

As originally published in *The Atlantic Monthly*, September 1993

Can Selfishness Save the Environment?

Conventional wisdom has it that the way to avert global ecological disaster is to persuade people to change their selfish habits for the common good. A more sensible approach would be to tap a boundless and renewable resource: the human propensity for thinking mainly of short term self-interest

by Matt Ridley and Bobbi S. Low

JOHN Hildebrand who has lived in the Artesian Valley, near Fowler, Kansas, since he was two years old, remembers why the valley has the name it does. "There were hundreds of natural springs in this valley. If you drilled a well for your house, the natural water pressure was enough to go through your hot-water system and out the shower head." There were marshes in Fowler in the 1920s, where cattle sank to their bellies in mud. And the early settlers went boating down Crooked Creek, in the shade of the cottonwoods, as far as Meade, twelve miles away.

Today the creek is dry, the bogs and the springs have gone, and the inhabitants of Fowler must dig deeper and deeper wells to bring up water. The reason is plain enough: seen from the air, the surrounding land is pockmarked with giant discs of green--quarter-section pivot-irrigation systems water rich crops of corn, steadily depleting the underlying aquifer. Everybody in Fowler knows what is happening, but it is in nobody's interest to cut down his own consumption of water. That would just leave more for somebody else.

Five thousand miles to the east, near the Spanish city of Valencia, the waters of the River Turia are shared by some 15,000 farmers in an arrangement that dates back at least 550 years and probably longer. Each farmer, when his turn comes, takes as much water as he needs from the distributory canal and wastes none. He is discouraged from cheating-- watering out of turn--merely by the watchful eyes of his neighbors above and below him on the canal. If they have a grievance, they can take it to the Tribunal de las Aguas, which meets on Thursday mornings outside the Apostles' door of the Cathedral of Valencia. Records dating back to the 1400s suggest that cheating is rare. The huerta of Valencia is a profitable region, growing at least two crops a year.

Two irrigation systems: one sustainable, equitable, and long-lived, the other a doomed free-for-all. Two case histories cited by political scientists who struggle to understand the persistent human failure to solve "common-pool resource problems." Two models for how the planet Earth might be managed in an age of global warming. The atmosphere is just like the aquifer beneath Fowler or the waters of the Turia: limited and shared. The only way we can be sure not to abuse it is by self-restraint. And yet nobody knows how best to persuade the human race to exercise self-restraint.

At the center of all environmentalism lies a problem: whether to appeal to the heart or to the head--whether to urge people to make sacrifices in behalf of the planet or to accept that they will not, and instead rig the economic choices so that they find it rational to be

environmentalist. It is a problem that most activists in the environmental movement barely pause to recognize. Good environmental practice is compatible with growth, they insist, so it is rational as well as moral. Yet if this were so, good environmental practice would pay for itself, and there would be no need to pass laws to deter polluters or regulate emissions. A country or a firm that cut corners on pollution control would have no cost advantage over its rivals.

Those who do recognize this problem often conclude that their appeals should not be made to self-interest but rather should be couched in terms of sacrifice, selflessness, or, increasingly, moral shame.

We believe they are wrong. Our evidence comes from a surprising convergence of ideas in two disciplines that are normally on very different tracks: economics and biology. It is a convergence of which most economists and biologists are still ignorant, but a few have begun to notice. "I can talk to evolutionary biologists," says Paul Romer, an economist at the University of California at Berkeley and the Canadian Institute for Advanced Research, in Toronto, "because, like me, they think individuals are important. Sociologists still talk more of the action of classes rather than individuals." Gary Becker, who won the Nobel Prize in economics last year, has been reading biological treatises for years; Paul Samuelson, who won it more than twenty years ago, has published several papers recently applying economic principles to biological problems. And biologists such as John Maynard Smith and William Hamilton have been raiding economics for an equally long time. Not that all economists and biologists agree--that would be impossible. But there are emerging orthodoxies in both disciplines that are strikingly parallel.

The last time that biology and economics were engaged was in the Social Darwinism of Herbert Spencer and Francis Galton. The precedent is not encouraging. The economists used the biologists' idea of survival of the fittest to justify everything from inequalities of wealth to racism and eugenics. So most academics are likely to be rightly wary of what comes from the new entente. But they need not fear. This obsession is not with struggle but with cooperation.

FOR THE GOOD OF THE WORLD?

BIOLOGISTS and economists agree that cooperation cannot be taken for granted. People and animals will cooperate only if they as individuals are given reasons to do so. For economists that means economic incentives; for biologists it means the pursuit of short-term goals that were once the means to reproduction. Both think that people are generally not willing to pay for the long-term good of society or the planet. To save the environment, therefore, we will have to find a way to reward individuals for good behavior and punish them for bad. Exhorting them to self sacrifice for the sake of "humanity" or "the earth" will not be enough.

This is utterly at odds with conventional wisdom. "Building an environmentally sustainable future depends on restructuring the global economy, major shifts in human reproductive behavior, and dramatic changes in values and lifestyles," wrote Lester Brown, of the Worldwatch Institute, in his State of the World for 1992, typifying the way environmentalists see economics. If people are shortsighted, an alien value system, not human nature, is to

blame.

Consider the environmental summit at Rio de Janeiro last year. Behind its debates and agreements lay two entirely unexamined assumptions: that governments could deliver their peoples, and that the problem was getting people to see the global forest beyond their local trees. In other words, politicians and lobbyists assume that a combination of international treaties and better information can save the world. Many biologists and economists meanwhile assert that even a fully informed public, whose governments have agreed on all sorts of treaties, will still head blindly for the cliff of oblivion.

Three decades ago there was little dissonance between academic thinking and the environmentalists' faith in the collective good. Biologists frequently explained animal behavior in terms of the "good of the species," and some economists were happy to believe in the Great Society, prepared to pay according to its means for the sake of the general welfare of the less fortunate. But both disciplines have undergone radical reformations since then. Evolutionary biology has been transformed by the "selfish gene" notion, popularized by Richard Dawkins, of Oxford University, which essentially asserts that animals, including man, act altruistically only when it brings some benefit to copies of their own genes. This happens under two circumstances: when the altruist and the beneficiary are close relatives, such as bees in a hive, and when the altruist is in a position to have the favor returned at a later date. This new view holds that there simply are no cases of cooperation in the animal kingdom except these. It took root with an eye-opening book called *Adaptation and Natural Selection* (1966), by George Williams, a professor of biological sciences at the State University of New York at Stony Brook. Williams's message was that evolution pits individuals against each other far more than it pits species or groups against each other.

By coincidence (Williams says he was unaware of economic theory at the time), the year before had seen the publication of a book that was to have a similar impact on economics. Mancur Olson's *Logic of Collective Action* set out to challenge the notion that individuals would try to further their collective interest rather than their short-term individual interests. Since then economics has hewed ever more closely to the idea that societies are sums of their individuals, each acting in rational self interest, and policies that assume otherwise are doomed. This is why it is so hard to make a communist ideal work, or even to get the American electorate to vote for any of the sacrifices necessary to achieve deficit reduction.

And yet the environmental lobby posits a view of the human species in which individual self-interest is not the mainspring of human conduct. It proposes policies that assume that when properly informed of the long term collective consequences of their actions, people will accept the need for rules that impose restraint. One of the two philosophies must be wrong. Which?

We are going to argue that the environmental movement has set itself an unnecessary obstacle by largely ignoring the fact that human beings are motivated by self-interest rather than collective interests. But that does not mean that the collective interest is unobtainable: examples from biology and economics show that there are all sorts of ways to make the individual interest concordant with the collective--so long as we recognize the need to.

The environmentalists are otherwise in danger of making the same mistakes that Marxists made, but our point is not political. For some reason it is thought conservative to believe that

human nature is inherently incapable of ignoring individual incentives for the greater good, and liberal to believe the opposite. But in practice liberals often believe just as strongly as conservatives in individual incentives that are not monetary. The threat of prison, or even corporate shame, can be incentives to polluters. The real divide comes between those who believe it is necessary to impose such incentives, and those who hope to persuade merely by force of argument.

Wherever environmentalism has succeeded, it has done so by changing individual incentives, not by exhortation, moral reprimand, or appeals to our better natures. If somebody wants to dump a toxic chemical or smuggle an endangered species, it is the thought of prison or a fine that deters him. If a state wants to avoid enforcing the federal Clean Air Act of 1990, it is the thought of eventually being "bumped up" to a more stringent nonattainment category of the act that haunts state officials. Given that this is the case, environmental policy should be a matter of seeking the most enforceable, least bureaucratic, cheapest, most effective incentives. Why should these always be sanctions? Why not some prizes, too? Nations, states, local jurisdictions, and even firms could contribute to financial rewards for the "greenest" of their fellow bodies.

PLAYING GAMES WITH LIFE

THE new convergence of biology and economics has been helped by a common methodology--game theory. John Maynard Smith, a professor of biology at the University of Sussex, in Britain, was the first effectively to apply the economist's habit of playing a "game" with competing strategies to evolutionary enigmas, the only difference being that the economic games reward winners with money while evolutionary games reward winners with the chance to survive and breed. One game in particular has proved especially informative in both disciplines: the prisoner's dilemma.

A dramatized version of the game runs as follows: Two guilty accomplices are held in separate cells and interrogated by the police. Each is faced with a dilemma. If they both confess (or "defect"), they will both go to jail for three years. If they both stay silent (or "cooperate"), they will both go to jail for a year on a lesser charge that the police can prove. But if one confesses and the other does not, the defector will walk free on a plea bargain, while the cooperator, who stayed silent, will get a five-year sentence.

Assuming that they have not discussed the dilemma before they were arrested, can each trust his accomplice to stay silent? If not, he should defect and reduce his sentence from five to three years. But even if he can rely on his partner to cooperate, he is still better off if he defects, because that reduces his sentence from three years to none at all. So each will reason that the right thing to do is to defect, which results in three years for each of them. In the language of game theorists, individually rational strategies result in a collectively irrational outcome.

Biologists were interested in the prisoner's dilemma as a model for the evolution of cooperation. Under what conditions, they wanted to know, would it pay an animal to evolve a strategy based on cooperation rather than defection? They discovered that the bleak message of the prisoner's dilemma need not obtain if the game is only one in a long series--played by

students, researchers, or computers, for points rather than years in jail. Under these circumstances the best strategy is to cooperate on the first trial and then do whatever the other guy did last time. This strategy became known as tit-for-tat. The threat of retaliation makes defection much less likely to pay. Robert Axelrod, a political scientist, and William Hamilton, a biologist, both at the University of Michigan, discovered by public tournament that there seems to be no strategy that beats tit-for-tat. Tit-for-two-tats--that is, cooperate even if the other defects once, but not if he defects twice--comes close to beating it, but of hundreds of strategies that have been tried, none works better. Field biologists have been finding tit-for-tat at work throughout the animal kingdom ever since. A female vampire bat, for example, will regurgitate blood for another, unrelated, female bat that has failed to find a meal during the night--but not if the donee has refused to be similarly generous in the past.

Such cases have contributed to a growing conviction among biologists that reciprocity is the basis of social life in animals like primates and dolphins, too. Male dolphins call in their debts when collecting allies to help them abduct females from other groups. Baboons and chimpanzees remember past favors when coming to one another's aid in fights. And human beings? Kim Hill and Hillard Kaplan, of the University of New Mexico, have discovered that among the Ache people of Paraguay, successful hunters share spare meat with those who have helped them in the past or might help them in the future.

The implication of these studies is that where cooperation among individuals does evolve, surmounting the prisoner's dilemma, it does so through tit-for-tat. A cautious exchange of favors enables trust to be built upon a scaffolding of individual reward. The conclusion of biology, in other words, is a hopeful one. Cooperation can emerge naturally. The collective interest can be served by the pursuit of selfish interests.

THE TRAGEDY OF THE COMMONS

ECONOMISTS are interested in the prisoner's dilemma as a paradoxical case in which individually rational behavior leads to collectively irrational results--both accomplices spend three years in jail when they could have spent only one. This makes it a model of a "commons" problem, the archetype of which is the history of medieval English common land. In 1968 the ecologist Garrett Hardin wrote an article in *Science* magazine that explained "the tragedy of the commons"--why common land tended to suffer from overgrazing, and why every sea fishery suffers from overfishing. It is because the benefits that each extra cow (or netful of fish) brings are reaped by its owner, but the costs of the extra strain it puts on the grass (or on fish stocks) are shared among all the users of what is held in common. In economic jargon, the costs are externalized. Individually rational behavior deteriorates into collective ruin.

The ozone hole and the greenhouse effect are classic tragedies of the commons in the making: each time you burn a gallon of gas to drive into town, you reap the benefit of it, but the environmental cost is shared with all five billion other members of the human race. You are a "free rider." Being rational, you drive, and the atmosphere's capacity to absorb carbon dioxide is "overgrazed," and the globe warms. Even if individuals will benefit in the long run from the prevention of global warming, in the short run such prevention will cost them dear. As Michael McGinnis and Elinor Ostrom, of Indiana University at Bloomington, put it in a recent

paper, global warming is a "classic dilemma of collective action: a large group of potential beneficiaries facing diffuse and uncertain gains is much harder to organize for collective action than clearly defined groups who are being asked to suffer easily understandable costs."

Hardin recognized two ways to avoid overexploiting commons. One is to privatize them, so that the owner has both costs and benefits. Now he has every incentive not to overgraze. The other is to regulate them by having an outside agency with the force of law behind it--a government, in short -restrict the number of cattle.

At the time Hardin published his article, the latter solution was very popular. Governments throughout the world reacted to the mere existence of a commons problem by grabbing powers of regulation. Most egregiously, in the Indian subcontinent communally exploited forests and grasslands were nationalized and put under the charge of centralized bureaucracies far away. This might have worked if governments were competent and incorruptible, and had bottomless resources to police their charges. But it made problems worse, because the forest was no longer the possession of the local village even collectively. So the grazing, poaching, and logging intensified--the cost had been externalized not just to the rest of the village but to the entire country.

The whole structure of pollution regulation in the United States represents a centralized solution to a commons problem. Bureaucrats decide, in response to pressure from lobbyists, exactly what levels of pollution to allow, usually give no credit for any reductions below the threshold, and even specify the technologies to be used (the so-called "best available technology" policy). This creates perverse incentives for polluters, because it makes pollution free up to the threshold, and so there is no encouragement to reduce pollution further. Howard Klee, the director of regulatory affairs at Amoco Corporation, gives a dramatic account of how topsy-turvy this world of "command and control" can become. "If your company does voluntary control of pollution rather than waiting for regulation, it is punished by putting itself at a comparative disadvantage. The guy who does nothing until forced to by law is rewarded." Amoco and the Environmental Protection Agency did a thorough study of one refinery in Yorktown, Virginia, to discover what pollutants came out from it and how dangerous each was. Their conclusion was startling. Some of the things that Amoco and other refiners were required to do by EPA regulations were less effective than alternatives; meanwhile, pollution from many sources that government does not regulate could have been decreased. The study group concluded that for one fourth of the amount that it currently spends on pollution control, Amoco could achieve the same effect in protection of health and the environment--just by spending money where it made a difference, rather than where government dictated.

A more general way, favored by free-market economists, of putting the same point is that regulatory regimes set the value of cleanliness at zero: if a company wishes to produce any pollutant, at present it can do so free, as long as it produces less than the legal limit. If, instead, it had to buy a quota from the government, it would have an incentive to drive emissions as low as possible to keep costs down, and the government would have a source of revenue to spend on environmental protection. The 1990 Clean Air Act set up a market in tradable pollution permits for sulfur-dioxide emissions, which is a form of privatization.

THE PITFALLS OF PRIVATIZATION

BECAUSE privatizing a common resource can internalize the costs of damaging it, economists increasingly call for privatization as the solution to commons problems. After all, the original commons--common grazing land in England--were gradually "enclosed" by thorn hedges and divided among private owners. Though the reasons are complex, among them undoubtedly was the accountability of the private landowner. As Sir Anthony Fitzherbert put it in *The Boke of Husbandrie* (1534): "And though a man be but a farmer, and shall have his farm XX [20] yeres, it is lesse coste to hym, and more profyete to quyckeset [fence with thorns], dyche and hedge, than to have his cattell goo before the herdeman [on common land]." The hawthorn hedge did for England what barbed wire did for the prairies -it privatized a common.

It would be possible to define private property rights in clean air. Paul Romer, of Berkeley, points out that the atmosphere is not like the light from a lighthouse, freely shared by all users. One person cannot use a given chunk of air for seeing through--or comfortably breathing--after another person has filled it with pollution any more than two people in succession can kill the same whale. What stands in the way of privatizing whales or the atmosphere is that enforcement of a market would require as large a bureaucracy as if the whole thing had been centralized in the first place.

The privatization route has other drawbacks. The enclosure movement itself sparked at least three serious rebellions against the established order by self-employed yeomen dispossessed when commons were divided. It would be much the same today. Were whale-killing rights to be auctioned to the highest bidder, protectors (who would want to buy rights in order to let them go unused) would likely be unable to match the buying power of the whalers. If U.S. citizens were to be sold shares in their national parks, those who would rather operate strip mines or charge access might be prepared to pay a premium for the shares, whereas those who would keep the parks pristine and allow visitors free access might not.

Moreover, there is no guarantee that rationality would call for a private owner of an environmental public good to preserve it or use it sustainably. Twenty years ago Colin Clark, a mathematician at the University of British Columbia, wrote an article in *Science* pointing out that under certain circumstances it might make economic sense to exterminate whales. What he meant was that because interest rates could allow money to grow faster than whales reproduce, even somebody who had a certain monopoly over the world's whales and could therefore forget about free riders should not, for reasons of economic self-interest, take a sustainable yield of the animals. It would be more profitable to kill them all, bank the proceeds, sell the equipment, and live off the interest.

So until recently the economists had emerged from their study of the prisoner's dilemma more pessimistic than the biologists. Cooperation, they concluded, could not be imposed by a central bureaucracy, nor would it emerge from the allocation of private property rights. The destructive free-for-all of Fowler, Kansas, not the cooperative harmony of Valencia's huerta, was the inevitable fate of common-pool resources.

THE MIDDLE WAY

IN the past few years, however, there has been a glint of hope amid the gloom. And it bears an uncanny similarity to tit-for-tat, in that it rewards cooperators with cooperation and punishes defectors with defection--a strategy animals often use. Elinor Ostrom and her colleagues at Indiana University have made a special study of commons problems that were solved, including the Valencia irrigation system, and she finds that the connective thread is neither privatization nor centralization. She believes that local people can and do get together to solve their difficulties, as long as the community is small, stable, and communicating, and has a strong concern for the future. Among the examples she cites is a Turkish inshore fishery at Alanya. In the 1970s the local fishermen fell into the usual trap of heavy fishing, conflict, and potential depletion. But they then developed an ingenious and complicated set of rules, allocating by lot each known fishing location to a licensed fisher in a pattern that rotates through the season. Enforcement is done by the fishermen themselves, though the government recognizes the system in law.

Valencia is much the same. Individuals know each other and can quickly identify cheaters. Just as in tit-for-tat, because the game is played again and again, any cheater risks ostracism and sanction in the next round. So a small, stable community that interacts repeatedly can find a way to pursue the collective interest--by altering the individual calculation.

"There's a presumption out there that users always overexploit a common resource," Ostrom says, "and therefore governments always have to step in and set things right. But the many cases of well-governed and -managed irrigation systems, fisheries, and forests show this to be an inadequate starting point. A faraway government could never have found the resources to design systems like Alanya." Ostrom is critical of the unthinking application of oversimplified game-theory models because, she says, economists and biologists alike frequently begin to believe that people who have depended on a given economic or biological resource for centuries are incapable of communicating, devising rules, and monitoring one another. She admits that cooperation is more likely in small groups that have common interests and the autonomy to create and enforce their own rules.

Some biologists go further, and argue that even quite big groups can cooperate. Egbert Leigh, of the Smithsonian Tropical Research Institute, points out that commons problems go deep into the genetics of animals and plants. To run a human body, 75,000 different genes must "agree" to cooperate and suppress free-riders (free-riding genes, known as outlaw genes, are increasingly recognized as a major force in evolution). Mostly they do, but why? Leigh found the answer in Adam Smith, who argued, in Leigh's words, that "if individuals had sufficient common interest in their groups good, they would combine to suppress the activities of members acting contrary to the group's welfare." Leigh calls this idea a "parliament of genes," though it is crucial to it that all members of such a parliament would suffer if cooperation broke down--as the members of real national parliaments do not when they impose local solutions.

WHAT CHANGED DU PONT'S MIND?

FOR all these reasons, cooperation ought not to be a problem in Fowler, Kansas--a community in which everybody knows everybody else and shares the immediate consequences of a tragedy of the commons. Professor Kenneth Oye, the director of the Center for International Studies at the Massachusetts Institute of Technology, first heard about Fowler's sinking water table when his wife attended a family reunion there.

Oye's interest was further piqued when he subsequently heard rumors that the state had put a freeze on the drilling of new wells in the Fowler area: such a move might be the beginning of a solution to the water depletion, but it was also a classic barrier to the entry of new competitors in an industry. Oye had been reflecting on the case of Du Pont and chlorofluorocarbons, wondering why a corporation would willingly abandon a profitable business by agreeing to phase out the chemicals that seem to damage the ozone layer. Du Pont's decision stands out as an unusually altruistic gesture amid the selfish strivings of big business. Without it the Montreal protocol on ozone-destroying chemicals, a prototype for international agreements on the environment, might not have come about. Why had Du Pont made that decision? Conventional wisdom, and Du Pont's own assertions, credit improved scientific understanding and environmental pressure groups. Lobbyists had raised public consciousness about the ozone layer so high that Du Pont's executives quickly realized that the loss of public good will could cost them more than the products were worth. This seems to challenge the logic of tit-for-tat. It suggests that appeals to the wider good can be effective where appeals to self interest cannot.

Oye speculates that this explanation was incomplete, and that the company's executives may have been swayed in favor of a ban on CFCs by the realization that the CFC technology was mature and vulnerable. Du Pont was in danger of losing market share to its rivals. A ban beginning ten years hence would at least make it worth no potential rival's while to join in; Du Pont could keep its market share for longer and meanwhile stand a chance of gaining a dominant market share of the chemicals to replace CFCs. Again self-interest was part of the motive for environmental change. If consciousness-raising really changes corporate minds, why did the utility industry fight the Clean Air Act of 1990 every step of the way? The case of Du Pont is not, after all, an exception to the rule that self-interest is paramount.

THE INTANGIBLE CARROTS

BESIDES, environmentalists cannot really believe that mere consciousness-raising is enough or they would not lobby so hard in favor of enforceable laws. About the only cases in which they can claim to have achieved very much through moral suasion are the campaigns against furs and ivory. There can be little doubt that the world's leopards breathe easier because of the success of campaigns in recent decades against the wearing of furs. There was no need to bribe rich socialites to wear fake furs--they were easily shamed into it. But then shame can often be as effective an incentive as money.

Certainly the environmental movement believes in the power of shame, but it also believes in appealing to people's better natures. Yet the evidence is thin that normative pressures work for necessities. Furs are luxuries; and recycling works better with financial incentives or legal sanctions attached. Even a small refund can dramatically increase the amount of material that

is recycled in household waste. In one Michigan study recycling rates were less than 10 percent for nonrefundable glass, metal, and plastic, and more than 90 percent for refundable objects. Charities have long known that people are more likely to make donations if they are rewarded with even just a tag or a lapel pin. Tit for tat.

The issue of normative pressure versus material incentive comes into sharp focus in the ivory debate. Western environmentalists and East African governments argue that the only hope for saving the elephant is to extinguish the demand for ivory by stifling supply and raising environmental consciousness. Many economists and southern African governments argue otherwise: that local people need incentives if they are to tolerate and protect elephants, incentives that must come from a regulated market for ivory enabling sustained production. Which is right depends on two things: whether it is possible to extinguish the demand for ivory in time to save the elephants, and whether the profits from legal ivory trading can buy sufficient enforcement to prevent poaching at home.

Even if it proved possible to make ivory so shameful a purchase that demand died, this would be no precedent for dealing with global warming. By giving up ivory, people are losing nothing. By giving up carbon dioxide, people are losing part of their standard of living.

Yet again and again in recent years environmentalists have persisted in introducing an element of mysticism and morality into the greenhouse debate, from Bill McKibben's nostalgia about a nature untouched by man in *The End of Nature* to James Lovelock's invention of the Gaia hypothesis. Others have often claimed that a mystical and moral approach works in Asia, so why not here? The reverence for nature that characterizes the Buddhist, Jain, and Hindu religions stands in marked contrast to the more exploitative attitudes of Islam and Christianity. Crossing the border from India to Pakistan, one is made immediately aware of the difference: the peacocks and monkeys that swarm, tame and confident, over every Indian temple and shrine are suddenly scarce and scared in the Muslim country.

In surveying people's attitudes around the Kosi Tappu wildlife reserve in southeastern Nepal, Joel Heinen, of the University of Michigan, discovered that Brahmin Hindus and Buddhists respect the aims of conservation programs much more than Muslims and low-caste Hindus. Nonetheless, religious reverence did not stand in the way of the overexploitation of nature. Heinen told us, "Sixty-five percent of the households in my survey expressed negative attitudes about the reserve, because the reserve took away many rights of local citizens." Nepal's and India's forests, grasslands, and rivers have suffered tragedies of the commons as severe as any country's. The eastern religious harmony with nature is largely lip service.

THE GOLDEN AGE THAT NEVER WAS

IN recent years those who believe that the narrow view of selfish rationalism expressed by economists and biologists is a characteristically Western concept have tended to stress not Buddhist peoples but pre-industrial peoples living close to nature. Indeed, so common is the view that all environmental problems stem from man's recent and hubristic attempt to establish dominion over nature, rather than living in harmony with it, that this has attained the status of a cliché, uttered by politicians as diverse as Pope John Paul II and Albert Gore. It is a

compulsory part of the preface in most environmental books.

If the cliché is true, then the biologists and economists are largely wrong. Individuals can change their attitudes and counteract selfish ambitions. If the cliché is false, then it is the intangible incentive of shame, not the appeal to collective interest, that changes people's minds.

Evidence bearing on this matter comes from archaeologists and anthropologists. They are gradually reaching the conclusion that pre industrial people were just as often capable of environmental mismanagement as modern people, and that the legend of an age of environmental harmony--before we "lost touch with nature"--is a myth. Examples are now legion. The giant birds of Madagascar and New Zealand were almost certainly wiped out by man. In 2,000 years the Polynesians converted Easter Island, in the eastern Pacific, from a lush forest that provided wood for fishing canoes into a treeless, infertile grassland where famine, warfare, and cannibalism were rife. Some archaeologists believe that the Mayan empire reduced the Yucatan peninsula to meager scrub, and so fatally wounded itself. The Anasazi Indians apparently deforested a vast area.

History abounds with evidence that limitations of technology or demand, rather than a culture of self-restraint, are what has kept tribal people from overgrazing their commons. The Indians of Canada had the technology to exterminate the beaver long before white men arrived; at that point they changed their behavior not because they lost some ancient reverence for their prey but because for the first time they had an insatiable market for beaver pelts. The Hudson's Bay Company would trade a brass kettle or twenty steel fishhooks for every pelt.

CAUSE FOR HOPE

WE conclude that the cynicism of the economist and the biologist about man's selfish, shortsighted nature seems justified. The optimism of the environmental movement about changing that nature does not. Unless we can find a way to tip individual incentives in favor of saving the atmosphere, we will fail. Even in a pre-industrial state or with the backing of a compassionate, vegetarian religion, humanity proves incapable of overriding individual greed for the good of large, diverse groups. So must we assume that we are powerless to avert the tragedy of the aerial commons, the greenhouse effect?

Fortunately not. Tit-for-tat can come to the rescue. If the principles it represents are embodied in the treaties and legislation that are being written to avert global warming, then there need be no problem in producing an effective, enforceable, and acceptable series of laws.

Care will have to be taken that free-rider countries don't become a problem. As Robert Keohane, of Harvard University's Center for International Affairs, has stressed, the commons problem is mirrored at the international level. Countries may agree to treaties and then try to free-ride their way past them. Just as in the case of local commons, there seem to be two solutions: to privatize the issue and leave it to competition between sovereign states (that is, war), or to centralize it and enforce obedience (that is, world government). But Keohane's work on international environmental regimes to control such things as acid rain, oil pollution, and overfishing came to much the same conclusion as Ostrom's; a middle way exists. Trade

sanctions, blackmail, bribes, and even shame can be used between sovereign governments to create incentives for cooperation as long as violations can be easily detected. The implicit threat of trade sanctions for CFC manufacture is "a classic piece of tit-for-tat," Paul Romer observes.

Local governments within the nation can play tit-for-tat as well. The U.S. government is practiced at this art: it often threatens to deprive states of highway construction funds, for example, to encourage them to pass laws. States can play the same game with counties, or cities, or firms, and so on down to the level of the individual, taking care at each stage to rig the incentives so that obedience is cheaper than disobedience. Any action that raises the cost of being a free-rider, or raises the reward of being a cooperater, will work. Let the United States drag its feet over the Rio conventions if it wants, but let it feel the sting of some sanction for doing so. Let people drive gas-guzzlers if they wish, but tax them until it hurts. Let companies lobby against anti-pollution laws, but pass laws that make obeying them worthwhile. Make it rational for individuals to act green.

If this sounds unrealistic, remember what many environmental lobbyists are calling for. "A fundamental restructuring of many elements of society," Lester Brown proposes; "a wholly new economic order." "Modern society will find no solution to the ecological problem unless it takes a serious look at its lifestyle," the Pope has said. These are hardly realistic aims.

We are merely asking governments to be more cynical about human nature. Instead of being shocked that people take such a narrow view of their interests, use the fact. Instead of trying to change human nature, go with the grain of it. For in refusing to put group good ahead of individual advantage, people are being both rational and consistent with their evolutionary past.