dioxide and other emissions from human activities were contributing to the thawing of tundra and the retreat of sea ice. Recent studies of accelerating flows of ice to the sea in some parts of Antarctica also point to the prospect of a quickening rise in sea levels in a warming world. Other scientists point to the prospect of intensified droughts and floods.

With pressure building for resolution and fresh action, some countries and groups of experts have tried to define a specific rise in earth's average temperature that presents unacceptable risks.

The European Union has set this threshold at 2.5 degrees of additional warming from current conditions. That was also the danger level chosen last week by an international task force of scientists, policy experts, business leaders and elected officials led by Senator Olympia J. Snowe, Republican of Maine, and Stephen Byers, a Labor Party member of the British Parliament.

Some scientists have criticized this approach, saying understanding of the impact of greenhouse gases on the atmosphere remains far too primitive to manage emissions and thus avoid a particular temperature target.

Others say the most logical response to the problem is to make societies more resilient to inherent extremes of climate. "If we just significantly minimize our vulnerabilities to the extremes which occurred during the last 250 years, we'll be O.K. for the next 100," said Dr. John Christy, a climate scientist at the University of Alabama who has long opposed cuts in emissions. As for rising seas, he said, "You've got 100 years to move inland."

Dr. Michael Schlesinger, who directs climate research at the University of Illinois, will contend at the meeting that the persistent uncertainty itself about big climate perils is precisely the reason to invest now in modest mandatory curbs on greenhouse-gas emissions.

Only with such a prod will societies move toward less-polluting choices, even as research continues on energy options that could in a few decades sharply reduce the human contribution to the greenhouse effect.

Without global participation in such emission curbs, though, the shared atmosphere will essentially remain a dump with no gate or tipping fee for countries rejecting action.

Any consensus on climate risks will likely intensify pressure on the Bush administration to shift from its current opposition to any cuts in the gases.

In a speech Wednesday at the World Economic Forum, Mr. Blair pressed the United States to join Britain and other industrialized countries that have agreed to curbs on the gases.

While the risks remained uncertain, Mr. Blair said, "It would be wrong to say that the evidence of danger is not clearly and persuasively advocated by a very large number of entirely independent and compelling voices."

The Exeter meeting will probably set the tone for the next review of climate trends and causes. In 2007, the Intergovernmental Panel on Climate Change, a United Nations body, will issue a report that is expected to be the most comprehensive summation so far of human understanding of global warming.

In three reports to date, that panel has fastidiously avoided defining unacceptable danger, though it has confirmed that humans have contributed to recent warming.

Its current chairman, Dr. Rajendra K. Pachauri, an economist and engineer from India, is to address the conference today.

In an interview, he said it was clear that emissions contributing to warming had to be reduced, but defining what is dangerous remained a "value judgment" that was fundamentally the responsibility of society and its elected officials.

He and several other experts said that everyone in the climate debate, scientists and policy makers, had to get used to the idea that whatever decisions were made, they would be made without scientific clarity.

Efforts to imply a false sense of certainty will backfire, and efforts to use uncertainty as an excuse for doing nothing will simply raise the stakes as more years slide by, and more long-lived emissions accumulate in the air.

February 16, 2005 *(New York Times)*

Mixed Feelings as Treaty on Greenhouse Gases Takes Effect

By MARK LANDLER

LUDWIGSHAFEN, Germany - From the day that Jürgen F. Strube joined BASF in 1969, his company has been cleaning up its act. At that time, it was making plans for a wastewater treatment plant at its chemical production complex here, which stretches for nearly five miles along the Rhine.

The plant helped purify the river, which sparkles these days as it flows past a tidy forest of pipes and smokestacks. Downstream from the factory is a vineyard that produces a crisp Riesling wine - which BASF, the world's largest chemical maker, buys in bulk to stock its million-bottle wine cellars.

That is why Mr. Strube, chairman of BASF's supervisory board, responds with a hint of impatience when asked how European industry plans to comply with the Kyoto Protocol, requiring Germany and 34 other nations to cut their emissions of carbon dioxide and other greenhouse gases.

As the agreement takes effect on Feb. 16, worries about its fairness are mixed with mild resentment. Europeans have set some of the most stringent targets for reducing greenhouse gases, which trap heat in the earth's atmosphere and have been linked by climate experts to global warming.

It is bad enough, in their view, that American and Chinese companies will not bear these extra costs. But worse, the ultimate goal of curbing greenhouse gases will not be realized because carbon dioxide emissions, unlike polluted rivers, are a global rather than a local problem.

"We have already done so much in the past that we feel others should not get a free ride," Mr. Strube said. "We could reach a situation where the leader is a lonely rider going into the sunset, and everyone else sits back and says, O.K., let's wait and see when he will return."

The pressure, he says, should be on the United States, which generates a fifth of the world's greenhouse gases but is staying out of the Kyoto system, or on nations with rapidly growing economies like China and India, which approved the agreement but are not required to reduce emissions - even though together, they already account for 14 percent of the world's total.

"The basic message has to be that we need to bring the other countries aboard," said Mr. Strube, who also heads a leading business group, the Union of Industrial and Employers' Confederations of Europe.

Still, in some ways, European fears may be overblown. Even in the United States, which formally rejected the pact in 2001, a growing number of companies regard mandatory reductions as inevitable. It is a future they must prepare for, whatever the politics of the moment.

There is a sense on both sides of the Atlantic that the Kyoto Protocol is already changing corporate behavior in lasting ways. From costly investments in carbon-filtering technologies to a complicated new system for buying and selling carbon-emission credits, the agreement is forcing change on businesses, regardless of whether they operate in Kyoto countries.

"The globe doesn't know whether greenhouse gas is coming from Bangor, Me., or Beijing, China," said Michael G. Morris, chief executive of American Electric Power, the largest electricity generator in the United States and a top emitter of carbon dioxide. "It simply affects the whole planet."

Mr. Morris said he thought that the United States would someday be party to a global treaty on

greenhouse gases. At company headquarters in Columbus, Ohio, he said, they refer to it as "son or daughter of Kyoto."

To get ready for such agreements, American Electric has pledged to reduce the carbon dioxide emissions from its plants 10 percent by 2006 - a reduction that, while less radical than that levied on German industry, is in keeping with the spirit of Kyoto.

To be sure, not all American companies are looking as far ahead as American Electric, particularly smaller ones without overseas operations. And the political balance in the United States remains heavily tilted against mandatory reductions in emissions.

Senators John McCain, Republican of Arizona, and Joseph I. Lieberman, Democrat of Connecticut, have reintroduced a bill that would impose modest emission curbs. But the last time it came to a vote, in 2003, it lost 55 to 43. And the measure faces a harder struggle in this Congress.

American Electric is in the process of selling its power plants overseas, a decision Mr. Morris said it made for economic rather than environmental reasons. But he acknowledged that the unevenness of regulations could pose a competitive disadvantage for European companies.

For the same reason, he added, American concerns could be handicapped compared with Chinese or Indian competitors, because environmental regulations are stricter in the United States, even without acceptance of Kyoto requirements.

Still, there is little evidence that multinational companies are seeking to locate plants mainly in countries that do not adopt the protocol. Environmental regulations are one of several factors taken into account by businesses in making decisions on new sites, but they are less important than matters like labor costs.

"Companies like Dow and DuPont are keeping their overseas operations, and are learning to live with Kyoto," said Annie Petsonk, a lawyer for Environmental Defense, an advocacy group based in New York.

To live with the accord, the companies must master a bewildering new world. Negotiated in 1997 in Kyoto, Japan, it requires industrial nations - with varying targets - to reduce their emissions of greenhouse gases below 1990 levels, in the five years from 2008 to 2012.

For the European Union, the target is an 8 percent reduction below emissions levels in 1990. But the Germans went beyond that and agreed to a more ambitious target of 21 percent because they expected windfall gains by shutting down polluting, coal-fired power plants in the former East Germany. (It now seems likely to fall somewhat short of that.)

BASF led the German chemical industry in vigorously opposing the mandatory reductions. It argued that the rules put an undue burden on companies that must make decisions, like whether to build a new plant, on a longer timetable than the five-year life of the Kyoto pact.

Having lost that battle, the companies were required to take inventories of their emissions. They were allocated credits, typically for less than their current levels. These credits can be traded, which means that if a company is unable to meet the targets, it can buy credits.

Conversely, if a company achieves greater-than-required reductions, it can sell its unused credits at a profit. It can also pick up credits by helping finance the building of "clean" power plants in developing countries, or by taking part in reforestation projects, because trees absorb carbon dioxide.

The carbon market has developed rapidly in Europe, with credits for six million tons of carbon

traded in January. (Each credit represents a metric ton.) The price of a credit fell 19 percent over the month, to about $9. Carbon, like other energy markets, is affected by the weather, with emissions rising when it is colder.

"The winter has been warm and wet," said James Emanuel, a carbon broker at Evolution Markets in London. "Plants aren't burning as much coal and because it's wet, hydro plants are producing lots of electricity."

Energy companies, which are used to trading electricity, have jumped into this market without hesitation. But for old-line manufacturers, the prospect of carbon trading can be daunting. "It's mostly a matter of mentality," said Markus Hüwener, a former investment banker at Dresdner Kleinwort Wasserstein who advises clients on how to deal with the market. "Germans like to have a law they have to comply with. The cap-and-trade system gives them too much freedom."

Indeed, the trading system is considered one of the Kyoto system's innovative features. Recognizing that greenhouse gases are fungible - emissions in China are no different from those in Europe, and they all mix freely in the atmosphere - it is an efficient way to reduce the overall level by allowing less-polluting companies to sell unused rights to emit.

For Mr. Strube, trading is a distraction from producing and selling chemicals. "If you are interested in exiting your business," he said, "then trading all your emissions rights might be an attractive opportunity."

BASF will not be able to avoid the trading game. Germany allocated it certificates for 1.2 million tons of carbon dioxide a year to operate its flagship factory complex here, which has two working power plants and one nearing completion.

That is about 85,000 tons less than its current emissions, which means that the company will have to make deeper cuts or buy additional credits, costing up to $700,000 a year.

This is not unmanageable for a company with $42 billion in sales. BASF also expects to lower its total emissions in Ludwigshafen, after it starts up a $300 million combined heat and power plant this year. That will enable it to sell credits, defraying at least part of its investment.

By far BASF's biggest investment is in China, where it is building a $2.9 billion petrochemical plant in Nanjing. Because it is using the latest technology, it says it will have little trouble complying with any emissions curbs that China may impose.

What concerns BASF is the next round of regulations at home. So far, European authorities have limited mandatory cuts to emissions-intensive industries like power generating and cement making. But it could expand that to include chemicals, affecting more BASF operations.

Mr. Strube and others are urging officials in Brussels to focus on luring new countries into participation rather than leaning harder on industry. The European Commission took some note of these concerns in its proposals for the post-Kyoto era, which it introduced early this month. It emphasized issues like halting deforestation, which appeals to the United States. But it also said emissions from planes and ships must be curbed, a proposal sure to be resisted because it could involve a fuel tax.

"There is still so much uncertainty about what the purpose of climate policy is," said Kevin Fay, a lobbyist in Washington who works on environmental issues. "It can't be, 'you emit, we cut.' Companies need to know what the long-term goal is, and long term is not just 2012."

As American companies try to make sense of a carbon-constrained future, some are seeking advice from the Environmental Protection Agency, which sponsors a voluntary program called Climate Leaders. General Motors, one of the 28 participants, said it had achieved its target of a

10 percent reduction in North American plant emissions from 2000 to 2005. It has not applied the goals to Europe, where it operates 11 plants in eight countries. It expects to face mandatory cuts there, but said it was not yet sure of the size. "It's still in a state of flux in Europe," said Kristin B. Zimmerman, G.M. manager of environment and energy policy.

For carmakers, of course, the issue is less how they run their plants than what they make. Two-thirds of carbon dioxide emissions come from cars and households - sources that are difficult to home in on because there are so many of them.

BASF is pushing Germany to give incentives to homeowners to insulate their houses. It has refurbished a 1930's apartment block near its factories to show that it can cut emissions 80 percent. The motive is clear: BASF makes the insulation.

"Some say it's best to put this off as long as possible," said Eileen Claussen, president of the Pew Center on Global Climate Change. "The other way of thinking is, 'We know we're going to be in this world, and our best bet is to develop technologies to benefit from it.' "

February 10, 2005

2004 Was Fourth-Warmest Year Ever Recorded

By ANDREW C. REVKIN

Last year was the fourth warmest since systematic temperature measurements began around the world in the 19th century, NASA scientists said yesterday.

Particularly high temperatures were measured over Alaska, the Caspian Sea region of Europe and the Antarctic Peninsula, while the United States was unusually cool. But the global average continued a 30-year rise that is "due primarily to increasing greenhouse gases in the atmosphere," said Dr. James E. Hansen, director of NASA's Goddard Institute for Space Studies, in Manhattan.

The main source of such gases is smokestack and tailpipe emissions from burning coal and oil.

The highest global average was measured in 1998, when temperatures were raised by a strong cycle of El Niño in the Pacific Ocean; 2002 and 2003 were second and third warmest.

Dr. Hansen said a weak Niño pattern was likely to make 2005 at least the second warmest year and could push it beyond 1998 and set a record.

The unusual nature of the recent warming was corroborated separately yesterday by a new analysis of 2,000 years of indirect temperature records in tree rings, stalagmites, seabed layers, and other evidence from around the Northern Hemisphere.

That study, published in the journal Nature, found that previous peaks of warming, particularly during medieval times about 1,000 years ago, were as warm as the 20th-century average but that no spikes in the last 2,000 years matched the warming since 1990.

It is one of several recent studies challenging a longstanding view that temperatures in the Northern Hemisphere were relatively unvarying until the recent warming, a pattern enshrined in a graph scientists have taken to calling the hockey stick for its long horizontal "shaft" and upward-hooking "blade."

The lead author of the new paper, Anders Moberg of Stockholm University in Sweden, said it was important to recognize that natural influences on climate could either amplify or mask human-caused warming in years to come.

But his paper "should not be a fuel for greenhouse skeptics in their arguments," Mr. Moberg said, adding that there were ample signs that the warming was now outside nature's recent bounds.

October 29, 2004 *(New York Times)*

Warming Trend in Arctic Is Linked to Emissions

By ANDREW C. REVKIN

The first thorough assessment of a decades long Arctic warming trend shows the region is undergoing profound changes, including sharp retreats of glaciers and sea ice, thawing of permafrost, and shifts in ocean and atmospheric conditions that are likely to harm native communities, wildlife, and economic activities while offering some benefits, as well.

The report, while noting that conditions in the far north have varied naturally in the past, says the current shifts match longstanding scientific projections that the Arctic should be the first place to feel the impact of rising atmospheric concentrations of heat-trapping greenhouse gases from smokestacks and tailpipes.

It adds that the warming and other changes are likely to accelerate in this century because of the ongoing buildup in greenhouse gases.

Prompt efforts to curb such emissions could slow the pace of change sufficiently to allow communities and wildlife to adapt, the report says. But it also stresses that some further warming and melting is unavoidable given the century long buildup of the long-lived gases, mainly carbon dioxide.

"These changes in the Arctic provide an early indication of the environmental and societal significance of global warming," the executive summary of the report says.

The study, called the Arctic Climate Impact Assessment, was commissioned four years ago by the eight nations with Arctic territory - Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden and the United States - and conducted and reviewed by 250 scientists and representatives of six organizations representing Arctic native communities.

The study was scheduled for release at a conference in Iceland on Nov. 9, but electronic copies of some portions were provided to The New York Times by European participants in the project, several of whom said that publication had been delayed in part by the Bush administration because of the political contentiousness of global warming.

Officials of the Arctic Council, the international body that commissioned the study, denied that was the case. "There is no truth to the contention that any of the member states of the

Arctic Council pushed the release of the report back into November," said Gunnar Palsson of Iceland, the chairman of the council's eight government representatives. A State Department official declined to comment directly on the Arctic report, saying that Mr. Palsson spoke for the council.

He said that the countries all agreed to delay the issuance to November from September because of conflicts with another international meeting in Iceland.

The American scientist directing the assessment, Dr. Robert W. Corell, an oceanographer and senior fellow of the American Meteorological Society, said the timing was set during diplomatic discussions that did not involve the scientists.He said he could not yet comment on the specific findings, but noted that the signals from the Arctic have global significance.

"The major message is that climate change is here and now in the Arctic," he said today. "The scientific evidence of the last 25 to 30 years is very dramatic and substantial. The projections of future change indicate that this trend will continue and be substantially greater than the trends we're seeing on a global scale."

The report is a profusely illustrated window on a region in remarkable flux, incorporating reams of scientific data as well as observations by elders from communities around the Arctic Circle.

The potential benefits of the changes include projected growth in marine fish stocks and improved prospects for agriculture and timber harvests in some regions, as well as expanded access to Arctic waters.

There, sea-bed deposits of oil and gas that have until now been cloaked in thick shifting crusts of sea ice could soon be exploitable, and ice-free trade routes over Siberia could significantly cut shipping distances between Europe and Asia in the summer. But the list of potential harms is far longer.

The same retreat of sea ice, it says, "is very likely to have devastating consequences for polar bears, ice-living seals and local people for whom these animals are a primary food source."

Oil and gas deposits on land are likely to be harder to extract as tundra continues to thaw, limiting the frozen season when drilling convoys can traverse the otherwise spongy ground, the report says. Alaska has already seen the "tundra travel" season on the North Slope shrink from about 200 days a year in 1970 to 100 days now.

And it concludes that the consequences of the fast-paced Arctic warming have global reach, in part as sea levels rise in response to the accelerated melting of Greenland's two-mile-high sheets of ice.

There have been continuing disagreements between American officials and other participants over the report's contents and timetable.

Last year, for example, the State Department distributed a document to representatives from the other Arctic countries saying that it opposed having the technical experts draw conclusions about policies on greenhouse gases or other related factors until the scientific findings had been reviewed by the eight participating governments.

A copy was provided to The New York Times by a person involved in the project who criticized the delay in considering the implications of the climate shifts.

The document said this was "a fundamental flaw" in the process. The implications of the findings could not be legitimately considered before the scientific assessment was completed and governments needed to have the right to suggest changes.

January 25, 2005 *(New York Times)*

Antarctica, Warming, Looks Ever More Vulnerable

By LARRY ROHTER

OVER THE ABBOTT ICE SHELF, Antarctica - From an airplane at 500 feet, all that is visible here is a vast white emptiness. Ahead, a chalky plain stretches as far as the eye can see, the monotony broken only by a few gentle rises and the wrinkles created when new sheets of ice form.

Under the surface of that ice, though, profound and potentially troubling changes are taking place, and at a quickened pace. With temperatures climbing in parts of Antarctica in recent years, melt water seems to be penetrating deeper and deeper into ice crevices, weakening immense and seemingly impregnable formations that have developed over thousands of years.

As a result, huge glaciers in this and other remote areas of Antarctica are thinning and ice shelves the size of American states are either disintegrating or retreating - all possible indications of global warming. Scientists from the British Antarctic Survey reported in December that in some parts of the Antarctic Peninsula hundreds of miles from here, large growths of grass are appearing in places that until recently were hidden under a frozen cloak.

"The evidence is piling up; everything fits," Dr. Robert Thomas, a glaciologist from NASA who is the lead author of a recent paper on accelerating sea-level rise, said as the Chilean Navy plane flew over the sea ice here on an unusually clear day late in November. "Around the Amundsen Sea, we have surveyed a half dozen glaciers. All are thinning, in some cases quite rapidly, and in each case, the ice shelf is also thinning."

The relationship between glaciers (essentially frozen rivers) and ice shelves (thick plates of ice protruding from the land and floating on the ocean) is complicated and not fully understood. But scientists like to compare the spot where the "tongue" of a glacier flows to sea in the form of an ice shelf to a cork in a bottle. When the ice shelf breaks up, this can allow the inland ice to accelerate its march to the sea.

"By themselves, the tongue of the glacier or the cork in the bottle do not represent that much," said Dr. Claudio Teitelboim, the director of the Center for Scientific Studies, a private Chilean institution that is the partner of the National Aeronautics and Space Administration in surveying the ice fields of Antarctica and Patagonia. "But once the cork is dislodged, the contents of the bottle flow out, and that can generate tremendous instability."

Glaciologists also know that by itself, free-floating sea ice does not raise the level of the sea, just as an ice cube in a glass of water does not cause an overflow as it melts. But glaciers are different because they rest on land, and if that vast volume of ice slides into the sea at a high rate, this adds mass to the ocean, which in turn can raise the global sea level.

Through their flights over this and other areas of Antarctica, NASA and the Chilean center hope to help glaciologists and other scientists interested in climate change understand what is taking place on the continent and why. To do that, they need to compile data not only on ice thicknesses but also the underlying geology of the region, information that is most easily obtained from the air.

The flights are taking place aboard a Chilean Navy Orion P-3 plane that has been specially equipped with sophisticated instruments. The devices include a laser-imaging system that shoots 5,000 pulses of light per second at the ground to map the ice surface, as well as ice-penetrating radar to determine the depth of the ice sheets, a magnetometer and digital cameras.

For most parts of Antarctica, reliable records go back less than 50 years, and data from satellites and overflights like the ones going on here have been collected over only the past decade or so.

But that research, plus striking changes that are visible to the naked eye, all point toward the disturbance of climate patterns thought to have been in place for thousands of years.

In 1995, for instance, the Larsen A ice shelf disintegrated, followed in 1998 by the collapse of the nearby Wilkins ice shelf. Over a 35-day period early in 2002, at the end of the Southern Hemisphere summer, the Larsen B ice shelf shattered, losing more than a quarter of its total mass and setting thousands of icebergs adrift in the Weddell Sea.

"The response time scale of ice dynamics is a lot shorter than we used to think it was," said Dr. Robert Bindschadler, a NASA scientist who is director of the West Antarctic Ice Sheet Initiative. "We don't know what the exact cause is, but what we observe going on today is likely to be what is also happening tomorrow."

Thus far, all of the ice shelves that have collapsed are located on the Antarctic peninsula. In reality a collection of islands, mountain ranges and glaciers, the peninsula juts northward toward Argentina and Chile and is "really getting hot, competing with the Yukon for the title of the fastest warming place on the globe," in the words of Dr. Eric Steig, a glaciologist who teaches at the University of Washington.

According to a recent study published in Geophysical Research Letters, the discharge rate of three important glaciers still remaining on the peninsula accelerated eightfold just from 2000 to 2003. "Ice is thinning at the rate of tens of meters per year" on the peninsula, with glacier elevations in some places having dropped by as much as 124 feet in six months, the study found.

But the narrow peninsula contains relatively little inland ice. Glaciologists are more concerned that they are now beginning to detect similar signs closer to the South Pole, on the main body of the continent, where ice shelves are much larger - and could contribute far more to sea level changes. Of particular interest is this remote and almost inaccessible region known as "the weak underbelly of West Antarctica," where some individual ice shelves are as large as Texas or Spain and much of the land on which they rest lies under sea level.

"This is probably the most active part of Antarctica," said Dr. Eric Rignot, a glaciologist at the Jet Propulsion Laboratory in Pasadena, Calif., and the principal author of the Geophysical Research Letters paper. "Glaciers are changing rapidly and increasingly discharging into the ocean, which contributes to sea level rise in a more significant way than any other part of Antarctica."

According to another paper, published in the journal Science in September, "the catchment regions of Amundsen Sea glaciers contain enough ice to raise sea level by 1.3 meters," or about four feet. While the current sea level rise attributable to glacier thinning here is a relatively modest 0.2 millimeters a year, or about 10 percent of the total global increase, the paper noted that near the coast the process had accelerated and might continue to do so.

As a result, the most recent flights of NASA and the Chilean center have been directed over the Thurston Island and Pine Island zones of West Antarctica, near the point where the Bellinghausen and Amundsen Seas come together. The idea is to use the laser and radar readings being gathered to establish a base line for comparison with future measurements, to be taken every two years or so.

"We're not sure yet how to connect what we see on the peninsula with what we observe going on further south, but both are very clearly dramatic and dynamic events," Dr. Bindschadler said. "On the peninsula, large amounts of melt water are directly connected to disintegration of the ice shelf, but the actual mechanism in West Antarctica, whether melt water, a slippery hill or a firmer bedrock, is not yet clear. Hence the need for more data."

The information being gathered here coincides with the recent publication of a report on accelerating climate change in the Arctic, an area that has been far more scrutinized than

Antarctica. That study, commissioned by the United States and seven other nations, found permafrost there to be thawing and glaciers and sea ice to be retreating markedly, raising new concerns about global warming and its impact.

"The Arctic has lots of land at high latitudes, and the presence of land masses helps snow melt off more quickly," said Dr. Steig. "But there's not a lot of land to speak of in the high latitudes of the Southern Hemisphere," making the search for an explanation of what is going on here even more complicated.

The hypotheses scientists offer for the causes of glacier and ice shelf thinning in Antarctica are varied. Rising air, land and ocean temperatures or some combination of them have all been cited.

Some scientists have even proposed that a healing of the seasonal ozone hole over the South Pole and southernmost Chile, a phenomenon expected to take place in the next 50 years or so, could change the circulation of the atmosphere over the frozen continent in ways that could accelerate the thinning of Antarctic ice fields. But even without that prospect, the situation developing in Antarctica is already sobering, glaciologists agree. The data being collected here in West Antarctica and on the peninsula farther north make that obvious, they say, though the degree to which that should be cause for concern around the rest of the planet will become clear only with more research.

"If Antarctica collapses, it will have a major effect on the whole globe," Dr. Rignot cautioned. He warned that "this is not for tomorrow, and Antarctica is such a big place that it's important to look at other areas" around the perimeter of the giant continent, but added, "Nature is playing a little experiment with us, showing us what could happen if the plug were to be removed."

November 9, 2004 *(New York Times)*

A Melting Glacier in Tibet Serves as an Example and a Warning

By HOWARD W. FRENCH

YUREN, China - Seen from afar, it looked like much of the surrounding landscape, even to the scientists who know these Tibetan wilds intimately: the looming, massive, soot-black shoulder of a mountain.

Close up, though, when one could finally see the base, all thick, glistening white ice, now clearly visible after nearly four hours of hiking through thick, pathless forests, there was no mistaking it.

Mountains, after all, don't melt. This was the 27-square-mile glacier the researchers had been seeking.

Pouring forth from the base of this huge mass of ice nearly 11,500 feet above sea level was a torrent of melting runoff that formed the powerful new headwaters of a mighty river - an infant river, in geological time, already broad and raging from its first few yards.

"Thirty years ago, there was no river here," said Dr. Yao Tandong, the director of China's Institute of Tibetan Plateau Research, who has spent the last two decades on expeditions like these to study Tibetan glaciers. "Of course, there has always been a river downstream, but up here, everything had always been frozen solid."

The glacier, named Zepu, has lost more than 100 yards of thickness, all in the last three decades, largely because of rising temperatures in the region. And it is hardly unique. Working with scientists from Ohio State University, Dr. Yao has documented similar losses all over Tibet, the largest and loftiest highlands on earth, and home to the biggest concentration of alpine glaciers anywhere.

Nor are these changes limited to Tibet. "Make no mistake, what's happening to the glaciers in Tibet is happening around the globe," said Dr. Lonnie G. Thompson, a professor of geological science at Ohio State. "Our measurements show that between 1850 and 1960, the glaciers retreated 7.5 percent. Between 1960 and 2000, there was a further 7 percent retreat.

"In the 1990's alone, the glaciers have shrunk by more than 4 percent."

Dr. Peter Clark, an Oregon State University geologist who specializes in glaciers and ice ages, agreed.

"Glacial retreat, which is happening globally, with the exception of one area, in Scandinavia, is a pretty widely understood and accepted phenomenon," he said. "Glaciers advance and retreat in response to two things, precipitation and temperature. Certainly by the standards of the last few thousand years, there has been a marked rise in temperature globally."

To be sure, there are vast stores of glacial ice left in Tibet. Flying into the province, a traveler passes over densely clustered ice-capped mountain ranges that dwarf the Alps, and ice fields that extend as far as the eye can see.

But the dominant impression of a traveler who spent a week driving over 800 miles on the muddy back roads of eastern Tibet was of a world of water, not ice.

Streaming white waterfalls fed by melting glaciers pour from mountains around every bend in some areas. Cliff-hugging roads are subject to mudslides and waterborne avalanches every few miles, and boulder-strewn whitewater rivers churn with uncommon ferocity.

Dr. Thompson said he had documented large puddles of melting ice at 20,000 feet in the Himalayas, where for thousands of years all has been frozen.

A craggy 56-year-old who says he has spent at least three years of his life at elevations of 18,000 feet or more researching glaciers, he spoke during a recent interview in Beijing. He had just completed the latest of many expeditions to Tibet over the last 20 years.

The essence of his work involves retrieving deep ice samples, or cores, from glaciers.

He spends much of his year like a migratory bird, traveling from one glacial mass to another, including the Himalayas and mountains in Peru, Kenya and Alaska.

"When we go to retrieve a core, it's usually to a place that no one has ever been, and the beauty of ice, which is really different from any other material, is how much you can learn from it," he said. "It tells you the history of precipitation, of dust accumulation and of wind strength. It also gives you a history of the atmosphere, including the presence of sulfates, nitrates and chlorides, which are precisely the factors associated with global warming."

In Peru, he said, the Quelccaya ice cap retreated a rate of more than 600 feet a year from 2000 to 2002 - up from just 15 feet a year in the 1960's and 70's - leaving a vast 80-foot-deep lake where none had existed when his studies began. On Kilimanjaro in Kenya, an 11,700-year-old ice cap that measured 4.3 square miles in 1912 had shrunk to 0.94 square miles in 2000, and is projected to disappear altogether in about 15 years.

"When you see the big picture accumulating from many sites, the evidence of drastic climate change becomes quite compelling," Dr. Thompson said.

Climate experts and geologists say the consequences of glacial ice melting on this scale are far-reaching. The most important long-term threat, perhaps, is to the low-lying coastal cities around the world - places like New York and New Orleans, or Tokyo and Shanghai - which could see more frequent flooding as a result of rising sea levels in this century.

In other parts of the Himalayas, large newborn lakes are accumulating behind dams of ice that could break, unleashing deadly flash floods.

For his part, Dr. Yao is unwilling to make sweeping predictions. Instead, fixing his gaze on the leading edge of the fast-melting Zepu glacier, he said, "If you come back here in another 30 years, one thing is for sure: There will definitely be no more ice here."

January 11, 2005 (Reuters)

Rising Seas Threaten Islands, Cities, Coasts

By Alister Doyle, Environment Correspondent

OSLO (Reuters) - It sounds insignificant alongside the Indian Ocean tsunami, yet an almost imperceptible annual rise in the world's oceans may pose a huge threat to ports, coasts and islands by 2100.

Leaders of 37 small island states meet in Mauritius this week to discuss an early warning system to protect against tsunamis and a creeping rise in ocean levels, blamed widely on global warming.

Rising sea levels, now about 0.08 inch a year, could swamp low-lying countries like Tuvalu in the Pacific or the Maldives in the Indian Ocean if temperatures keep rising.

They could also lead to hugely expensive damage worldwide.

"It's often presented as a problem only for developing nations," said Mike MacCracken, chief scientist for climate change programs at the Climate Institute, a Washington think-tank.

"(But) developed countries will be very much at risk because so much infrastructure is at sea level."

Many of the world's biggest cities are near coasts -- including Calcutta, Dhaka, Lagos, London, New York, Shanghai and Tokyo. Flooding could cause billions of dollars of damage. In Bangladesh, 17 million people live less than three feet above sea level.

McCracken and some other experts say that recent evidence of a faster than expected melt of Greenland and Antarctic ice indicate that the rise in sea levels would be in the upper half of a 3.5-34.5 inch range projected by the U.N.'s climate panel by 2100.

Seas rose by 3.9-7.8 inches in the 20th century, according to the U.N. scientists. Thermal expansion -- water gets bigger as it warms -- would be the main cause of rising seas while melting glaciers and ice caps would add volume.

CO2 RISES

The U.N. panel projects that overall temperatures will rise by 2.5-10.5 degrees Fahrenheit by 2100, mainly because of a build-up of carbon dioxide from cars, factories and power plants. Some scientists say U.N. models are scare-mongering.

"We have no reason to believe, as suggested by most global warming scenarios, that massive flooding will occur due to an increase in sea levels," Nils Axel-Morner of the University of Stockholm wrote in a report.

He predicted oceans would gain 3.9 inches by 2100, avoiding the need for extra measures like those to protect Venice, where the city is sinking, or dykes like those to shield the Netherlands.

Others say the world can adapt -- fossil seashells have been found high in the Himalayas and continents are almost always rising or falling. Still, many countries favor caution.

The U.N.'s 128-nation Kyoto protocol, which seeks to curb emissions of carbon dioxide, will come into force on Feb. 16. The United States pulled out in 2001, saying it was too costly and that its targets to 2012 wrongly excluded poor countries.

"The cost of defending cities would be enormous but the value at stake is also enormous so protection makes sense," said Richard Klein, a senior researcher at the Potsdam Institute for Climate Impact Research.

"It makes less sense to defend agricultural land," he said.

Poor countries would be least able to build defenses, exacerbating the impact of rising seas, he added. "Vulnerability to rising seas has as much a social dimension as an environmental one," he said.

NEW ROAD DESIGN?
McCracken said countries needed to consider whether to build roads parallel to the coast on levies in low-lying areas or further back, with spurs toward the sea. And they needed to stop, for instance, building sewage farms at sea level.

He said a gradual rise in sea levels often caused erosion because, over time, it made coasts more vulnerable to hurricanes or cyclones.

"It doesn't happen gradually. People stay on the coast and then there is a big event like a storm or a tsunami. Then the coastline changes dramatically," he said. More than 145,000 people died in the Dec. 26 earthquake and ensuing huge waves which hit coasts from Indonesia to Somalia.

Scientific evidence from the past varies widely.

Yossi Mart, of Israel's University of Haifa, said that based on structures like Roman aqueducts and the sluice gates of a Herodian harbor, sea levels 2,000 years ago in the eastern Mediterranean were similar to those now.

"In the Crusader times, during the 12th-13th centuries, the principal jetty was built for a sea level which is lower than the present by more than 50 cm (19.7 inches)," he said.

Conrad Neumann, professor of marine sciences at the University of North Carolina, said sea levels jumped inexplicably by 12 feet about 120,000 years ago, based on surveys in the Bahamas. They dropped again almost as rapidly.

"There was no man-made effect on the climate then," he said. "But we shouldn't mess with the climate; it can change in a hurry. If it's a sleeping dragon don't poke it with a stick: our stick might be carbon dioxide."

December 25, 2003 *(New York Times)*

Court Blocks U.S. Effort to Relax Pollution Rule

By KATHARINE Q. SEELYE and JENNIFER 8. LEE

WASHINGTON, Dec. 24 — A federal appeals court on Wednesday at least temporarily blocked a Bush administration rule, due to take effect on Friday, that would have relaxed existing regulations and so allowed hundreds of aging power and industrial plants to make upgrades without installing modern pollution controls.

The order, by a three-judge panel of the United States Court of Appeals for the District of Columbia Circuit, indicates that the court has substantial doubt about the White House's claims that it has authority to modify the Clean Air Act by regulation and that its changes would not hurt the environment.

In staying the new regulation, the court said it would expedite a case brought against the rule by 14 states, among them New York, New Jersey and Connecticut, as well as several cities and environmental groups; it will then hear the case on its merits.

The ruling on Wednesday essentially places a burden on the administration to justify a regulatory change that it has been unable to accomplish through the legislative process. That change had been expected to help utilities, refiners and other industries, which had long complained about the government's environmental enforcement actions, to avoid installing billions of dollars' worth of pollution controls.

Scott Segal, a lobbyist with the Electric Reliability Coordinating Council, an industry group founded largely to advance the regulatory change, described the ruling as a setback, and added, "This stay motion and litigation undermine certainty for consumers and the regulated community."

The Environmental Protection Agency, which had proposed the new rule, said in a statement that it was "disappointed with the court's decision" and that neither the regulation nor the court's stay of it would have much effect on emissions.

But plaintiffs were buoyant.

"This is an enormously important victory that halts the Bush administration efforts to eviscerate the Clean Air Act," said Eliot Spitzer, attorney general of New York. "Piece by piece, the Bush administration has been undercutting meaningful enforcement of the Clean Air Act. The D.C. court has said it can do so no longer."

"Not only does it freeze the regulation," Mr. Spitzer said of the ruling, "but the court has also signaled that it may throw out the entire regulation after further review."

Indeed, to win a stay, plaintiffs must typically demonstrate not only a likelihood of irreparable harm if a proposed action is allowed to proceed, but also a likelihood of success once the case is heard on the merits. The order issued by the appeals court said these plaintiffs had met the two criteria.

The members of the three-judge panel were Harry T. Edwards, Judith W. Rogers and David S. Tatel. All were appointed by Democratic presidents but have voted many times to uphold other actions of the Bush administration.

The fight currently being waged deals with an issue called "new source review," and its roots can be traced back three decades, to adoption of the Clean Air Act.

When the law was enacted, it exempted from its requirements for modern, expensive pollution controls those plants that were already in operation. Lawmakers assumed that these "grandfathered" plants would be replaced over time by new ones.

Instead of building new plants, though, some utilities upgraded the existing ones, avoiding the costs of the emissions controls while adding to capacity, and to pollution.

In response, Congress modified the law, requiring that upgrades were to be considered "new sources" of pollution and thus subject to the control requirements. Industry subsequently objected that what environmentalists and government frequently considered upgrades were in fact nothing more than routine maintenance, which the requirements did not cover.

The battle has raged ever since, with industry claiming "maintenance," and states and environmentalists protesting that it is "upgrades."

Under the relaxed rule that the court stayed on Wednesday, companies would have been allowed to replace aging equipment with its "functional equivalent" without taking on the expensive pollution-reducing requirements. The rule would also have exempted projects in which replacement costs were less than 20 percent of the plant's value.

The rule grew out of a recommendation by Vice President Dick Cheney's energy task force, which urged the administration two years ago to study industry complaints about federal enforcement actions.

Environmentalists have been particularly critical of this regulation, one of the administration's most significant environmental initiatives, saying that it would fail to reduce emissions of sulfur dioxide and nitrogen oxides fast enough, and undermine environmental lawsuits and investigations undertaken against dozens of plants.

Indeed, after the administration made the rule final in October, E.P.A. officials announced that they would drop enforcement actions, some dating from the Clinton administration, involving past violations of the Clean Air Act attributed to some 50 power plants.

In maintaining on Wednesday that neither the regulation nor the court's stay of it would have much effect on emissions, the E.P.A. pointed to a separate proposal, introduced by the administration this month, that it said would reduce pollution substantially. Many environmentalists have agreed with that claim.

That proposal, adopted from the president's Clear Skies Initiative, is called the Interstate Air Quality rule. It would create a market-based program to reduce sulfur dioxide and nitrogen oxides in about 30 states in the East. Administration officials say this would help bring nearly every county into compliance with the Clean Air Act.

With an estimated cost to industry of more than $5 billion a year, the proposal is one of the most expensive ever advanced by the E.P.A., and could bring some of the greatest health and environmental benefits.

February 6, 2004 *(New York Times)*

Most States Expect Pollution to Rise if Regulations Change

By JENNIFER B. LEE

WASHINGTON, Feb. 5 — A majority of state environmental officials believes that air pollution from coal-burning power plants would increase if the Bush administration's changes to the Clean Air Act were to take effect, according to a survey to be released on Friday by the General Accounting Office.

The administration has said the changes, originally approved in August, would have minimal impact on air pollution.

The survey, which was requested by Senators Joseph I. Lieberman, Democrat of Connecticut, and James M. Jeffords, the Vermont independent, gathered responses from 44 states on the section of the Clean Air Act governing aging coal-burning plants, New Source Review.

Officials from 27 states said the administration's changes would increase emissions, while officials from 5 states said it would cut them. Officials from the other 12 states that responded said emissions would remain the same or were unsure about the impact.

"State and local authorities know best, and the vast majority say that these rule changes take us backward, not forward, in cleaning our skies and improving public health," Mr. Lieberman said.

The report highlights the tensions between the Environmental Protection Agency and a number of states, concentrated in the Northeast, since the administration started pushing the changes at the urging of industry.

Fourteen states, including New York, and several cities have sued the E.P.A. to block the new policy. The United States Court of Appeals for the District of Columbia Circuit barred the changes from taking effect in late December pending the resolution of a court case, in part because the changes were likely to cause irreparable harm.

The Bush administration has said the changes would reduce confusion and bureaucracy in the upgrading of power plants. But officials from 30 states said the changes would result in continued uncertainty.

State officials from 29 states said the changes' main benefits would be to give the utility industry increased flexibility.

Indeed, the E.P.A. said when it first announced the rule changes that it would hold off pursuing a number of cases against power companies, since those cases would no longer be valid. After the court suspended the changes in December, though, Michael O. Leavitt, the E.P.A. administrator, said the agency could continue to investigate the cases.

E.P.A. officials have said they are pushing other, more comprehensive policies to reduce air pollution.

"We have proposed a rule that will require power plants to reduce their emissions by 70 percent," said Cynthia Bergman, a spokeswomen for the agency, referring to a recent proposal that would create market-based trading in acid rain-causing sulfur dioxide and smog-causing nitrogen dioxides.

April 7, 2004 *(New York Times)*

White House Minimized the Risks of Mercury in Proposed Rules, Scientists Say

By JENNIFER 8. LEE

WASHINGTON, April 5 — While working with Environmental Protection Agency officials to write regulations for coal-fired power plants over several recent months, White House staff members played down the toxic effects of mercury, hundreds of pages of documents and e-mail messages show.

The staff members deleted or modified information on mercury that employees of the environmental agency say was drawn largely from a 2000 report by the National Academy of Sciences that Congress had commissioned to settle the scientific debate about the risks of mercury.

In interviews, 6 of 10 members of the academy's panel on mercury said the changes did not introduce inaccuracies. They said that many of the revisions sharpened the scientific points being made and that justification could be made for or against other changes. Most changes were made by the White House's Office of Management and Budget, which employs economists and scientists to review regulations.

But scientists on the academy panel and others outside it as well as environmentalists and politicians expressed concern in recent interviews that a host of subtle changes by White House staff members resulted in proposed rules that played down the health risks associated with mercury from coal-fired power plants. The proposal largely tracks suggestions from the energy industry.

While the panel members said the changes did not introduce outright errors, they said they were concerned because the White House almost uniformly minimized the health risks in instances where there could be disagreement.

"What they are saying is not scientifically invalid on its face," said Alan Stern, a New Jersey toxicologist who served on the panel. "Partially they edited for clarity and relevance from a scientific standpoint. But there appears to be an emphasis on wordsmithing that is not necessarily dictated by the science."

Last Thursday attorneys general from 10 states and 45 senators asked the E.P.A. to scrap the proposed rules, saying they were not strict enough.

They also asked Michael O. Leavitt, the agency's administrator, to extend the comment period for the rules, which now ends April 30. Under a court-ordered agreement, the rules are to be in final form by Dec. 15.

In some cases, White House staff members suggested phrasing that minimized the links between power plants and elevated levels of mercury in fish, the primary source from which Americans accumulate mercury in their bodies, in a form known as methylmercury.

The academy has found that exposure to elevated levels of mercury can damage the brains of children and fetuses.

In another instance, a draft passage originally read, "Recent published studies have shown an association between methylmercury exposure and an increased risk of heart attacks and coronary disease in adult men."

It was changed to "it has been hypothesized that there is an association between methylmercury exposure and an increased risk of coronary disease; however this warrants further study as the new studies currently available present conflicting results."

The change understates known science, some academy panel members said in interviews.

The proposed regulations are available on the E.P.A. Web site (epa.gov/). The proposed rules would limit mercury emissions by an estimated 70 percent over decades and would also allow power plants to buy and sell among themselves the rights to create mercury pollution.

Mr. Leavitt is reconsidering elements of the rules.

Small amounts of mercury occur naturally in the environment. In December 2000, however, the environmental agency concluded that mercury from power plants should be classified as a hazardous air pollutant to be strictly regulated under the Clean Air Act. In December 2003, the Bush administration reversed that finding.

The proposed regulations for power plants — the single-largest source of mercury emissions in the United States — are the culmination of 14 years of lawsuits, scientific review and government reports.

Coal and utility groups lobbied intensively to help shape the regulations, which will cost billions of dollars. Paragraphs in the proposed rules are inserted nearly verbatim from memorandums from the firm of Latham & Watkins, where two top political officials in the E.P.A.'s office overseeing air regulations, Bill Wehrum and Jeffrey Holmstead, once worked.

White House officials and E.P.A. political appointees say the changes in the draft rules reflect the typical back and forth of developing regulations among agencies, and environmental agency officials had the option of rejecting the suggestions, which in some cases they did.

"This is a standard collaborative process that involved experts across the government to create a solid product," said Dana Perino, the spokeswoman from the Council on Environmental Quality, which coordinates federal environmental efforts.

But some critics are not convinced. "This is a pattern of undermining and disregarding science on political considerations," said Senator Hillary Rodham Clinton, Democrat of New York, citing a recent letter by the Union of Concerned Scientists, signed by 60 scientists, including 20 Nobel laureates, which criticized the administration's handling of science issues.

Others feel the White House's Office of Management and Budget is overstepping its bounds. "O.M.B.'s role is supposed to be to review the economics of rules — which they did very poorly here — not to fly speck the science and minimize health threats," said Lisa Heinzerling, a professor at Georgetown University who is a co-author of the book "Priceless," on cost-benefit analysis.

Throughout an E.P.A. draft of the proposed regulations circulated in November, a White House staff member crossed out the word "confirmed" from the phrase describing mercury as a "confirmed public health risk." In some instances, sentences in the final proposals were changed to mercury "warrants regulation."

Mr. Wehrum, the chief counsel of E.P.A.'s air regulation office, said that the handwritten changes were prompted by his agency's desire to use more precise legal language from the Clean Air Act.

Some members of the National Academy said that sections of the regulations on health effects could have been made more clear, but that the science was strong enough not to delete them entirely.

An official with the Office of Management and Budget who emphasized that neurologic risks to children were the most important concern, said language on other health effects was deleted or softened for a number of reasons. In some cases the draft had overstated the known science, while in others, like cerebral palsy, the effects were not relevant to mercury exposure in fish or power plants.

Even taking into account studies that have been published since their report in 2000, some panel members said the language was made too soft in several cases.

"There is increasing evidence of an association between mercury exposure and cardiovascular effects," said Thomas Burke, an epidemiologist from Johns Hopkins University and a member of the panel. "I would call it stronger than a hypothesis."

In another case, a toxicologist with the Office of Management and Budget recommended changes to a sentence saying children exposed to mercury in the womb "are at increased risk of poor performance on neurobehavioral tests." The final sentence that was published said children "may be at increased risk." That pattern was repeated a number of times throughout regulations where "are" or "can" was changed to "may." The official said that the softened language reflected the fact that low levels of mercury exposure below the safe dose were not known to be risky, even to children.

Other scientists interpret the edit differently. Joseph L. Jacobson, a professor of psychology at Wayne State University, who served on the academy panel, said, " `May be' suggests an effort to discount the fact that we have consistent evidence across more than one study."

While it is standard for the White House to review federal agency testimony and reports, E.P.A. staff members say the Bush administration also minimized the amount of mercury that comes from power plants. Over agency staff objections, the White House on several occasions in the past year added the statement that coal burning produces "roughly one percent of mercury in the global pool."

According to the E.P.A. staff, the 1 percent figure was added to an agency report on children's health; Senate testimony by Christie Whitman, who was the E.P.A. administrator; and Senate testimony of Mr. Holmstead, who is the assistant agency administrator for air.

While that figure is cited in the E.P.A.'s 1997 report to Congress, agency staff members and independent scientists say it is misleading because much of the mercury that ends up in the nation's water and soil comes from nearby sources.

December 17, 2004 *(Wall Street Journal)*
Invisible Export

A Hidden Cost Of China's Growth: Mercury Migration

Turning to Coal, Nation Sends Toxic Metal Around Globe; Buildup in the Great Lakes Conveyor Belt of Bad Air

By MATT POTTINGER, STEVE STECKLOW and JOHN J. FIALKA
Staff Reporters of THE WALL STREET JOURNAL

On a recent hazy morning in eastern China, the Wuhu Shaoda power company revved up its production of electricity, burning a ton and a half of coal per minute to satisfy more than half the demand of Wuhu, an industrial city of two million people. **AES** Corp., an American energy company, owns 25% of the 250-megawatt facility, which local officials call an "economically advanced enterprise."

The Chinese plant is outfitted with devices that prevent soot from billowing into the sky. But other pollutants, such as nitrogen oxides, sulfur dioxide and a gaseous form of mercury, swirl freely from the smokestacks. Rather than install more sophisticated and costly antipollution equipment, the plant, which is majority owned by state-controlled entities, has chosen to pay an annual fee, which it estimates will be about $500,000 this year. That option meets Chinese standards but wouldn't be allowed in the U.S.

The airborne output of Chinese power plants like Wuhu Shaoda was once considered the price of China's economic growth, and a mostly local problem. But just as China's industrial might is integrating the country into the global economy, its pollution is also becoming a global concern. Among the biggest worries: the impact of China's vast and growing power industry, mostly fueled by coal, on the buildup of mercury in the world's water and food supply.

Scientists long assumed mercury settled into the ground or water soon after it spewed forth as a gas from smokestacks. But using satellites, airplanes and supercomputers, scientists are now tracking air pollution with unprecedented precision, discovering plumes of soot, ozone, sulfates and mercury that drift eastward across oceans and continents.

Mercury and other pollutants from China's more than 2,000 coal-fired power plants soar high into the atmosphere and around the globe on what has become a transcontinental conveyor belt of bad air. North America and Europe add their own dirty loads to the belt. But Asia, pulsating with the economic rebirth of China and India, is the largest contributor.

"We're all breathing each other's air," says Daniel J. Jacob, a Harvard professor of atmospheric chemistry and one of the chief researchers in a recent multinational study of transcontinental air pollution. He traced a plume of dirty air from Asia to a point over New England, where samples revealed that chemicals in it had come from China.

One reason China's power industry spews out so much pollution is that under the nation's rules, many plants have the option of paying the government annual fees rather than installing antipollution equipment. Moreover, Beijing officials concede they lack the authority to shut down heavily polluting plants. And local inspectors, who don't report to Beijing, are reluctant to crack down on power companies that generate jobs.

In the U.S., the consequences are being detected not just in the air people breathe but in the food they eat. The U.S. Environmental Protection Agency recently reported that a third of the country's lakes and nearly a quarter of its rivers are now so polluted with mercury that children and pregnant women are advised to limit or avoid eating fish caught there. Warnings about mercury, a highly toxic metal used in things ranging from dental fillings to watch batteries, have been issued by 45 states and cover four of the five Great Lakes. Some scientists now say 30% or more of the

mercury settling into U.S. ground soil and waterways comes from other countries -- in particular, China.

The increasingly global nature of the problem is rendering local solutions inadequate. Officials in some countries are using the presence of pollution from abroad "as an argument to do nothing [at] home," says Klaus Toepfer, executive director of the United Nations Environment Program in Nairobi, Kenya.

Yet global remedies -- primarily treaties -- are even harder to achieve. The last such initiative, the Kyoto Protocol, aimed at limiting emissions related to global warming, was rejected by the U.S., the largest contributor of such emissions -- and doesn't apply to China, the second-largest emitter. The best shot at a treaty for transcontinental pollution, Mr. Toepfer believes, would be to regulate a single pollutant that everyone agrees is hazardous. He recommends starting with mercury.

China is already believed to be the world's largest source of nonnatural emissions of mercury. Jozef Pacyna, director of the Center for Ecological Economics at the Norwegian Institute for Air Research, calculates that China, largely because of its coal combustion, spews 600 tons of mercury into the air each year, accounting for nearly a quarter of the world's nonnatural emissions. And the volume is rising at a time when North American and European mercury pollution is dropping. The U.S. emitted about 120 tons of mercury into the air in 1999 from manmade sources. Chinese power plants currently under construction -- the majority fueled by coal -- will alone have more than twice the entire electricity-generating capacity of the U.K.

The overwhelming majority of China's power plants are built, owned and operated by Chinese companies. Speaking about the Wuhu Shaoda power plant, Robin Pence, a spokeswoman for AES, says the Arlington, Va., company "is a minority partner in Wuhu. As such, we neither operate nor control the plant." She adds that AES didn't build the plant and that its world-wide policy for plants that it does design and build is to meet emission standards set either by the local country or the World Bank, whichever are more stringent. The Wuhu plant's manager declined to comment.

Natural Sources

EPA scientists estimate that a third of the mercury in the atmosphere gets there naturally. Traces of the silvery liquid in the earth's crust make their way into the sky through volcanic eruptions and evaporation from the earth's surface. It took the industrial age to turn mercury into a public-health concern. Mining, waste incineration and coal combustion emit the metal in the form of an invisible gas. After it rains down and seeps into wetlands, rivers and lakes, microbes convert it into methylmercury, a compound that works its way up the food chain into fish and eventually people.

The dangers of significant methylmercury exposure to the nervous system are well documented, particularly in fetuses and children. Permanent harm to children can range from subtle deficits in memory and attention span to mental retardation. In January, EPA scientists released research indicating that 630,000 U.S. babies born during a 12-month period in 1999-2000 had potentially unsafe levels of mercury in their blood -- about twice as many babies as previously estimated.

Adults aren't immune, either. Joel Bouchard, a National Hockey League defenseman who spent the past two seasons with the New York Rangers, says that last December he began suffering dizziness, headaches, insomnia and blurred vision -- forcing him to miss around 25 games. "It was, honestly, like I was in the Twilight Zone," he says. A team doctor discovered Mr. Bouchard had abnormally high levels of mercury in his bloodstream. The suspected cause: the tuna and other fish he'd been eating almost daily as part of what he thought was a healthy diet. He says his blood levels have since returned to normal and the symptoms have disappeared.

Few places more starkly illustrate the threat from mercury, and the obstacles to containing it, than China.

In Qingzhen, a town in the poor mountainous province of Guizhou about 800 miles southwest of Wuhu, a 53-year-old female rice grower who goes by the single name of Zhang and thousands of other farmers are surrounded by mercury pollution. Dark smoke surges from the local power plant, staining crops a drab gray. The plant flushes eight million cubic meters, or about 10 million cubic yards, of ash and water each year into an area adjacent to a major drinking-water reservoir. Some fish near the plant have levels of mercury 18 times what the EPA and the Chinese government consider safe, according to the Guizhou Provincial Environmental Science and Research Institute, which recently did a seven-year study of the province's mercury pollution.

The plots of land that Ms. Zhang and her neighbors tend are especially poorly situated. Nearby is the Guizhou Crystal Organic Chemical factory, which over the years released up to 100 tons of mercury into a stream that runs through her village, according to the study. An official in the factory's environment and safety department calls the report's estimate "too high," and says the factory stopped dumping mercury by 1998. But the stream still runs black and reeks so strongly of chemicals that people unaccustomed to the smell struggle not to gag when standing downwind.

Ms. Zhang and her neighbors are used to the smell. With no other choice, they pump water from the poisoned stream onto dozens of acres of rice paddies each planting season. Rice from the fields tastes sour, she says. "When you wash it, the water in the pot turns the same color as the river." Grain from these fields contains nearly 40 times as much mercury as rice from Shanghai, according to the study. Laboratory mice fed the rice became hyperactive and their nervous systems began deteriorating within a month, the study says.

Farmers in the village complain of periodic fits of shaking. Ms. Zhang suspects the pollution is the reason she and some neighbors have stomach cancer.

Once airborne, by drifting as an invisible gas or clinging to particles of dust, mercury begins to wander. Last April, an instrument-laden U.S. surveillance aircraft near the California-Oregon border hit a plume of dirty air inbound from China. Among the pollutants: black carbon, sulfur dioxide and mercury. "Storms didn't wash it away," marvels Veerabhadran Ramanathan of the Scripps Institution of Oceanography in La Jolla, Calif.

Dr. Ramanathan, who helped pioneer the field of tracking international air pollution, says such plumes shed some of the noxious load over the ocean. But their bulk continues to drift across the U.S. at the leisurely speed of a blimp, polluting lakes and rivers as it goes.

The density of Chinese pollution has amazed researchers. Hans Friedli, a chemist at the National Center for Atmospheric Research in Boulder, Colo., recalls flying through plumes off the Chinese coast near Shanghai two years ago that contained pollutants in the "highest concentration that I have ever seen from an aircraft, except when I've flown into forest fires."

And it is going to get worse. By 2020, China will have nearly 1,000 gigawatts of total electricity-generating capacity, more than twice the current amount, according to the State Power Economic Research Center. The majority of new plants will burn coal. Coal-fired plants today produce three-quarters of the country's electricity, compared with around 50% in the U.S. China will this year burn about 1.9 billion tons of coal, a 12% increase from last year, and consumption is expected to keep rising.

China is phasing in several measures to tackle air pollution. But soot plus sulfur dioxide and nitrogen oxides -- often referred to as "SOx and NOx" -- are understandably taking priority over mercury. Even with the existence of poisoned villages like Ms. Zhang's, other pollutants affect even more Chinese people. Airborne particulates are a suspected leading cause of respiratory disease around the country. Acid rain from sulfur dioxide now pelts a third of China's territory, a ratio that is "expanding, not shrinking," says Pan Yue, the deputy director of China's State Environmental Protection Administration, or SEPA.

Mr. Pan, an outspoken champion of stricter environmental standards, says there currently aren't any rules being drafted to address mercury. Asked if he is aware of recent studies linking Chinese emissions to mercury in American lakes and rivers, he nods.

"As for China's impact on surrounding countries, I'm first to admit the problem. But let's talk about this in the context of international fairness," he says, before firing rhetorical questions aimed at Washington: "Whose development model are we emulating? Who has been shifting all of its pollution-heavy factories to China? ... And who bears an even greater international responsibility than China -- but has yet to shoulder it -- on matters like greenhouse-gas emissions?"

Environmentalists say U.S. action to control its own mercury emissions from power plants has been sluggish. James Connaughton, head of the White House Council on Environmental Quality, counters that the Bush administration has promised by next March to announce regulations aimed specifically at restricting mercury emissions from coal plants, which he calls a "world first." The plan, which follows years of delays and lawsuits, is expected to include market-based trading of pollution credits among utilities and won't be implemented fully until 2018. Other technologies, such as flue gas desulfurisation, that remove some mercury while scrubbing other pollutants from coal have helped cut mercury emissions in Europe and North America.

Weak Incentive

On the face of it, China's new rules on sulfur dioxide should help combat emissions of mercury, too. Beijing is requiring many power plants approved after 1995 to install equipment that reduces sulfur dioxide, and such equipment often has a bonus effect of filtering out some mercury. China this summer also increased the fees that power plants must pay for each ton of sulfur dioxide they emit, hoping the change will give all coal-fired power plants an incentive to buy such equipment.

But the reality is that sheer increases in Chinese coal consumption, together with difficulty policing polluters, will more than offset whatever reductions in sulfur dioxide and mercury are achieved by the rules, experts say. For China, the economics of coal remain irresistible.

It's cheaper, and "with current global reserves, it probably wouldn't be a stretch to keep using coal another 200 years," says Fan Weitang, president of the China National Coal Association. Sitting in his Beijing headquarters at Coal Tower, a sleek new 22-story building, Mr. Fan is caught off guard by questions about mercury pollution. "It is hard for me to discuss that in depth," he says. Other pollutants like airborne particulates, and SOx and NOx, receive more attention, and "won't be much of a problem" in the near future, he promises.

That view isn't shared by Chinese scientists. " 'No problem'? Big problem," says Tang Dagang, head of atmospheric research at the Academy of Environmental Sciences, which is funded in part by SEPA. By the end of last year, only 5% of the installed capacity of coal-fired plants in China had technology to reduce sulfur dioxide, according to official statistics. While new rules will require the retrofitting of many plants with such technology, Mr. Tang says older plants that account for half of existing power-making capacity are exempt.

What's more, there is little economic incentive for power plants like Wuhu Shaoda, the company partly owned by AES, to further clean up its act.

Next year, Wuhu Shaoda will pay an estimated fee of $400,000 for the several thousand tons it is expected to emit of sulfur dioxide alone, according to an official with knowledge of the plant's emissions. That's much less than the $14.5 million engineers at the plant say it would cost to buy sulfur-dioxide-removal equipment.

August 28, 2002 *(New York Times)*

Saving Water, U.S. Farmers Are Worried They'll Go Dry

By DOUGLAS JEHL

PETERSBURG, Tex. — Ronnie Hopper grows cotton, and he has learned firsthand that water is precious. The water that he pumps from underground costs him five times as much as it used to, so he does his best not to waste a drop.

He has installed new, high-efficiency center-pivot sprinklers, designed to eliminate losses to evaporation. He has cut back on his planting on his 2,000-acre farm to concentrate water on fields that can use it best. He is even considering drip irrigation, water by the trickle.

Mr. Hopper has reason to be parsimonious. Though he lives atop one of the world's largest aquifers, the Ogallala, which spans eight states, it is falling every day. Here in dry northwest Texas, the problem is particularly acute, with declines of at least three times the average.

"Putting more wells in this particular ground would be like putting more straws in a glass," Mr. Hopper said, ruddy-faced in the Texas sun.

People have warned of the threat to the aquifer, which supplies roughly a quarter of the United States' irrigated farmland, for more than 20 years, and it is still in danger. But the experience of farmers like Mr. Hopper offers reasons both for hope and caution for those struggling to save scarce water elsewhere, and to arrest drastic declines in other underground supplies in places like India and China.

In a shift of much significance, per capita water use — on the rise in most of the rest of the world — is now declining in the United States. That retreat has been led by industrial users and farmers like Mr. Hopper, who began to save water through technology and conservation even before the recent years of drought, which this summer will affect more than a third of states.

Now, however, after years of conservation, these users now worry that whatever savings are achieved will only be lost to competition from fast-growing American cities and suburbs. Despite America's overall decline in water consumption, these booming population centers are making greater demands than ever on limited water supplies.

"We're coming to the reality that we may not have enough water to farm all of this land," Mr. Hopper said, in fields that stretched toward the pancake-flat horizon. "But we don't want anyone coming in and telling us that we don't know how to use it best."

By global standards, the United States remains one of the world's most gluttonous water users. But Americans' water use declined more than 20 percent from 1980 to 1995, to about 1,500 gallons of water per person a day from 1,900, according to the most current data from the United States Geological Survey, which says the downward trend appears to be continuing.

Today the depletion of the Ogallala — beneath parts of Nebraska, South Dakota, Wyoming, Colorado, New Mexico, Kansas, Oklahoma and Texas — has slowed to an extent not predicted by any forecasts. It is dropping by just a few inches a year on average, after averaging declines of about two feet a year since intensive irrigation began about 60 years ago.

Still, it is the outlook beyond their fields that makes farmers almost as anxious as the falling water levels beneath them.

In most of the country, farmers have primary water rights, ahead of suburbs and cities. But competition is intensifying. Texas, for instance, with rapid population growth and few restrictions on water use, is increasing its water consumption faster than any other state.

By 2050, Texas water planners say the state's population will leap to 40 million people from nearly 21 million in 2000. By the same year, the board has warned, Texas' supply of water, from existing sources, will be 19 percent less than it is today.

Given that imbalance, the Texas water board said, it would be unrealistic to think that the Ogallala could be sustained into the indefinite future. The aquifer should be treated like a mine, it said, and plumbed until it runs out. But then what?

Doing More With Less

At 58, Mr. Hopper remembers when water was so plentiful and the Ogallala lay so near the surface that conservation and cost barely entered his mind. But cotton is a thirsty plant, and out where he lives, farming has always been a marginal business.

On Mr. Hopper's farm, the aquifer, which stood 95 feet below the surface when he was a boy, now stands at 335 feet, with just 65 to go before it hits bottom. Now, he figures, his water bill (in electricity, for pumping from ever greater depths) accounts for a fifth of his overhead. Last year, he earned 52 cents an acre for his cotton, not enough to break even, and 20 cents of that came from the government.

Environmentalists call it a waste twice over: the United States produces a surplus of cotton, and pays subsidies to its farmers, yet in places like Texas the water-intensive crop is draining a finite water supply.

Still, water managers like those in Texas have resisted limiting farmers' water use — and often do not even gauge it.

"One of the goals, I think, of most of the producers here is to reduce the use of water," said Jim C. Conkwright, the general manager for the district based in Lubbock, which covers Mr. Hopper's farm. "But it's not something we can accomplish overnight."

Most water experts say the most urgent task is to find ways to do more with less. "If you become more efficient within reason, we can improve the situation in many places around the world," said Ben Dziegielewski, executive director of the International Water Resources Association.

Mr. Hopper says that is what he and many other farmers have done. American farmers who withdrew 2.9 feet of water for every irrigated acre in 1980 were making do with 2.6 feet by 1995, government statistics show.

The savings reflect efforts to eliminate losses from evaporation, wind and runoff, as Mr. Hopper has done by installing the center-point sprinklers. They deliver water closer to his cotton with about 95 percent efficiency, compared with about 50 percent for old-fashioned furrow irrigation.

With the savings in pumping costs, Mr. Hoppers says he has paid for his investment in just a few years. "It all comes down to economics," he said. "I'll take as good care of the land as I can afford to do."

But even as farmers like Mr. Hopper try to conserve, thirsty cities and suburbs in the region have begun to look to the Ogallala to meet their expanding water needs. By 2050, planners in Texas expect municipal water use to rise by nearly 67 percent.

The competition alarms farmers like Mr. Hopper, who argues that the cities have no claim on the aquifer at all. "Who are they to say that farming is not the most beneficial use?" Mr. Hopper asked.

Controlling Water's Use

In places like Petersburg, there is much talk these days about what is unfolding near Abilene, to the north, as a possible barometer of the future. There, the wealthy investor Boone Pickens and his company, Mesa Water Inc., own farmland, and their plan is to pump the water from underground and sell it to other parts of the state.

Over a lunch of cheeseburgers and tater tots smothered in chili and cheese, Craig Heinrich, 38, who grows cotton himself, was among the local farmers who said he just did not know what to think of the plan.

"If they're going to pump all that water out of the aquifer, it's going to have a real impact on farming," he said. "But if they start telling him what he can and can't do with his water, they'll be telling us next."

Telling people how to use their water, something many see as a natural right, is a sensitive issue. In Texas and most other Ogallala states, landowners still have the final say over how and how much of the water beneath their land they should use.

But in Nebraska, local water districts have taken the authority to limit how much water can be used for crops.

"As we restrict the water supply, the irrigators are more or less required to use the water as efficiently as they can," said Bob Hipple, general manager of a water district in Nebraska's southwest. There, to supplement rainfall, farmers may use just 14.5 inches of underground water per acre per year, down from 22 inches a year in 1980, when the limits were first imposed.

But such restrictions have for the most part been left to states to apply. The federal government has mostly limited its own efforts to promote conservation to making grants available to help farmers switch to more efficient irrigation.

For now, states like Texas seem comfortable with the idea that conservation will more or less take care of itself.

Over the next 50 years, Texas' water board expects rising pumping costs to push some farmers out of business. That, it hopes, will free up increasing amounts of Ogallala water. To water managers like Mr. Hipple in Nebraska, though, such projections seem optimistic and and misplaced.

"When I was in Vietnam," he said, "we used to kid about the idea that we might as well live fast, die young and leave a good-looking corpse. An area can let everyone pump all the water they want, or it can say, perhaps it is better to live slower, live to be older and look as good as you can along the way."

May 2, 2004 *(New York Times)*

Drought Settles In, Lake Shrinks and West's Worries Grow

By KIRK JOHNSON and DEAN E. MURPHY

PAGE, Ariz. — At five years and counting, the drought that has parched much of the West is getting much harder to shrug off as a blip.

Those who worry most about the future of the West — politicians, scientists, business leaders, city planners and environmentalists — are increasingly realizing that a world of eternally blue skies and meager mountain snowpacks may not be a passing phenomenon but rather the return of a harsh climatic norm.

Continuing research into drought cycles over the last 800 years bears this out, strongly suggesting that the relatively wet weather across much of the West during the 20th century was a fluke. In other words, scientists who study tree rings and ocean temperatures say, the development of the modern urbanized West — one of the biggest growth spurts in the nation's history — may have been based on a colossal miscalculation.

That shift is shaking many assumptions about how the West is run. Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, the states that depend on the Colorado River, are preparing for the possibility of water shortages for the first time since the Hoover Dam was built in the 1930's to control the river's flow. The top water official of the Bush administration, Bennett W. Raley, said recently that the federal government might step in if the states could not decide among themselves how to cope with dwindling supplies, a threat that riled local officials but underscored the growing urgency.

"Before this drought, we had 20 years of a wet cycle and 20 years of the most growth ever," said John R. D'Antonio, the New Mexico State engineer, who is scrambling to find new water supplies for the suburbs of Albuquerque that did not exist a generation ago.

The latest blow was paltry snowfall during March in the Rocky Mountains, pushing down runoff projections for the Colorado River this year to 55 percent of average. Snowmelt is the lifeblood of the river, which provides municipal water from Denver to Los Angeles and irrigates millions of acres of farmland. The period since 1999 is now officially the driest in the 98 years of recorded history of the Colorado River, according to the United States Geological Survey.

"March was a huge wake-up call as to the need to move at an accelerated pace," said Mr. Raley, assistant secretary of the interior for water and science.

Losing Water at Lake Powell

Some of the biggest water worries are focused here on Lake Powell, the vast blue diamond of deep water that government engineers created in one of the driest and most remote areas of the country beginning in the 1950's. From its inception, Lake Powell, the nation's second-largest artificial lake, after Lake Mead in Nevada, was a powerful symbol across the West. Some saw it as a statement of human will and know-how, others of arrogance.

Powell, part of the Glen Canyon National Recreation Area, has lost nearly 60 percent of its water and is now about the size it was during the Watergate hearings in 1973, when it was still filling up. White cliffs 10 stories high, bleached by salts from the lake and stranded above the water, line its side canyons. Elsewhere, retreating waters have exposed mountains of sediment.

The tourist economy here in Page has been battered. The National Park Service, which operates the recreation area, has spent millions of dollars in recent years just to lay concrete for boat-launch ramps that must be extended every year, a process that one marina operator here called "chasing water."

Daniel C. McCool, a professor of political science at the University of Utah and director of the American West Center, says Powell is the barometer of the drought because what has happened here is as much about politics, economics and the interlocking system of rules and rights called the law of the river as it is about meteorology.

Part of the lake's problem, for example, dates to a miscalculation in 1922, when hydrologists overestimated the average flow of the Colorado River and locked the number into a multistate agreement called the Colorado River Compact. The compact, along with a subsequent treaty with Mexico, requires Lake Powell to release 8.23 million acre-feet of water each year below the river's dam, Glen Canyon, no matter how much comes in.

Because the river's real average flow was less than the 1922 compact envisioned, Powell very often released more than half of the water the Colorado River delivered. But it did not really matter because the upper basin states were not using their share. Now, communities from Denver to Salt Lake City and Indian tribes with old water rights in their portfolios are stepping forward to stake their claims. Lake Powell, which has been called the aquatic piggy bank of the upper West, is overdrawn.

If water levels continue to fall, Powell will be unable to generate electricity as early as 2007 or sooner, some hydrologists say. And it would be reduced more or less to the old riverbed channel of the Colorado River not long after that. Even now, the lake's managers say, it would take a decade of historically normal rainfall to refill it.

"If we're only in the middle of this drought, then Lake Powell might be very close to some very dramatic problems," said Dr. John C. Dohrenwend, a retired geologist for the Geological Survey who lives near the lake.

Insufficient water for the Glen Canyon Dam turbines would be only the beginning. At that point, much of the lake bottom would be exposed, creating a vast environment for noxious weeds like tamarisk and thistle. The next step in the spiral would come at what is called "dead pool," where decades' worth of agricultural chemicals at the lake bottom would begin mixing more actively with the reactivated river. The question then, environmentalists say, is what would happen to the Grand Canyon, just south of the dam.

An Issue That May Go to Congress

"Americans won't stand for the Grand Canyon being endangered," said John Weisheit, the conservation director for Living Rivers, an environmental group in Moab, Utah, that advocates removing the dam at Glen Canyon and allowing the river to return to its natural course. "In another year, they're going to be talking more seriously about Powell in Congress."

But the fact is, no one knows: the weather could change tomorrow. Many past Western droughts have ended suddenly, with a bang of precipitation. But some dry spells persisted for generations. From about 900 to 1300, scientists say, periodic drought in the West was the norm. Only a few times during that period, according to tree-growth measurements, was precipitation anywhere near the relatively high levels of the 20th century.

"What is unusual is not the drought periods, but the above-average wet periods," said Dr. Robert Webb, a hydrologist with the Geological Survey who specializes in the Colorado River.

The uncertainty has local, state and federal officials along the 1,450-mile river scurrying to secure water allotments while also preparing for the worst.

Already in Las Vegas, the regional water agency is removing the equivalent of a football field of grass every day from front lawns, playgrounds and golf courses to save on outdoor watering. Farther downriver, Arizona officials are pumping billions of gallons of water into aquifers to save for an even less rainy day.

Electricity has become a concern. The Western Area Power Administration, the federal agency that distributes power from hydroelectric projects in the Rocky Mountain West, plans to reduce by about 25 percent the amount of electricity it can promise in future years.

Conserving on a Large Scale

In Los Angeles, a representative from the West's largest urban water agency, the Metropolitan Water District of Southern California, is among a group of Western water officials dusting off plans to help limit evaporation from reservoirs, which could save billions of gallons. One idea is to pour a nontoxic substance over the reservoirs to form a water-trapping barrier.

The group, which has been holding meetings, is even looking at far-off solutions like raising the height of Hoover Dam so that more water could be collected and saved during wet times.

"We understand we have a problem and we are working on it," said the Los Angeles representative, Dennis Underwood, a former head of the federal Bureau of Reclamation, which oversees dams and reservoirs in the West.

There are also worries downstream from Powell at Lake Mead, which serves Nevada, Arizona and California. It could drop low enough as early as next year to force officials to declare a drought emergency. That would hurt the booming southern Nevada economy through significantly higher water rates and outright bans on things like new swimming pools, said Patricia Mulroy, general manager of the Southern Nevada Water Authority.

Mr. Raley of the Interior Department said he wanted the states to consider a water bank, in which unused water could be leased or sold across state lines. Some previous efforts to create banks, with federal oversight, have been contentious because they were seen by smaller states as a means to funnel more of the river to water-guzzling California.

But the notion of cutting private water deals on the Colorado is gaining broader acceptance, in large part because of the drought. The most celebrated example was a deal last year to sell irrigation water in the Imperial Valley of Southern California to the urban water district in San Diego.

Some advocates for agriculture fear that water-to-the-highest-bidder could ravage ranches and farms if owners were induced to sell their irrigation rights. But private-market supporters say the truth, like it or not, is that farmers own most of the West's water, and ultimately there will be fewer of them.

There is some concern that if the Colorado River goes into crisis, the ensuing tangle of litigation over water rights, endangered species and border disputes could undo the system of Western water law that has evolved over the last 100 years.

Some say that would be a good thing.

"The law of the river is hopelessly, irretrievably obsolete, designed on a hydrological fallacy, around an agrarian West that no longer exists," Professor McCool at the University of Utah said. "After six years of drought, somebody will have to say the emperor has no clothes."

Water officials in Arizona and Nevada say they would also like to rethink the law of the river to put their states on a more equal footing in sharing the Colorado River. But Mr. Raley said such talk invites disaster and chaos, especially during a drought.

"This isn't the time to plunge into chaos," he said.

Other people who live here on the fringe of Lake Powell say that the West's great reservoirs have, in their very decline, proved their value in stretching out limited water resources and underlined the difference between past civilizations here that anthropologists say were wiped out or displaced by drought.

"Those people back then had nothing to catch and save their water — now we do," said Ronald W. Thompson, district manager of the Washington County Water Conservancy District in southwestern Utah.

"I'm a believer that history repeats itself — long-term drought could return," Mr. Thompson said. "But I suspect our civilization can weather this."

Kirk Johnson reported from Page, Ariz., for this article and Dean E. Murphy from Grand Canyon National Park.

August 27, 2002 *(New York Times)*

Chinese Will Move Waters to Quench Thirst of Cities

By ERIK ECKHOLM

DANJIANGKOU, China — The booming cities of northern China are parched and constrained by a growing shortage of water. Yet in China's rainy south, the mighty Yangtze River pours vast volumes, unused, into the sea.

So why not, Chinese leaders have long asked, cross the country with new canals, bringing that "wasted" water to where it is vitally needed for the country's progress?

In a world short of fresh water, one of the gravest challenges facing governments is that needs and supplies are often far apart. Now China, with water scarcity reaching the critical stage in sprawling showcase cities like Beijing and Tianjin, has embarked on one of history's great water-moving projects.

At huge cost and great risk to the environment, the government plans to rechannel vast rivers of water from the Yangtze basin to the thirsty north, over three pathways of nearly 1,000 miles each. The official price tag of $58 billion, nearly half to be spent in the next eight years, is more than twice that of the Three Gorges Dam, China's most recent mega-project now nearing completion.

Some officials speak of delivering new waters to a "green Beijing" in time for the 2008 Olympics, an indication of the political overtones of the project as well as the crash timetable.

"We have to sacrifice so that people in Beijing can drink water," said Zhang Jize, a 32-year-old farmer and father of two daughters who is among 370,000 people the plan will uproot.

Such immense, centrally planned projects have been tried before, notably in Central Asia, where a Soviet-era plan has steadily drained the Aral Sea, turning what was one of the world's largest inland bodies of water into a salty desert and providing a vivid illustration of the dangers of bending nature to economic needs.

But China, convinced of its future as a great power, believes the project is essential. Some have drawn parallels to the great water works of the United States, like the Tennessee Valley Authority that spurred rural development beginning in the 1930's or, more appropriately, the canals that took northern waters to fuel fantastic growth in arid Southern California. But the Chinese project is on an even grander scale.

Like China's construction of the Three Gorges Dam, which set off global debate, this latest venture raises a host of tough questions, including how to deliver clean water across one of the world's most polluted landscapes.

Perhaps toughest of all, in a country where no good patch of land lies idle, is how to provide for those like Mr. Zhang and his family who will be moved.

For Mr. Zhang and many others who live around the Danjiangkou Reservoir — a linchpin of the new project — it is not the first time they are being displaced, and their travails parallel China's expanding ambition to meet its water needs.

Some 30 years back, when Mr. Zhang was a toddler and the dam was first completed, he and his parents were sent from their fertile valley plot to a remote spot on the banks of the new lake, receiving little compensation for their troubles.

"Life is too hard here," he recently told a visitor, gathering with his family in their house with walls of wood and packed earth, covered with old calendars and newspapers.

As the government makes its plans for a new mass move, bitterness survives from those earlier rounds of resettlements. Party leaders know that the issue could be explosive if not handled with more care than during past projects, including the Three Gorges Dam project, which will eventually displace more than a million people.

Chinese officials have often glossed over the challenges in public, and most planning has taken place entirely behind closed doors. But they and their scientists are working feverishly on a host of issues as construction of two routes is expected to begin in the coming year.

Northern cities have begun to raise water prices for consumers and reduce waste, vital steps if the project is to provide lasting solutions. Provinces, meanwhile, are already fighting over how the water will be shared, because some of the delivered waters will require expensive cleansing.

"If we're given smelly water and Beijing receives all the clean water, it will be bad for our image and our living standards," said a city engineer in Tianjin, a teeming city of 10 million that desperately needs new water but fears the expense.

The demand has become urgent throughout the densely populated north-central plains, home to metropolises like Tianjin and Beijing, with a population of 13 million, as well as dozens of smaller cities that are bursting with people and construction.

Over-pumping of groundwater in the region has forced people to probe deeper for wells every year, and in some areas has caused disastrous sinking of land. Urban consumers take scarce water from farmers, while planners warn of smothering new restrictions on industry.

Much of China's arid northwest, at the same time, is turning into a dust bowl, its land destroyed by drought and overuse and its residents caught in desperate poverty.

3 Routes and Numerous Detours

Each of the three routes envisioned to bring water to these thirsty areas has its own challenges.

Of these, the western route is most tentative, with construction scheduled to start in 2010. It would channel water from upper tributaries of the Yangtze to China's arid, needy northwest. But as it takes water from Tibetan regions it may stir political controversy, and it poses severe engineering challenges and awesome costs. The current estimates are $36 billion for this spur alone.

The eastern, coastal route is technically simple, though it will require 13 pumping stations, which will consume large amounts of electricity to lift water from near the mouth of the Yangtze to the higher north. It will save costs by following much of the same path as the ancient Grand Canal — second only to the Great Wall as a wonder of Imperial China — that once moved silk and rice from the south to Beijing.

The main challenge is pollution. The route cuts across many of the world's most soiled river basins. Along the hundreds of miles of the canal that is still in use, it bustles with barges carrying sand, coal and other goods. Its shores are lined with primitive houseboats, home to hundreds of thousands of people who rely on the canal for work and waste disposal as well as living space. The waterway also receives untreated sewage from hundreds of nearby towns and villages and the effluence of thousands of factories.

"If you drink the water you get rashes and diarrhea," said Cui Xiao, 38, who had docked his sand barge at Pizhou, within sight of the waste of a chemical fertilizer factory that gushed into the stream. "You can't even use the canal water for washing."

Some scientists are quietly asking how the coastal route can ever affordably deliver water that will be safe enough even for industry, let alone drinking.

The cleanup plans, to the extent they have been disclosed, stretch credibility. They include the forced closure of thousands of dirty factories that line the canal's route, many of which are owned by local governments that have evaded controls in the past.

The government is also mobilizing to build sewage treatment plants in each of 119 counties along the canal, a leading water expert said, itself a mammoth undertaking in the hurried time frame.

The people who live on the canal all expressed hope that the water project would give them an economic lift. But the government has not said what is to become of this decrepit flotilla and the multitudes who live on or near the canal.

Along the final, central route, officials say that pollution will not be a problem. But there are other challenges.

This plan calls for diverting water north from the Han River, a tributary of the Yangtze, by constructing a new canal. But to do so the Danjiangkou dam and reservoir will have to be raised, displacing about 300,000 villagers in Hubei and Henan Provinces, like Mr. Zhang, the farmer.

Even then, many engineers say, the reservoir will not hold enough water both to feed the north and to meet regional needs. Its waters will have to be replenished by a new feeder canal, built across mountains at enormous expense, to bring water from the new Three Gorges Dam — in turn reducing its electrical capacity by 6 percent or more.

Waiting for Another Moving Day

Earlier this year, sign painters traveled along the banks of the Danjiangkou Reservoir and splashed a new slogan in big blue characters on village walls urging people to support "the project," alongside the usual appeals to limit births, trust in the Communist Party and pay taxes.

Long aware of the water-transfer plans, hundreds of thousands of people near the reservoir have waited a decade or more in limbo, putting off home repairs or construction and sometimes postponing marriages.

Now, with that day apparently approaching, many are fearful.

Local television has carried announcements that people should prepare for orders to vacate homes, and county officials have taken a census of households and assessed property. But villagers still have heard nothing about the terms of the relocation.

There are not many options. The hilly region around the lake is badly overcrowded, and entire families live off less than an acre each. The new moves may cause destruction of forests and grasslands and will require costly efforts to bring safe drinking water, electricity and roads to those moved.

In the 1970's, 270,000 people in rich valley lands had to make way for the reservoir as it was filled. Their compensation was paltry, if they received any at all.

Many are still fuming. Rao Fumin, a 58-year-old man whose family was moved first in 1958 and then three more times, can hardly contain his fury. "We were moved around like prisoners," he said.

His legs now crippled by arthritis, Mr. Rao lives with his sister near the foot of the Danjiangkou Dam itself, subsisting on a monthly $12 welfare payment.

"We never see a cent of the resettlement money," he said. "All these city, county, town and village officials stuff the money into their own pockets."

If he doesn't get more aid this year, he said, "I'll hang myself at the gateway of the Danjiangkou City Party Committee."

The comments suggest the potential for fresh anger facing a government that in any case sees little choice but to push ahead with the plan. Even many of those who will be most affected, like Mr. Zhang, are resigned.

"We don't know when or where we'll move, but we just hope we get some decent farmland," Mr. Zhang said, exchanging a nervous glance with his wife. "We're all just waiting to hear what will happen to us.

"This is central government policy," he added stoically, "so it must be a good thing for the country."

June 9, 2003 *(New York Times)*

As a Dam Closes, Chinese Tally Gain and Loss

By ERIK ECKHOLM

FENGJIE, China, June 7 — There's an odd calm along this part of the Yangtze, no jubilation and no weeping, as the tawny waters lap several feet higher each day and a 350-mile stretch of this mightiest of rivers is finally transformed into a long narrow lake.

After decades of bitter debate, years of heavy construction and the uprooting so far of 700,000 people, the Three Gorges Dam has closed its gates.

On June 15, the reservoir will be filled to its interim level of 135 meters, or 443 feet above sea level. The next day, the first commercial ships will pass through the locks, heralding the eventual passage of ocean vessels hundreds of miles upstream to Chongqing, a booming metropolis in central China.

In August, two initial turbines from what will be the world's most colossal array of generators are to start spinning electricity — a down payment on the promised riches from a $25 billion megaproject with gains and perils that may be forever disputed.

"For the country as a whole, this project might be worthwhile," said Yang Hongwen, who runs an ailing small business in Fengjie, a city some 150 miles upstream of the dam.

"But from the perspective of the ordinary people around here, it was a mistake," he said, surveying what had been the lower half of a lively town of 100,000 and now resembles ground zero of an atomic blast, flattened for service as the lake bed and teems with people slaving to scavenge every ounce of steel.

Many of those resettled up to now — another 430,000 or more people must be moved from the area before the project is completed in 2009 — are already hurting for good land or jobs. For some longtime residents like Mr. Yang, nostalgia runs deep for the lost ancient city and the nearby scenic gorges that will soon be a little less deep and majestic.

But not everyone is unhappy. In a pattern repeated throughout China in this age of ebullient construction, the quick and the connected are making out fine, while the slow, the poor and the aged eat dust.

A few miles up river from the old town, a bright, new, high-rise Fengjie has sprung up in a miraculous six years. It is already home to 80,000 people and starting to bustle with characteristic Sichuanese color and cheer. Throughout the region, some enterprising types have made fortunes off the billions being spent on new towns, highways and bridges.

Worried most about their own livelihoods, few people here share Mr. Yang's concerns for the loss of scenery or cultural relics or the effects on the environment downstream, and few have thought about the pollution that many experts now see as the biggest headache for the project. Already, with the river waters stilled for little more than a week, a jump has been registered in E. coli, the bacterial marker of sewage contamination.

The closing of the dam on June 1 was a key turning point in a project that, by 2009, will see the lake surface raised by yet another 130 feet, flooding huge additional areas of town and country.

A visionary project long ago extolled long ago by Mao Zedong himself, the dam has come to symbolize the Chinese Communist Party's drive to conquer nature, and it is still touted as the mark of a great nation's arrival.

Any grandeur is hard to find in the fractured old town of Fengjie. A half-mile-wide swath of what had been a dense, decrepit, but happy warren of homes and markets and small factories has been blasted to rubble.

Here, the giant engineering project has produced a scene out of the 19th century. Hundreds of men and women pound away at the tangled sea of concrete with picks and sledgehammers and bare hands, salvaging steel rods and bricks to earn perhaps $25 for a month of work.

Li Shinli, 51, heaved his pick under a slab of concrete that hung dangerously above him but was tantalizingly replete with steel rods.

"I'm trying to save up some money so my son can go to college," said Mr. Li, who like many of the rock-pile workers was from a nearby village where he earns little from growing grain.

"Yes this is dangerous," he said, waving to the hovering slab, "but we can't do anything about that."

"The people in my village don't really have any strong feelings about the dam," he said. "But at least it has given us a chance to earn a little money."

Shopkeepers and remaining residents on the ragged new edge of the dying town, laggards who will mostly have to move in the next year or two, grumble about stingy relocation funds and corruption.

"We've lived here for 20 years and this is our home," said Li Changshu, a woman in her late 50's who runs a small herb shop just yards from the edge of the rubble. By this week, she was more resigned than angry.

Because she and her husband never did obtain official classification as urban residents, she said, they have not been given an apartment or shop in the new city, as more fortunate Fengjie residents were. Now they wait for the paltrier compensation being offered to farmers and wonder, she said, where they will end up.

"There are lots of people here in this position," said Mrs. Li, who added with a chuckle that over the years she has sold aphrodisiacs from this now-condemned spot to all kinds of characters, police chiefs and criminals alike.

Like megaprojects anywhere, this one has been dogged by controversy and its true costs and benefits are as murky as the silt-laden Yangtze waters.

The benefits to shipping seem clear enough, though some worry about a potentially disastrous build-up of silt at the reservoir head near Chongqing.

As the world's largest hydroelectric project, if all goes to plan, the dam will support China's development and replace dozens of large coal or nuclear plants, an environmental plus.

The 1.4-mile wide dam, promoters long claimed, will tame the floods that have devastated the Yangtze basin for millennia. Hydrologists now say it will prevent some floods but that others, such as the most recent disastrous surge in 1998, may be little affected because they rise from swollen tributaries downstream of the dam.

The famed Three Gorges, honored through the centuries by painters and poets, will be diminished but still an attraction. Hundreds of tourist ships, now docked because of SARS fears, expect to ply the new lake.

Perhaps the greater cultural loss will be the archaeological sites, graves and temples that are being inundated. Some of the most prominent temples and relics have been moved, but countless more, including those never excavated, will be lost for good.

One of the chief sites, the White Emperor Temple, is on a hilltop near Fengjie, at the entrance to the famed gorges. Its main buildings lie just above the water line projected for 2009, but some lower buildings have already had to be demolished. A cave that had contained an important Buddhist sculpture has been cemented over, the figurine cut off the rock and moved.

"The temples and relics aren't a problem because they are being taken to high ground," said Pu Dongping, a 40-year-old rural woman who was overseeing construction of a huge retaining wall on the hillside below the temple.

Eighteen years ago, as early construction began, her husband parlayed his building skills into contracts that have gradually become larger and more complex. "We were just ordinary farmers, but we've gotten rich from the Three Gorges project," she said.

Within the last several years, as it became clear that the dam would actually be built, scientists have raised grave concerns about the industrial poisons, farm chemicals and sewage that have long poured into the Yangtze and out to the sea.

The government has belatedly scrambled to curb pollution and has plans for at least 19 new sewage treatment plants along the upper Yangtze, mainly in larger cities, but most are not yet complete, said Lei Xiongshu, a retired engineering professor, former national legislator and longtime skeptic about the dam.

"It's not enough just to have treatment plants," he said in a telephone interview. "You need to insure that all industrial and domestic waste, including sewage, is diverted to them for proper treatment, and we're a long way from that."

Already, he said, worrisome levels of E. coli bacteria have been registered in water backing up from the dam, which may render the lake water undrinkable.

But so far, the most nettlesome problem has been the resettlement of hundreds of thousands in a region of steep, overexploited land and a country with little empty arable areas.

According to official estimates, close to 700,000 people have already been moved, some to new and existing cities, some to farming areas and some to distant provinces. By 2009, officials say, the number must reach 1.13 million, including many people like Mrs. Li, in Fengjie, who have no obvious place to go.

March 10, 2004 *(New York Times)*

Dam Building Threatens China's 'Grand Canyon'

By JIM YARDLEY

DIMALUO, China — The highest villages in the mountains above the Nu River seem to hang in the air. Farmers grow cabbage and corn nearly a quarter-mile up, as if cultivating ski slopes. Necessity has pushed them into the sky; land is precious along the river.

They may have to move higher still, perhaps into the clouds.

The Nu, which flows through a region that is home to old-growth forests, some 7,000 species of plants and 80 rare or endangered animal species, is the latest waterway coveted by a Chinese government that is planning to build a new generation of dams to help power its relentless, booming economy.

Unlike the Three Gorges Dam, the world's largest hydroelectric project and the subject of a bitter international debate, the Nu River plan has barely stirred a ripple outside China. But in China the project, which calls for 13 dams in all, has unexpectedly touched a nascent chord of environmental awareness and provoked rare public rifts within the government.

The reason is that the Nu is one of the last pristine rivers in one of the world's most polluted countries, running through a canyon region unlike any other, which a United Nations agency has designated a World Heritage Site. Last year, China's State Environmental Protection Agency and the Chinese Academy of Sciences publicly criticized the Nu project.

"If this river system is destroyed, it would be a terrible blow," said Li Bosheng, a prominent Chinese botanist. "This area has been called the Grand Canyon of the Orient. It forms one of the world's most special canyon environments."

For China, which already has more large dams than any other country, environmental awareness has been slowly growing since the long fight over the Three Gorges, where ground was broken a decade ago for a project that will cost at least $25 billion and displace more than a million people by the time it is finished in 2009.

No estimate has been made public for the cost of the Nu project. In Yunnan Province in southwest China, the Nu project would force the relocation of as many as 50,000 people, many descended from Lisu, Nu, Drung, Tibetan and other ethnic hill people. Many are farmers and herders who cannot speak Chinese and who choose to live on the land as their ancestors did.

"If people are forced to move around because of the projects, they are going to lose the way of life that makes them special," said one villager, Alou, an ethnic Tibetan. "It's inevitable that people will lose their traditions if they move away."

From its beginnings in the Tibetan high plateau, the Nu runs through one of China's most remote areas as it carves canyons through the rugged mountain ranges east of the Himalayas. It drops like a roller coaster, a descent of nearly a mile, plunging through gorges as the powerful current scrapes boulders white, as if with a steel brush.

Nor is it alone. It is in the family of rivers flowing out of the Tibetan plateau that become some of the most celebrated and important waterways in Asia: the Dulong, which becomes the Irrawaddy in Myanmar, formerly Burma; the Jinsha, which becomes the Yangtze; the Lancang, which turns into the Mekong in Southeast Asia; and the Nu, which becomes the Salween as it flows into Myanmar and along the border with Thailand.

China is moving to tighten its grip on many of these rivers. It has already drawn downstream protests for dam projects on the upper reaches of the Mekong. Plans are also under way to build

several major new dams on the Jinsha nicknamed the "Double Three Gorges" because combined, they would generate twice as much power as the earlier project.

Opponents of the Nu project say their best chance may be to influence the project rather than to stop it. The political momentum to develop such projects in China is simply too powerful, particularly because China is facing a growing energy shortage.

The country is outstripping its power supply and suffering isolated blackouts and power shortages. It is also under heavy international pressure to shift from dirtier coal to cleaner energy sources.

But to critics, the government's answer to its energy problems — developing the vast natural resources in China's west to power the economic boom in the east — smacks of naked exploitation. Chinese environmentalists warn that China will have nowhere left unspoiled for future generations.

"The west development program has turned into the west destruction," said Wu Dengming, whose environmental group, the Chongqing Green Volunteer Union, collected 15,000 petition signatures opposing the Nu dams.

In early February, the switchback trails slicing up the mountains above the Nu in Yunnan were filled with villagers lugging pieces of roofing to mend their houses.

Village women washed their hair in the drainage ditch by the river, while a small boy used a bamboo pole to practice his calligraphy in the road. Many villagers still lived in huts built with strips of woven bamboo.

Hu Huashen lived in Yonglaga, a village of about 200 people on the coveted level land by the riverbank. He walked lightly down a concrete irrigation ditch, past wooden shacks built on stilts above pens of pigs and chickens, before stopping at a small tongue of land. He said that land, maybe three or four acres, allowed his village to survive.

"These fields may be flooded, and then we've got to move up in the hills," said Mr. Hu, a teacher. "What can we plant up there?"

Most villagers, he said, have no idea where the dams are to be built or whether their village will have to move. "It's useless caring anyway, because nobody cares what we think," Mr. Hu said. "If the government wants to go ahead with dams, there's nothing peasants can do about it."

Resettlement is always a bitter issue in dam projects, and villagers often complain that officials do not fully deliver promised compensation and other benefits. Wu Fan, a provincial official in Yunnan, said people from the Nu River would be resettled in nearby townships.

"They shouldn't be living totally detached from the modern world," said Mr. Wu, a deputy director general of the Yunnan Development Planning Commission. "If it were not for the founding of the People's Republic, these people would still be living a primitive way of life, like monkeys or ape-men."

Unemployment is a huge problem in China, and the Nu River prefecture is among the country's poorest. Half of the population earns less than $80 a year. Mr. Wu, though, predicted that the resettled villagers, many of them illiterate and untrained in anything other than farming, would quickly find work.

"They can either join the tourism industry, the service industry or a tertiary industry," he said. "That will raise their incomes."

In winter the Nu changes from blue to jade to milky green, turning yellowish brown only after the river rises with the spring melt. The river's humid upper reaches pass through Gaoligongshan National Park, considered one of the world's least disturbed temperate ecosystems, where the cliffs are thick with ferns and leafy stalks of bamboo that rise like green plumed fingers.

The area designated a World Heritage Site, located in this region, is named the Three Parallel Rivers, because the Jinsha, Lancang and Nu run beside one another, in some stretches carving gorges nearly two miles deep.

At least a fourth of China's indigenous plant species and half of its native animal species can be found here, including the snow leopard.

"It is one of the most biodiverse regions in the world," said Edward Norton of the Nature Conservancy, which is acting as a consultant to the Chinese government in developing Gaoligongshan as a national nature preserve.

The dam proposal became public last August after reports appeared in the Chinese news media, including China Environment News, the official newspaper of the national environmental agency. It ran several front-page articles, including one titled "The Pristine Environment of the Nu River Should Be Preserved."

Experts who attended closed government-sponsored meetings on the project said the fact that critics were allowed to voice concerns represented a significant change for China. Still, they expect the project to be approved in some form and are pushing for an independent environmental review and other safeguards.

Mr. Wu, the Yunnan official, said the government was committed to environmental protection. He said that relocating villagers would end slash-and-burn farming and added that hydropower was a "clean" power source that would generate the annual equivalent of 37 million tons of coal. "We should not go to extremes in terms of either environmental protection or development," Mr. Wu said.

Up in the mountains, the village of Dimaluo may already be glimpsing the future. A few months ago workers began building a dam on a tributary that flows from a glacier. The dam, separate from the Nu project, came with little warning, and officials have not explained what will happen to the 20 families that must move to higher ground.

Alou, the villager who has been critical of the dams, said officials had promised that the dams would create jobs and provide more electricity, but he is skeptical.

"As far as I can see, no jobs will go to the locals," said Alou, who like many Tibetans uses only one name. "The reason is local education hasn't kept up with the modern world."

The 2,400 villagers in Dimaluo are divided among Lisu, Nu and Tibetans, many of whom live in wooden shacks where dirt pits are built on the wood floors so that fires can be lighted for cooking and heat. "We're used to life here, so we don't find it very difficult," said one woman, Ba Wenhua. "The river gives us water to drink, and the mountain gives us food to eat."

Aluo says he doubts that many villagers would ever leave the only life they have ever known. He has earned extra money as a tracking guide, and environmentalists are pushing eco-tourism as a way to lift living standards along the Nu. But Aluo doubts that eco-tourism alone is a solution and says the dam will be even worse. "I told villagers that it's going to be like dropping an atomic bomb on the village," he said.

September 2, 2003

Yosemite and the Invention of Wilderness

By JAMES GORMAN

YOSEMITE NATIONAL PARK, Calif. — Rebecca Solnit is something of a connoisseur of place. She is a writer, an environmentalist and a hiker, a free-range intellectual who dislikes boundaries and enjoys deserts and digressions.

At the moment, she is following the trail of the American idea of wilderness, through libraries and up rock faces, in archives and lakes.

Lake Tenaya is her kind of place — 11 acres of cool water in a glacier-carved bowl just off the main park road here and surrounded by granite domes, pine forest and intellectual history.

It draws the eye, and that is why it became a famous subject for landscape photographers like Eadweard Muybridge, Ansel Adams, Edward Weston and uncounted others, professional and amateur.

And it draws the mind. If you look into the water from some vantage points, you can see its physical history — remnants of a thousand-year-old forest, stumps rooted in the lake bottom, left over from an ancient drought when the lake was dry.

If you look into the murkier waters of written history you find other old stumps with powerful roots, like the notion of nature as pure and untouched, virgin, in the common metaphor of the 19th century. Lake Tenaya is one of those places, Ms. Solnit says, where the American idea of pristine wilderness was formed. And that idea, she argues, is a powerful, profoundly mistaken fantasy that has left a mark on everything from landscape photography to forest management. Only in recent years has it begun to fade, she says, to be replaced by a more complex and realistic view of the natural world.

"For me, this place is amazing," Ms. Solnit said, "because you have the visible scientific history, of climate, of geology, etc. But you also have these indigenous histories, these environmental histories, these photographic histories, so that Tenaya, which is so uneventful, is just this incredible crossroads for a huge number of narratives and characters."

Her own history with the lake goes back a dozen years, to a time when she was working on her 1994 book, "Savage Dreams: A Journey Into the Landscape Wars of the American West." She revisited it briefly in "River of Shadows: Eadweard Muybridge and the Technological Wild West."

For three summers, she has been back plumbing Tenaya's figurative depths again with two photographers. She expects their collaboration of text and photographs to be published as a book in 2005.

She is working with Mark Klett, a regents professor of art at Arizona State University, and Byron Wolfe, an assistant professor of communication design at California State University at Chico. Mr. Klett started the Rephotographic Survey Project in the late 1970's to take pictures of sites first photographed as part of a government survey in the 19th century.

Mr. Wolfe joined Mr. Klett 20 years later in another return to the same sites, called Third View: A Rephotographic Survey of the American West.

The work with Ms. Solnit is somewhat different, because they are rephotographing not survey images but some of the great landscape photographs of the 19th and 20th centuries, photographs that were influenced by the idea of the wild and themselves helped form it.

In "Savage Dreams," Ms. Solnit discussed her decision to concentrate on Lake Tenaya.

"Yosemite," she wrote, "is the very crucible and touchstone for American landscape, and I thought that if I could understand what happened at this lake within it, I could begin to see into the peculiarities, blindnesses, raptures and problems that constitute the Euro-American experience of landscape."

What she found was a view of nature, expressed in writing and photographs, that did not include people. And that, she wrote, is how Americans have come to think of the natural world. There is a small problem with this view. When white Americans first encountered Yosemite, it was a well-peopled landscape. It took soldiers to un-people it.

The Yosemite Valley and the area near Lake Tenaya were home to the Ahwahneechee Indians. But the gold rush was on, the future beckoned, and Indians did not fit in.

In 1851, the Mariposa brigade drove them away, killing some and relocating the rest. In an act that Ms. Solnit finds astonishing, the soldiers named the lake after the chief at the very moment they were removing him from the land. They informed him of the name change as a kind of honor.

He replied, Ms. Solnit writes, drawing on Lafayette Bunnell's "Discovery of the Yosemite and the Indian War of 1851 Which Led to That Event," that the lake already had a name, Py-we-ack. The soldiers were undeterred. They completed their pre-emptive strike, in fact and name, taking the Indians out of the picture even before the pictures were made.

From that point on, Yosemite drew scientists, intellectuals and visionaries. In 1864, Abraham Lincoln signed a bill protecting it. The naturalist John Muir arrived in 1868 and found both rapture and a cause. He founded the Sierra Club, led the memorable but losing battle to stop a dam in Hetch Hetchy Valley, and he passed on his mystical bond with the land to the most idealistic strain of modern environmentalism. He did not have a bond with the Indians, Ms. Solnit wrote.

Artists, scientists, philosophers and photographers were all drawn to Yosemite. It was beautiful, but it was also a geology laboratory, Ms. Solnit writes in an early draft of her new book, at a time when geology was the science of the moment. In geology lay the evidence for an old earth, and evolution, or a young earth and biblical creation.

In the summer of 1872, Muir guided leading scientists like Asa Gray, the foremost botanist and a supporter of Darwin; Joseph LeConte, geologist, friend of Muir and later a charter member of the Sierra Club; John Torrey, botanist and chemist; and others.

Clarence King, the first director of the United States Geological Survey, traveled with the painter Albert Bierstadt. Muybridge and the photographer Carleton Watkins led their own expeditions.

"These were the people" Ms. Solnit writes, "who would shape American ideas about nature and landscape, and their crossed paths in 1872 suggests a sort of wilderness symposium was afoot."

The scientists may have disagreed about God, geology and evolution, but they did have something in common. "If one thing unites nearly all the characters roaming Yosemite in 1872," she adds, "it's their scorn for Native Americans." In one example, she notes that Mr. King of the Geological Survey wrote flippantly, "The Quakers will have to work a great reformation in the Indian before he is really fit to be exterminated."

As Ms. Solnit recounts, the Indians of Yosemite were not, in fact, exterminated. They continued to live in and around the park. They did, however, become invisible for a variety of reasons, one being that the land was easier to celebrate without them.

Not that the generations of Yosemite worshipers that followed venerated mainstream American culture and the exploitation of natural resources. Far from it. On a rock dome overlooking Lake

Tenaya, working with Mr. Wolfe on a photograph, with Ms. Solnit observing, Mr. Klett said: "What we saw in the Adams photographs is: `This is nature. And it's beautiful because you're not there.'

Someone was, however, there. Yosemite was a park by then, and in rephotographing one of Adams's sites, Mr. Klett found that a parking lot had been right behind Adams when he took his inspiring vision.

Photography, Mr. Klett said, tells stories. And the story of humanity-free nature was a very appealing one. Even when photographers reacted against it by showing ugliness that more romantic photographers had overlooked — what Ms. Solnit calls "bulldozers in paradise" — the message was still the same, said Mr. Klett. Nature is good. People are bad.

The problem was that the nature that inspired Muir, Muybridge, Adams and others was partly created by people. As ecologists, botanists and others studied the nature of some of the California woodlands, they found that in the Yosemite Valley the Indians had used fire to burn away brush and saplings, to the benefit of mature black oaks. A result was a healthy crop of acorns and a remarkable almost parklike landscape that appealed mightily to the European-American sensibility. This western Eden may have seemed like the creator's gift to an expanding nation, but it was, inconveniently, the work of the unwelcome Indians.

One book, a collection of articles about human life and ecology in this part of California before white men and women arrived, neatly captures the idea in its title, "Before the Wilderness." What Ms. Solnit, Mr. Klett and Mr. Wolfe are now finding might be called "After the Wilderness."

After a century or so of being left out, people are back, and not just the tourists, who have always pretended not to be there so they could imagine pristine nature. This is true literally, in that park rangers set fires to prevent fires, actively managing forests, trying to produce not engineered virginity, but tended forests.

The Indians themselves have become visible again. A park brochure, "The Miwok in Yosemite," published in 1996, is printed in both English and Miwok. The Ahwahneechee were a subgroup of the Miwok.

"We're in such a different landscape, imaginatively, than we were 20 years ago," she added.

Photographically, the change is sometimes subtle and confusing. Some Muybridge photographs show dying trees, and new work shows new growth. It is almost as if time were flowing backward, Mr. Klett said. And the evidence can be found everywhere. In one lovely piece of comic serendipity, humor coexisting with reverence, Mr. Klett and Mr. Wolfe photographed a tiny toy camera that looks like a toy from a Cracker Jack box, found at a place where Muybridge, Adams and Weston photographed Lake Tenaya.

But perhaps the most telling photograph is a retake of an Adams image, "Clearing Winter Storm," from 1944 that captures what Mr. Klett called an "almost primordial" feeling from the light's returning as the clouds dissipate. In the Klett and Wolfe image, from 2002, the mountains are not quite as stark, the contrast not quite so great. The beauty of Yosemite is still there, but it is not quite paradise.

The smoke drifting across the hills is real smoke. To prevent conflagrations, the park service creates controlled burns in parts of Yosemite, an echo of Indian practices. The new image is called, "Clearing Autumn Smoke, Controlled Burn."

As Ms. Solnit says of a new conception of nature that does not require closing one's eyes or turning away from the parking lot, "There are bulldozers, and it's beautiful."

May 4, 2003 *(New York Times)*

Bah, Wilderness! Reopening a Frontier to Development

By TIMOTHY EGAN

SEATTLE — More than a century after historians declared an end to the American Frontier, the Interior Department made a somewhat similar announcement last month, with no fanfare. On a Friday night, just after Congress had left for spring break, the government said it would no longer consider huge swaths of public land to be wilderness.

The administration declared that it would end reviews of Western landholdings for new wilderness protection. As long as the lands had been under consideration for the American wilderness system, they had temporary protection from development.

With a single order, the Bush administration removed more than 200 million acres from further wilderness study, including caribou stamping ground in Alaska, the red rock canyons and mesas of southern Utah, Case Mountain with its sequoia forests in California and a wall of rainbow-colored rock known as Vermillion Basin in Colorado.

By declaring an end to wild land surveys, the administration ruled out protection of these areas as formal wilderness — which, by law, are supposed to be places people can visit but not stay. Now, these areas, managed by the Bureau of Land Management, could be opened to mining, drilling, logging or road-building.

The idea of designating an area as wilderness — wild land left as is, for its own sake — is an American construct. Artists and writers in the mid-19th century led the charge for wilderness, with Henry David Thoreau arguing from his pond-side home in Concord, Mass., that wilderness sanctuaries were a necessary complement to civilization.

In setting aside the first wildlife refuge in 1903, on Pelican Island in Florida, President Theodore Roosevelt protected a patch of America that is now the smallest of the formally protected lands — a mere five acres. And since passage of the Wilderness Act of 1964, 106 million acres have been given the wild lands designation, with more than half of that total in Alaska.

Over the years, the Bureau of Land Management, the nation's biggest landlord, with 262 million acres under its control, has continued to survey its vast holdings, trying to determine whether more land is suitable for wilderness. But the Bush administration says wilderness reviews should have ended 13 years ago, at the close of a study period mandated by Congress. This interpretation is challenged by conservationists who plan to appeal the Bush order in court.

If the Friday night declaration represents the beginning of a broad new land management policy, the Interior Department has not said so. There was not even an announcement of the end of the wilderness reviews on the department's Web site.

Instead, the change came about in a settlement of a 1996 lawsuit filed by the State of Utah against the Interior Department over a reinventory of three million acres conducted by Bruce Babbitt, the interior secretary at the time. Most of the lawsuit had been dismissed and sat dormant until the state amended its complaint in March.

"This does not mean that someday down the road we may still manage some of these lands as wilderness," said Patricia Lynn Scarlett, an assistant interior secretary.

The move follows a consistent pattern in the president's environmental policy: to change the way the land is managed, without changing the law. Whether the issue is allowing snowmobiles in Yellowstone National Park or logging in the Pacific Northwest, the course has been to settle lawsuits by opponents of wild land protection, opening up the areas to wide use, without going to Congress to rewrite the rules.

Oil and gas developers and others point out that the Clinton administration did the same thing — making broad changes of policy by administrative order — but on behalf of an environmental constituency. In their view, wilderness protection amounts to a land grab, putting potential timber or mining areas off limits. They say citizen groups were abusing the law by bringing land surveys to the government, which then managed the land as de facto wilderness. Leaders of some Western states have long complained that wilderness study essentially eliminates the chance to gain any economic value from the land, money that is needed for state coffers.

To many conservationists, the announcement was more than another setback. Wilderness, in the oft-quoted line of the writer Wallace Stegner, is "the geography of hope." To have that geography capped, they argue, has had the same effect on some outdoor lovers as the fencing of the public range had on open-country cattle ranchers. "They are trying to declare, by fiat, that wilderness does not exist," said Heidi McIntosh of the Southern Utah Wilderness Alliance.

The interior secretary, Gale A. Norton, said that the policy reflected the administration's attempt to cooperate with local officials and heed concerns of industries that rely on public lands' resources. "The Department of the Interior believes that we should manage these lands in a way that provides the greatest benefit to the public," Ms. Norton wrote in a letter to Senator Robert F. Bennett, Republican of Utah.

In another letter, Ms. Norton said it seemed senseless to consider declaring any more wilderness areas in Alaska because its elected officials are against expanding this protection. But critics say that in California, a majority of elected officials favor more wilderness. And in New Mexico, Gov. Bill Richardson, a Democrat, has asked the government to prevent drilling in 1.8 million acres of the Otero Mesa, an area that has all the qualities of wilderness.

The New Mexico land is the largest contiguous piece of Chihuahuan Desert grassland left in North America, Governor Richardson said. It may be wild, but for now, it can no longer be Wilderness.

July 1, 2003 *(New York Times)*

Few Habitats, Many Species and a Debate on Preservation

By JON CHRISTENSEN

Conservationists call them hot spots — habitats that cover just 1.4 percent of the earth's land surface but are so rich in biological diversity that preserving them could keep an astonishing number of plant and animal species off the endangered list.

Since 1988, when Dr. Norman Myers and his colleagues began describing these hot spots in a series of scientific papers and arguing for their protection, they have become a focus of worldwide conservation efforts. Private organizations and government agencies, including the World Bank, have made preserving 25 such ecological arks — from the Atlantic rain forest of Brazil to the semiarid Karoo region of South Africa — a top priority for financing and protective legislation.

But a growing chorus of scientists is warning that directing conservation funds to hot spots may be a recipe for major losses in the future. Just as an investor should maintain a balanced portfolio, the scientists argue, conservationists should avoid putting all of their eggs in one basket.

Hot spots are top performers in one dimension, these scientists say: the number of unique species that live in them. Of species that live on land, nearly half of all plants and more than a third of all animals are found only in the hot spots. But they do not include many rare species and major animal groups that live in less biologically rich regions ("cold spots").

And the hot-spot concept does not factor in the importance of some ecosystems to human beings, the scientists argue. Wetlands, for example, contain just a few species of plants, but they perform valuable service by filtering water, regulating floods and serving as nurseries for fish.

This debate has been simmering quietly among biologists for years. But it is coming to a boil now with the publication of an article in the current issue of American Scientist arguing that "calls to direct conservation funding to the world's biodiversity hot spots may be bad investment advice."

"The hot-spot concept has grown so popular in recent years within the larger conservation community that it now risks eclipsing all other approaches," write the authors of the paper, Dr. Michelle Marvier, a professor of biology at Santa Clara University, and Dr. Peter Kareiva, an associate at the university and a scientist with the Nature Conservancy, a group that has increasingly focused on hot spots.

"The officers and directors of all too many foundations, nongovernmental organizations and international agencies have been seduced by the simplicity of the hot spot idea," they go on. "We worry that the initially appealing idea of getting the most species per unit area is, in fact, a thoroughly misleading strategy."

Other prominent ecologists have grown critical of hot spots. "Focusing all of our attention on hot spots is just nuts," said Dr. Paul Ehrlich, president of the Center for Conservation Biology at Stanford University.

"The hot-spot approach was a good one when it was proposed by Myers way back when," Dr. Ehrlich said. "It attracted important attention to the distribution of species diversity. Now it's clear that saving a few percent of the earth's surface to preserve species will not accomplish what needs to be accomplished."

Even if people succeeded in preserving a single viable population of every species on earth, he said, the human race would die out unless it managed to protect the ecosystems that support broader populations of plants, animals and people too.

"One has to balance the necessary attempts to preserve species diversity with what may be much more important," he said of "the preserving of population diversity and in the process the preserving of ecosystem services."

But hot spots have their ardent defenders, notably Dr. Myers, a fellow at Oxford University, and Dr. Russell Mittermeier, president of Conservation International, a nonprofit organization that has made hot spots the centerpiece of its global strategy.

Dr. Mittermeier says hot spots have been successful at attracting attention and financing for conservation in tropical countries. "And that has been good," he said. "No one is suggesting that one invest solely in hot spots, but if you want to avoid extinctions, you have to invest in them."

By definition, hot spots contain many species that exist nowhere else on earth and that are under threat because more than 70 percent of their habitat has been destroyed. Conservation International is still working on expanding the hot spots list, Dr. Mittermeier said, with 10 new ones to be announced later this year.

And the organization puts a high priority on protecting five vast wilderness areas that have many unique species and are still relatively intact. They include the world's largest tropical rain forests, the Amazon, the Congo forests of central Africa and the island of New Guinea, as well as the Miombo-Mopane grasslands and woodlands of southern Africa, and the deserts of northern Mexico and the American Southwest. These areas still have more than 75 percent of their natural habitat and fewer than 13 people per square mile, said Dr. Mittermeier, but they will become hot spots if they are not protected,

Dr. Myers said that since he wrote his first paper on hot spots, $750 million had been committed to protecting them, including a $261 million donation to Conservation International from the Gordon and Betty Moore Foundation, the largest single gift ever to an environmental organization. Still, he said, the hot spots need more attention and more money — "a lot more," he said.

Dr. Agnes Kiss, an environment specialist with the World Bank, acknowledges that when it comes to spending money on conservation, hot spots loom large. "Put it this way," she said. "When we're trying to justify a project, if it's a hot spot, basically it's a shoo-in."

The World Bank and its Global Environment Facility, which makes grants in addition to the bank's traditional loans, is halfway through a five-year $125 million Critical Ecosystems Partnership Fund to invest in protecting hot spots, along with the MacArthur Foundation, the Japanese government and Conservation International.

Still, Dr. Kiss said, the bank also takes other factors into account, including the commitment of governments and local communities to preserve biodiversity and their track records with previous projects.

In a world where funds are limited, that is just the kind of approach that is needed, Dr. Marvier and Dr. Kareiva assert in their American Scientist article. In a coming paper in Ecology Letters, written with their student at Santa Clara University, Casey O'Connor, they propose a "return on investment" model to determine which countries provide the best opportunities for preserving biodiversity. Their analysis compares the feasibility and cost-effectiveness of conservation efforts in different countries, alongside biological diversity and the threat of habitat destruction.

When factors like the costs of doing business, the reliability of governments and pressure from population growth are taken into account, they write, some countries on Conservation International's list of the 17 most "megadiverse" countries — Colombia, Ecuador, Indonesia, and Venezuela, for example — drop off the priority list. And some other countries not found on the list emerge as priorities, including Argentina, Bangladesh, Mozambique and Vietnam.

Still others appear on every list, no matter which priority-setting model is used: China, India, Madagascar, Papua New Guinea and South Africa.

Dr. Marvier and Dr. Kareiva say the largest conservation organizations — the Nature Conservancy, the World Wildlife Fund and Conservation International — have many offices concentrated in countries with hot spots, but are understaffed in countries with vast biological resources, like Argentina and Russia.

Since no one strategy is enough, they argue, conservationists need a way to make explicit trade-offs. Preserving 1,000 species in a "cold spot" like Montana, they argue, would be more important than preserving 1,000 species in a hot spot like Ecuador because in Montana 1,000 species represents a third of the total, while in Ecuador it represents just 5 percent.

"Conservationists widely accept the need for some sort of triage," they argue, "whereby limited funds go to places where the greatest good can be done."

Dr. Kareiva acknowledged that there would never be one magic equation everyone would accept. "But we can all get more sophisticated by focusing on different variables," he said. Biological diversity, he said, "should be one variable in the equation; it shouldn't be the end-all or be-all."

Dr. Kiss, the World Bank environmental specialist, agreed. "The basic principle that biology isn't everything is quite sound," she said. But Dr. Mittermeier of Conservation International worries that focusing on "return on investment" could lead to bad decisions in the long run. Colombia, for example, demands conservationists' attention despite the uncertainties raised by its guerrilla war, he said, adding, "If a country is rich in diversity it's very dangerous to write it off because of temporary difficulties."

Dr. Thomas Lovejoy, president of the H. John Heinz Center for Science, Economics and the Environment in Washington, called the debate "useful, but somewhat academic."

"The real issue here is not the sort of fine-tuning of what is the best way to set priorities from organization to organization. It's about changing the scale of the funding," he said. "In the real world, there is a real need for a diversity of approaches in the field of conservation."

Hot-spots research "highlighted that there are certain places where the fire engines ought to go right away," Dr. Lovejoy said, "whereas other places under less pressure can wait a few years, if you have to do them in sequence."

"But you'd better not wait too long," he added.

March 14, 2005 *(New York Times)*

Chain Saw Thins Flocks of Migrants on Gold Wings

By JAMES C. McKINLEY Jr.

CONTEPEC, Mexico, March 9 - Homero Aridjis, a poet and naturalist, can remember years when monarch butterflies filled the streets here in his hometown like a living torrent of orange and black and stayed all winter on the fir-covered mountain rising above the village.

Not this year. The colony of butterflies that arrived here in November was tiny and retreated up the mountain, as far away as possible from the lower slopes where loggers have thinned or destroyed the forest the butterflies depend on.

"There used to be rivers of butterflies, but now there are years when there are no butterflies at all," Mr. Aridjis said as he climbed the mountain of his youth recently. "This is a village full of ghosts, not of people, but of nature, a paradise lost."

The tourists still come, but there is not as much for them to see. This is a small town of 10,000, like many in Mexico, dominated by a church and a school in rolling fields at the foot of Cerro Altamirano. The country people here still work on their small farms, but in recent decades the town's adobe houses have been replaced by uglier cinderblock buildings, and rusting automobiles outnumber burros and horses.

Not only are there comparatively few monarchs in Contepec, but the numbers that came to weather the winter at five other forest sanctuaries in central Mexico also dropped sharply this year.

Two storms killed most of the butterflies spending winter here in 2003 and 2004. But these reproductively hardy insects have bounced back before. In 2002, a storm killed about 80 percent of wintering butterflies, but the next summer, they found perfect breeding conditions in the central United States and southern Canada.

Last summer, though, cold and wet weather in the American corn belt kept the diminished population from regrouping. The number arriving this winter was the smallest since Mexico and the World Wildlife Fund began keeping records in the 1970's, down three-quarters from the winter before, the wildlife fund and independent biologists said.

Biologists and nature lovers say bad weather is not the whole story. They warn that logging in Mexico and herbicides in the United States have endangered these almost miraculously migratory insects, which flutter thousands of miles.

Hardier genetically altered corn and soybean crops in the United States and Canada, in the breadbasket areas that are the monarch's main summer conjugal grounds, have enabled farmers to use stronger herbicides to eliminate weeds. That has drastically depleted the supply of flowers on which the butterflies feed, as well as common milkweed, on which the monarch lays its eggs in the spring and summer and on which its larvae feed, several biologists say.

The drop in butterfly counts is staggering. In 2004, at a monitoring site in Cape May, N.J., for instance, scientists registered the lowest number of butterflies heading to Mexico since the program began in 1991, according to scientists in the field. Similar results were found in Virginia. Scientists from the University of Minnesota who have been counting larvae in the Midwest since 1997 recorded their lowest numbers. Some environmentalists say that preventing permanent devastation of the monarch population might require concerted action by Mexico, the United States and Canada, though these countries have not put the issue on their foreign affairs agendas.

"We have a trinational crisis," said Mr. Aridjis, who helped set up sanctuaries in Michoacán State for the butterflies in the 1980's.

In August, as the days shorten, the last monarch generation hatched in the summer stops reproducing and goes into a sort of sexual hibernation. The monarchs fly south to the forested hills in Michoacán and the State of Mexico, where their ancestors have spent winter for millennia. There, they find the perfect balance of coolness and humidity to remain alive for several months, without laying eggs. In February, they mate. Finally, in March, they return to the southern United States to lay their fertilized eggs and die.

In Mexico, illegal logging in these protected forests has shrunk the monarchs' habitat and forced the insects to higher elevations, where they are vulnerable to the cold. The government protects the forests with armed federal agents during winter, but large logging operations have continued to eat away at the dense stands of Oyamel fir trees here.

Satellite photos compiled by United States scientists show that vast numbers of trees in the 140,000-acre Monarch Butterfly Biosphere Reserve, 75 miles east of Mexico City, have been logged and carted out, often by armed gangs who pay off the authorities, people tracking the fate of the butterflies say. The northeast face of Cerro Pelón, one of the mountains in the core of the reserve and a former winter home of butterflies, is stripped of trees now.

"The deforestation is increasing per year in each period we studied," said Daniel A. Slayback, a United States scientist studying the butterflies who has compared satellite photos from 1976 through 2004. "Whatever measures the Mexicans are taking, they are totally ineffective."

A group of 11 biologists who study the monarch concluded in a paper distributed Feb. 17, "Monarchs have proven resilient to many environmental stresses but the ongoing deterioration and loss of habitat in Mexico, the United States and Canada has the potential to drive the population below a level from which it can recover."

Lincoln P. Brower, a biologist at Sweet Briar College in Virginia who is one of the world's foremost Monarch specialists, said the population had been cut so severely that one more bad storm over the winter might have finished it. "I would say the monarch is in a precarious situation now," he said.

One reason is poverty. Martin Uilshes Maya, 35, a farmer from Contepec who loves the butterflies, is typical of many people in the region. He said he had 10 acres of land to feed his wife and two children. He grows enough corn and wheat to make about $3,600 a year, but the need for firewood sometimes drives him and his neighbors into the forest.

"Clearly, we are destroying the forest, but that is what life is giving us," he said sadly. "It's a very beautiful phenomenon, the butterflies, that gives us so much life."

"But," he said, "we don't have any way to make money off tourism."

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KINSHASA JOURNAL

The Gentlest of Beasts, Making Love, Ravaged by War

By SOMINI SENGUPTA

KINSHASA, Congo - Upstream from this dog-eat-dog capital, where the Congo River spills its tendrils into the belly of the equatorial rain forest, lies the jungle home of one of mankind's closest cousins and one of the most endangered primates on earth: the bonobo.

Genetically, humans and bonobos, a species of chimpanzee, are more than 98 percent similar. Socially, it is another matter. Matriarchal as a rule, bonobos eschew conflict. They do not fight over territory. They do not kill. Any small friction they resolve through sexual contact: a playful rub, oral sex, full intercourse.

Peace-loving they may be, but during Congo's latest war, the bonobos' jungle habitat fell smack on the front line between fighting factions.

Fishing and farming all but ground to a halt during the war, which officially ended last year. Civilians and soldiers alike turned to the forest to fill their bellies.

More and more, the bonobos turned up as supper. Their smoked remains showed up at riverine markets. Babies were orphaned, which is to say they were more or less destined to die: the bonobo infant, accustomed to staying on its mother's back for the first several years of life, has great trouble making it on its own.

So it was that the bonobo orphans of the central African rain forest found themselves hurtling hundreds of miles down the Congo River to this gritty metropolis and into the arms of a redheaded Frenchwoman called Claudine André.

Ms. André recalls it as love at first sight. More than 10 years ago, after a famous, ruinous pillage of Kinshasa, Ms. André, then a businesswoman, went to the ravaged city zoo and chanced upon a bereft infant bonobo. He looked as though he wanted to die, she recalled. She named him Mikano, took him home and became, in her words, his surrogate mother.

When the war came, more orphans trickled in. She kept them on the grounds of an elite American school. Then, last year, when peace came, she opened Lola Ya Bonobo, a sanctuary for orphaned bonobos on a 75-acre patch of green on the fringes of the capital.

Infants are paired up with surrogate mothers. There is an endless supply of bananas and sugar cane (bonobos have an incurable sweet tooth). An electric fence encircles the park, so as to keep the apes from scampering out of the woods and into Kinshasa's traffic. The park is open to visitors.

On a Sunday afternoon not long ago, the park's 31 young charges did what young bonobos do: chewed on blades of grass, swung from palm fronds, kissed, frolicked and fondled.

"It's the hippies of the forest," Ms. André said, taking their wrinkled hairy hands in hers. "When they feel anxious, when they are afraid, they have sex. And they calm down."

As if on cue, a big bonobo mounted a small bonobo. They rolled around on the grass, rubbed against each other and went on their merry ways.

Bonobos are not proprietary about mates, and sex is not always about procreation. Homosexuality is au courant, and sexual play begins when they are barely a year old, though intercourse must wait until they are teenagers. Much to Ms. André's delight, a teenage orphan, a male, arrived recently. Hopefully, she said, mating will soon begin.

"It's really make love, not war," Ms. André said of the bonobo way of life. "It was so sad to see such a pacific animal so destroyed by war."

The plight of the bonobos, a species found only in Congo, is a window into the repercussions of war on the ecology of the Congo River Basin, one of the most diverse ecosystems in the world and home to more than 400 species of mammals. Mining, logging and a sustained trade in bush meat have all put the squeeze on their habitats.

War having made vast swaths of the country inaccessible to researchers, it is impossible to know precisely how these creatures have fared. Certain habitats may have been left untouched, others devoured.

In the Virunga Highlands near the border of Uganda and Rwanda, the mountain gorilla population has grown, according to a census by the Wildlife Conservation Society. By contrast, in the Kahuzi-Biega National Park, the eastern lowland gorilla's population has fallen by 70 percent to fewer than 5,000, according to Conservation International. The elephants in the same park may well have vanished.

As for the bonobo population, scientists have no reliable numbers but fear the species may be nearing extinction. Late last year, the United Nations Environment Program reported that the bonobo, along with the gorilla, chimpanzee and orangutan, could disappear in 50 years.

Peace is likely to present a new challenge to forest dwellers: Congo's rain forests have once again opened up to logging companies, and today the first batches of timber can be seen floating downriver from Équateur Province to the port here in Kinshasa. With blessings from the World Bank, 150 million acres of rain forest could be opened up for logging.

As the World Bank sees it, timber concessions could pour hundreds of millions of dollars into government coffers. Environmentalists fear that the logging could also endanger the habitat of the Pygmy people, who have eked out a living in the forest for centuries. The bonobos are sometimes called Pygmy chimpanzees, because Pygmies too are averse to conflict; they too prefer to hunt and forage in the forest rather than fight one another for territory. United Nations investigators suspect that some of them had been eaten during the war too.