
WATER WARS
AND PROFIT
SHIVA

CONVERTING ABUNDANCE INTO SCARCITY

Water is the matrix of culture, the basis of life. In Arabic, Urdu, and Hindustani it is called *ab. Abad rabo* is a greeting for prosperity and abundance. The name India itself is derived from the great river Indus, and India was called the land beyond the Indus.[1] Water has been central to the material and cultural well-being of societies all over the world. Unfortunately, this precious resource is under threat. Although two-thirds of our planet is water, we face an acute water shortage.

The water crisis is the most pervasive, most severe, and most invisible dimension of the ecological devastation of the earth. In 1998, 28 countries experienced water stress or scarcity.[2] This number is expected to rise to 56 by 2025. Between 1990 and 2025 the number of people living in countries without adequate water is projected to rise from 131 million to 817 million.[3] India is supposed to fall into the water stress category long before 2025.[4]

A country is said to be facing a serious water crisis when available water is lower than 1,000 cubic meters per person per year. Below this point, the health and economic development of a nation are considerably hampered. When the annual water availability per person drops below 500 cubic meters, people's survival is grievously compromised. In 1951, the average water availability in India was 3,450 cubic meters per person per year.

By the late 1990s, it had fallen to 1,250 cubic meters. By 2050, it is projected to fall to 760 cubic meters. Since 1970, the global per capita water supply has declined by 33 percent.[5] The decline does not result from population growth alone; it is exacerbated by excessive water use as well. During the last century, the rate of water withdrawal has exceeded that of population growth by a factor of two and one-half.[6]

I have witnessed the conversion of my land from a water-abundant country to a water-stressed country. I saw the last perennial stream in my valley run dry in 1982 because of the mining of aquifers in catchments. I have seen tanks and streams dry up on the Deccan plateau as eucalyptus monocultures spread. I have witnessed state after state pushed into water famine as Green Revolution technologies guzzled water. I have struggled with communities in water-rich regions as pollution poisoned their water sources. In case after case, the story of water scarcity has been a story of greed, of careless technologies, and of taking more than nature can replenish and clean up.

The Ecology of Water

The hydrological cycle is the ecological process through which water is received by the ecosystem as rain or snow. The falling moisture recharges streams, aquifers, and groundwater sources. The water endowment of a particular ecosystem depends on the region's climate, physiography, vegetation, and geology. At each of these levels, modern humans have abused the earth and destroyed its capacity to receive, absorb, and store water. Deforestation and mining have destroyed the ability of water catchments to retain water. Monoculture agriculture and forestry have sucked ecosystems dry. The growing use of fossil fuels has led to atmospheric pollution and climate change, responsible for recurrent floods, cyclones, and droughts.

Industrial Forestry and the Water Crisis

Forests are natural dams, conserving water in catchments and releasing it slowly in the form of streams and springs. Rainfall or snowfall is intercepted by forest canopies that protect the soil and increase the potential of forest floors to absorb water. Some of this water evaporates back to the atmosphere. If forest floors are covered with leaf litter and humus, they retain and regenerate water. Forest logging and monoculture agriculture allow water to run off and destroy the water conservation capacity of soils.

Cherapunji in northeast India is the wettest region on earth, with 11 meters of rainfall a year. Today, its forests are gone and Cherapunji has a drinking-water problem. My own transition from physics to ecology was spurred by the disappearance of Himalayan streams in which I played as a child. The Chipko movement was also launched to stop the destruction of water resources through logging in the area.[7]

The ecological crisis in the Himalayas was accelerated by commercial forestry. Villages once self-sufficient in food production were forced to import food when water sources dried up. With the forests gone, floods and landslides became frequent; in 1970, the Alaknanda disaster, where a major landslide blocked the Alaknanda River and inundated 1,000 kilometers of land, washed away numerous bridges and roads. In 1978, the Tawaghat tragedy took an even greater toll; an entire mountain slope collapsed into the Bhagirathi River, forming a lake four kilometers wide. The lake burst and flooded the Gangetic Plain.[8] The incident was a wake-up call to the government regarding the value of forest catchments.

Long before these flood disasters, there had been warnings about the Himalayan threat. In 1952, Gandhi's disciple Mira Behn remarked:

> Year after year the floods in the north of India seem to be getting worse, and this year they have been absolutely devastating. This means that there is something radically wrong in the Himalayas, and that "something" is, without doubt, con-

nected with the forests. It is not, I believe, just a matter of deforestation as some people think, but largely a matter of a change of species.

Living in the Himalayas as I have been continuously now for several years, I have become painfully aware of a vital change in species of trees which is creeping up and up the southern slopes—those very slopes which let down the flood waters on to the plains below. This deadly changeover is from Banj (Himalayan oak) to Chir pine. It is going on at an alarming speed, and because it is not a matter of deforestation, but of change from one kind of forest to another, it is not taken sufficiently seriously. In fact the quasi-commercial Forest Department is inclined to shut its eyes to the phenomenon, because the Banj brings in no cash for the coffers, whereas the Chir pine is very profitable.[9]

Despite the value of the leaf litter of oak forests as the primary mechanism for water conservation in the Himalayan mountain watersheds, and despite warnings about the disappearance of the forests, industrial forestry continued unabated, leading to massive catastrophe in the region.

Eucalyptus and Water Scarcity

In India and other parts of the Third World, the spread of eucalyptus monocultures for the paper and pulp industry has been a major source of water problems. Eucalyptus, ecologically adapted to its native habitat in Australia, is hazardous in water-deficient regions. Nowhere outside its native habitat is eucalyptus a self-sustaining system of vegetation. A study conducted by the hydrological division of the Australian Central Scientific and Industrial Research Organization found that during years with precipitation less than 1,000 millimeters, deficits in soil moisture and groundwater were created by eucalyptus.[10] Even throughout Australia, reports confirm the rapid destruction of water resources as a consequence of large-scale planting of eucalyptus.

Mahashweta Devi described the impact of eucalyptus on water resources in the tribal areas of Bihar and west Bengal in India:

> I am concerned with the India I know. My India is of the poor, starving, and helpless people. Most of them are landless and the few who have land are happy to be able to make the most of the given resources. To cover Purulia, Bankura, Midnapur, Singbhum, and Palamau with eucalyptus will be to rob my India of drinking and irrigation water.[11]

In 1983, farmers in the state of Karnataka marched en masse to the forest nursery and uprooted millions of eucalyptus seedlings and planted tamarind and mango seeds in their place.[12] In South Africa, women launched a major water campaign to cut down eucalyptus trees that had dried up streams and groundwater sources. South Africa's Working for Water program, spearheaded by the Department of Water Affairs and Forestry, was established to rejuvenate water resources by getting rid of alien plants like eucalyptus, which have invaded more than 10 million hectares and use 3.3 billion cubic meters of water in excess of native vegetation. Shortly after the clearing of eucalyptus along river banks, stream flow increased by 120 percent.[13]

Mining and the Water Crisis

Mining is a practice that destroys water catchments. In the 1980s, limestone mining destroyed my home, Doon Valley. The mining companies saw limestone purely as a raw material for industry; the value of the deep cavities, nature's water reservoirs, was completely ignored. Building an artificial structure with the depth of the Doon Valley catchments would have cost $500 million.[14] In addition to devastating water resources, mining on the precipitous slopes was also causing landslides and filling streams and rivers with debris. I have seen deep and narrow streams transformed into rivers of debris, with beds higher than the surrounding land. Limestone quarrying converted a valley with abundant rainfall into a water-deprived region.

During the conflict over limestone quarrying in Doon Valley, the water resources recharged by the Mussoorie Hills were treated as worthless and given no consideration. The devaluation of Doon Valley's natural resources was merely an extension of the devaluation of nature by conventional economics and development models. The failure of modern economics to address natural resources in their ecological totality has been noted by many. Nicholas Georgescu-Roegen eloquently summarized this incompetence of conventional economics:

> The no-deposit, no-return analogy benefits the businessman's view of economic life. For, if one looks only at money, all one can see is that money just passes from one hand to another: except by regrettable accident it never gets out of the economic process. Perhaps the absence of any difficulty in securing raw materials by those countries where modern economics grew and flourished was yet another reason for economists to remain blind to this crucial economic factor. Not even the wars the same nations fought for the control of the world's natural resources awoke the economists from their slumber.[15]

The deepening ecological crisis, however, is making it imperative that nature's values and functions be taken into account through proper ecological audits that assign value to natural functions on the basis of the cost of technological alternatives to deliver the same set of goods and services. Thus the value of the Mussoorie Hills and their potential for water provision would be equivalent to the cost of technical installations required to provide the same quantity and quality of water. Quite obviously, the damage involved is equivalent to the destruction of a gigantic waterworks. Recognizing the social and ecological value of a resource leads to its equitable and sustainable use. In contrast, assessing a resource only in terms of market price creates patterns of nonsustainable and inequitable use.

In 1982, the Indian Ministry of Environment in New Delhi invited me and a team of ecologists to conduct an impact assessment of mining. We worked with local communities to build a movement to save the mountains and streams, and we supported citizen groups. The environment ministry initiated legal action to stop limestone mining in Doon Valley, and in 1985 the Supreme Court ordered the permanent or temporary closure of 53 out of the 60 limestone quarries in the region. The court opined:

> This is the first case of its kind in the country involving issues related to environment and ecological balance, and the questions arising for considerations are of grave moment and of significance not only to the people residing in the Mussoorie Hill range forming part of the Himalayas but also in the implications to the welfare of the generality of the people living in the country. It brings into sharp focus the conflict between development and conservation and serves to emphasize the need for reconciling the two.[16]

The court further held that the closure of mining operations was

> a price that has to be paid for protecting and safeguarding the right of the people to live in a healthy environment with minimum disturbance of ecological balance and without avoidable hazards to them and to their cattle, homes and agricultural land and undue affection of air, water and environment.[17]

The decision by the Supreme Court of India was the precedent for accepting a stable and healthy environment as a human right. The court intervened on behalf of citizens.

Unfortunately, globalization is reversing the democratic and ecological victories of the 1980s. Mining is spreading in the most vulnerable areas, including Rajasthan, home to several ancient water systems. Limestone mining has intensified in the coastal regions of Gujarat. Around Gandhi's birthplace, 25 cement factories are scooping out nature's storage and protection systems and exposing the region to water famines. The forests in the sacred Gandmardhan Mountains are a refuge for various plants and provide water to 22 streams, which in turn fill major rivers.

In 1985 the Bharat Aluminum Company (BALCO) began the desecration of these sacred grounds. BALCO was involved in bauxite mining. The company arrived in Gandmardhan after destroying the sanctity and ecology of Amarkantak, another important mountain where the Narmada, Sone, and Mahanadi Rivers originate. Since 1985, the tribals of the region have obstructed the work of the company and refused to be tempted by its offers of employment. Even the police have failed to stop the determined protesters. "Mati Devata, Dharam Devata" ("The soil is our goddess; it is our religion") were words chanted by the women of the "Save Gandmardhan" movement as they were being dragged away by the police. Dhanmati, a 70-year-old protester, summarizes the conviction of the women: "We will sacrifice our lives, but not Gandmardhan. We want to save this hill which gives us all we need."[18]

BALCO's quest for aluminum in this sacred land is particularly disturbing when one considers India's accumulated surplus of the mineral. Local residents have long known how to make aluminum using methods that predate industrial society. Even today, such craftspeople can be found in Orissa. Tribal technology did not destroy the rivers and mountains as industrial mining does. BALCO's mining activity is not based on the needs of the Indian people—it is entirely driven by the demands of industrialized countries whose own aluminum plants are closing for environmental reasons. Japan has reduced its aluminum smelting capacity from 1.2 million tons to 140,000 tons and now imports 90 percent of its aluminum.[19] The survival of Gandmardhan's tribals is under threat because rich countries want to preserve their economies, environments, and luxurious lifestyles.

The local and national ecology movements had stopped mines in many vulnerable catchments to protect rivers. Globalization, however, is reversing many laws. Thirteen minerals—iron, manganese, chrome, sulfur, gold, diamond, copper, lead, zinc, molybdenum, tungsten, nickel, and platinum—have

been cleared for exploitation, and mining operations have been deregulated. Automatic approval is given for foreign companies that own 50 percent of the mines. The normal area limit of 25 square kilometers has now been relaxed to 5,000 square kilometers for a single prospecting license.[20]

Large corporations such as Rio Tinto-Zinc (RTZ) are now in Gandmardhan where the local tribals do not want them. As Basano Dehury, an elected representative of her village, points out, "If the company comes, they will dump all the waste and it will block the source of our rivers. Therefore, we do not want the mine."[21] Tikayat Dehury, another villager, wonders, "Why should we work in the mines? We already have what we want. If we work there, it will be we that have to work and work and work and they will take out the cream from here and go."[22]

In Orissa, mining has unleashed a life-and-death battle between local communities and global corporations supported by the military. In December 2000, protesters were killed during an antimining demonstration.[23] Whether it is industrial fisheries or forestry, mining or pollution, corporations have stopped the destruction of water resources only when forced by citizens through direct action or through courts.

Drought: An Unnatural Disaster

Since the 1950s, the Green Revolution has been hailed for its success in expanding the global food supply, particularly in developing nations such as India and China.[24] High-yield miracle seeds were promoted all over the developing world, and the Green Revolution was praised for preventing the starvation of millions of people. The ecological and social costs of the Green Revolution were largely ignored. Through its emphasis on high-yield seeds, this agricultural model displaced drought-resistant local crop varieties and replaced them with water-guzzling crops. The water-intensive Green Revolution led to water mining in water-scarce areas.

Prior to the Green Revolution, groundwater was accessed through protective, indigenous irrigation technologies. However, these technologies, which relied on renewable human or animal energy, were identified as "inefficient" and were subsequently replaced by oil engines and electric pumps that extracted water faster than nature's cycles could replenish the groundwater.

Tube Wells and Energized Pumps

Across India, fossil-fuel and electricity-run wells have mushroomed as part of an informal privatization of groundwater. After the 1972 drought in Maharashtra, the World Bank heavily subsidized and mechanized water withdrawal systems. The bank also gave credit for tube wells that were to feed commercial irrigation and reduce water scarcity. The result was an explosion of sugarcane cultivation. Maharashtra is now known as the "Land of Sugar Barons." It has recently been discovered that this power was built on the water resources of rural Maharashtra.

In less than a decade, sugarcane fields converted groundwater into a commodity and left people and staple food crops thirsting for water. While sugarcane is cultivated on only three percent of Maharashtra's irrigated land, it consumes 80 percent of all the irrigation water and eight times more water than other irrigated crops.[25] As the state struggles with famine, the sugarcane plantations and sugar mills flourish. Ten years ago, Maharashtra was home to 77 sugar cooperatives, whose water came from 70 percent of the villages. The sugar factories have been actively supporting tube well construction. In the meantime, public wells and shallow wells owned by small farmers have run dry.

In the Sangli district, for instance, groundwater irrigation of sugarcane has increased dramatically over the past two decades, even as water scarcity has grown. Although the shift from rainfed, coarse-grain production to a water-hungry cash crop has increased average household income, the costs have been great. Manerajree village is a perfect example of an area that benefitted

financially in the short run but paid dearly materially and ecologically in the long run. A new water scheme with a potential supply of 50,000 liters was commissioned in November 1981 at a cost of $14,000. The water supply lasted only one year. To increase production, three 60-meter power pump bores were drilled near the first well, and they supplied 50,000 liters per day in 1982. By November 1983, all three bores were completely dry. More than 2,000 privately owned wells in this sugarcane region had also gone dry. Since 1983, there has been a continuous tanker service providing water to the area.

The Malwa plateau of central India is another tragedy. What was once a water-abundant region—"Malwa's soil is so rich that there is food in every home, and water at every step" was a common expression—is now dry, and residents travel an average distance of four kilometers in search of water. The crisis is a result of dependence on tube wells and the desertion of traditional water-harvesting systems.

In the village of Belawati, 500 tube wells were created over the past decade and only five still work.[26] The rest have run dry. In Guraiya village, only 10 of the 100 tube wells built have water. In Ismailkhada village, the 1,000 tube wells drilled over a span of seven years dried up the 12 ponds that served the community for centuries. Residents now travel two kilometers for water. Of the 200 tube wells dug in Sadipura, only four are working.[27]

Mechanized water extraction has also created ecological stress in other parts of the world. Development projects in arid sub-Saharan Africa played critical roles in the Sahelian famine of the 1970s and 1980s.[28] Well digging was believed to be the best mechanism for developing pastoral regions. The traditional pastoral practice of moving herds to different locations was eroded with the introduction of energized wells. The new wells supplied more water than the pastoralists needed and encouraged their settlement in one location, increasing grazing pressure on the land. Settling pastoralists in fact worsened the problem of deser-

tification; it bypassed century-old traditions that ensured survival under conditions of low water availability.

Community Rights and Collective Management

In most indigenous communities, collective water rights and management were the key for water conservation and harvesting. By creating rules and limits on water use, collective water management ensured sustainability and equity. With the advent of globalization, however, community control of water is being eroded and private exploitation of water is taking hold. Water-renewing traditional systems are now decaying. In a study of 152 villages using traditional water-harvesting systems, 79 were dry or polluted.[29] The Chobala Pond in Mundlana village is still communally maintained and it still serves the water needs of 10 villages. On the other hand, Mankund, named after the hundreds of ponds and tanks it once boasted, now has no water. The 1,000 tube wells introduced to the region have drained the traditional water sources.[30]

Water is available only if water sources are regenerated and used within limits of renewability. When development philosophy erodes community control and instead promotes technologies that violate the water cycle, scarcity is inevitable. In India, even as capital investment was being poured into water projects, more and more villages were running out of water.

In 1972, the government identified 150,000 villages as facing water problems and introduced programs to provide water in 94,000 of them. The programs included drilling tube wells and pumps to bring water from long distances. Despite these efforts, the number of water-stressed villages had risen to 231,000 by 1980. The government then decided to rescue 94,000 more villages; in 1985, a total of 161,722 villages still faced water problems. More investments were made that year to assist all but 70 villages; but by 1994, 140,975 villages were without water.[31]

In the 1970s and 1980s, the World Bank and other aid agencies focused on disastrous technologies as a means of water provision. Since the 1990s, these agencies have been aggressively pushing privatization and market-based distribution of water, which already promise to be equally catastrophic. In the Indian states of Gujarat and Maharashtra, the World Bank is pushing privatization as a replacement for its own failed technology-intensive water system from the 1980s. The result has been an accelerated extraction of groundwater. In the water-stressed state of Gujarat, groundwater is mined from a depth of 1,500 to 1,800 feet, leaving aquifers shallower and surface storage empty.

Gujarat was once home to a number of highly functional tanks and wells. In the 1930s, wells provided the water for 78 percent of the irrigation in the region.[32] Water was lifted from a well by *kos*, indigenous water lifting tools, and energy for the wells was provided by animals. When the state was hit with a water crisis in 1985 and 1986, the government, along with the World Bank, created an emergency program and Gujarat received potable water by special trains, tankers, camels, and bullock carts.

The close to $18 million government program aggravated the problem further. The new sources, including some 4,000 tube wells, ran dry. The government spent an additional $19.4 million on long-distance transfer and on more tube wells. The World Bank also funded a $28.4 million water supply project. In the end, these programs failed to provide water. In fact, the schemes ended up depleting water sources.[33]

The water famine in Maharashtra in the 1980s also reveals a similar story. Ninety-three percent of Maharashtra is made up of hard rocks comprising the Deccan Trap. The Deccan recharge is slow because there is very little storage space for groundwater. In the Deccan Trap, therefore, there is nothing like a subsoil water table. Water is stored in joints and bedding planes and recharged locally. Traditionally, groundwater extraction in Maharashtra came from open dug wells. Fifty-nine percent of the state had been irrigated by groundwater through 939,000 open dug wells. Large-scale development projects have tried to overcome this

limitation by digging deeper and using more power for the withdrawal of water. The old methods of withdrawal were regarded as inefficient. As one expert comments:

> There were 5.42 lakh wells in Maharashtra in 1960–61. This number increased to 8.16 lakh in 1980. The average increase per year during the last two decades was 13,700. It is significant to note that although the number of wells increased by about 51 per cent during the 20 years, the area irrigated by them has nearly doubled during the same period of years. This is mainly due to the fact that more and more wells are being fitted with mechanised pumps (oil engines and electric pump sets), discarding the outmoded device of draft-like mbots, Persian wheels, etc. Mechanisation of draft has increased the utility of wells and has resulted in optimum use of water available for each well.[34]

The notion of increasing well efficiency through energized pumps was short-lived. Powerful water-withdrawal technologies merely led to the exhaustion of water and not to its optimum use. The result was groundwater famine.

Ecological Democracy

Technological solutions to an ecological problem have been unsuccessful. Reductionist assumptions about water development hold that when it comes to using natural resources, nature is deficient and people's traditions are inefficient. However, different ecozones have been the basis of diverse cultures and economies. The arid zones have been sustainably used for pastoralism, and the semiarid zones have been used for dry farming with protective irrigation.

Everyone agrees that the world is facing a severe water crisis. Water-abundant regions have become water scarce, and water-scarce regions face water famines. There are, however, two conflicting paradigms for explaining the water crisis: the market paradigm and the ecological paradigm. The market paradigm sees water scarcity as a crisis resulting from the absence of water trade.

If water could be moved and distributed freely through free markets, this paradigm holds, it would be transferred to regions of scarcity, and higher prices would lead to conservation. As Anderson and Snyder state, "[A]t higher prices people tend to consume less of a commodity and search for alternative means of achieving their desired ends. Water is no exception."[35]

Market assumptions are blind to the ecological limits set by the water cycle and the economic limits set by poverty. Over-exploitation of water and disruption of the water cycle create absolute scarcity that markets cannot substitute with other commodities. The assumption of substitution is in fact central to logic of commodification. For example, economist Jack Hirshleifer and his colleagues state:

> This is not to deny that as a commodity, water has its special features, for example, its supply is provided by nature partly as a store and partly as a flow, and it is available without cost in some locations but rather expensive to transport to others. Whatever reason we cite, however, the alleged unique importance of water disappears upon analysis.[36]

Such abstract arguments miss the most crucial point—when water disappears, there is no alternative. For Third World women, water scarcity means traveling longer distances in search of water. For peasants, it means starvation and destitution as drought wipes out their crops. For children, it means dehydration and death. There is simply no substitute for this precious liquid, necessary for the biological survival of animals and plants.

The water crisis is an ecological crisis with commercial causes but no market solutions. Market solutions destroy the earth and aggravate inequality. The solution to an ecological crisis is ecological, and the solution for injustice is democracy. Ending the water crisis requires rejuvenating ecological democracy.

1 Bill Aitkin, *Seven Sacred Rivers* (Columbia, MO: South Asia Books, 1992), p. 1.
2 Marq De Villiers, *Water: The Fate of Our Most Precious Resource* (New York: Houghton Mifflin, 2000), p. 17.
3 Ibid., p. 18.
4 Robin Clarke, *Water: The International Crisis* (Cambridge, MA: MIT Press, 1993), p. 67.
5 Sandra Postel, *Water for Agriculture* (Washington, DC: Worldwatch Institute, 1989).
6 Ibid.
7 Vandana Shiva, *Staying Alive: Women, Ecology and Development in India* (London: Zed Books, 1988), pp. 67-77.
8 Vandana Shiva et al., *Ecology and the Politics of Survival: Conflicts Over Natural Resources in India* (New Delhi: Sage, 1991), p. 109.
9 Mira Behn, "Something Wrong in the Himalaya," (n.d.)
10 Vandana Shiva et al., *Ecology and the Politics of Survival*, p. 147.
11 Ibid.
12 Vandana Shiva, *Staying Alive*, p. 82.
13 Personal communication, Kader Asmal, Water Minister, South Africa; CSIR Division of Water, Environment and Forestry Technology, *The Environmental Impacts of Invading Alien Plants in South Africa* (Pretoria, SA: Department of Water Affairs and Forestry, 2001).
14 Vandana Shiva et al., *Doon Valley Ecosystem* (Government of India: Report produced for the Ministry of Environment).
15 Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, MA: Harvard University Press, 1974), pp. 2-21.
16 Shiva et al., *Ecology and the Politics of Survival*, p. 300.
17 Ibid.
18 Vandana Shiva, "Homeless in the Global Village," in Maria Mies and Vandana Shiva, *Ecofeminism* (Halifax, NS: Fernwood Publications; London: Zed Books, 1993), p. 100.
19 Vandana Shiva and Afsar Jafri, *Stronger than Steel: People's Movement Against Globalisation and the Gopalpur Steel Plant* (New Delhi: Research Foundation for Science, Technology, and Ecology, 1998), p. 1.
20 Vandana Shiva et al., *The Ecological Costs of Globalisation* (New Delhi: Research Foundation for Science, Technology and Ecology, 1997), p. 7.
21 "What is RTZ Doing in Orissa?" (report by Mines, Minerals and People, April 15, 2001).
22 Ibid.
23 Prafulla Samantra, "Kashipur Alumina Projects and the Voice of Tribals for Life and Livelihood," (presentation at the Conference on Globalisation and Environment sponsored by the Research Foundation for Science, Technology and Ecology, September 30, 2001).

24 Vandana Shiva, *Violence of the Green Revolution* (London: Zed Books, 1991).
25 V.B. Vebalkar, "Irrigation by Groundwater in Maharashtra," (Poona, India: Groundwater Survey and Development Agency, 1984).
26 Anjana Trivedi and Rajendar Bandhu, "Report of Water Scarcity in Malwa," *Niti Marg* (May 2001), pp. 19-25.
27 Ibid.
28 Lloyd Timberlake, *Africa in Crisis: The Causes, the Cures of Environmental Bankruptcy* (London: International Institute for Environment and Development, 1985).
29 Anjana Trivedi and Rajendar Bandhu, "Report of Water Scarcity in Malwa."
30 Ibid.
31 Centre for Science and Environment, "Water Report," Delhi, 2000.
32 Vandana Shiva et al., *Ecology and the Politics of Survival*, p. 187.
33 "Gujarat in for Acute Water Famine," *Times of India*, December 20, 1986; "Solutions that Hold No Water," *Times of India*, December 8, 1986.
34 V.B. Hebalkar, "Irrigation by Groundwater in Maharashtra."
35 Terry Anderson and Pamela Snyder, *Water Markets: Priming the Invisible Pump* (Washington DC: Cato Institute, 1997), p. 8.
36 Jack Hirshleifer, James C. De Haven, and Jerome W. Milliman, *Water Supply: Economics, Technology, and Policy* (Chicago, IL: University of Chicago Press, 1960).