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Madhav Gadgil

Abstract

Today's environment-development debate is cast in inappropriate terms of just two choices. This is a false contradiction; the real issue is not whether India can afford the so-called luxury of worrying about environment, but whether India can afford to slide into a lawless, tyrannical society that abuses the liberating spirit of science. Economics, properly interpreted, tells us that any country should aim at ensuring a harmonious development of the sum total of the nation's capital stocks of natural, man-made, human and social capitals. This calls for focussing on creating a law-abiding, genuinely democratic society that truly imbibes the scientific spirit. A well-informed citizenry able to exercise its democratic rights will automatically ensure that environment is properly cared for, as has happened in the highly industrialized Germany and Scandinavia. What we must do is concentrate on implementing what by all rights should be implemented: the many well designed provisions of various Acts and Schemes for protecting the environment, and for devolution of democratic powers, provisions that are being systematically sabotaged today.

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Nehru's Legacy

I greatly appreciate the privilege of delivering a public lecture at this venue dedicated to the memory of Pandit Jawaharlal Nehru. I wish to focus on three of his important legacies: Science, Democracy and Ecology. He emphasized the vital role of the scientific spirit in nurturing modern India, and he ably steered India onto a democratic course despite manifold difficulties. He pioneered nature conservation efforts in modern India, establishing India's first bird sanctuary at Bharatpur, acting on a suggestion from his good friend, and my guru, Salim Ali. These also happen to be my three passions, and I want to take advantage of this opportunity to take stock of where we stand today on these three vital concerns: Science, Democracy and Ecology.

An Asian Century?

It is being said that the 21st century will belong to India and China. We live in a world shaped by science and products of science-based technologies. These technologies are now moving from a focus on machines to one on information, and the 21st century promises to be an age of knowledge. It will also be a century of worldwide awareness of ecological concerns. Knowledge, including science, prospers in the free atmosphere of democracies; democracies also take far better care of their environment. It is therefore our fond hope that given our democratic strengths India will eventually take a leading position in the community of nations despite the current higher rate of economic growth in China.

But are we doing justice to our democracy, to our scientific and technological capabilities, to our heritage of environmental prudence? We currently seem to be launched on a path of development that is based on the premises that free markets ensure economic efficiency and lead to economic growth with wealth flowing down to all segments of the society, and therefore all interference with market forces, including regulations towards protection of environment and sensitivities towards what the people at the grass-roots want should be set aside. But this market fetishism is neither justified by good empirical evidence, nor by sound logic. Free markets ensure economic efficiency only if there

is completely free and fair competition without any monopolies, and if the consumer has full information relating to the possible choices; this is simply not the case. Furthermore, markets, even if entirely free, do not take into account externalities such as depletion of natural resources, and therefore do not guarantee genuine economic efficiency. Nor are the markets responsive to the aspirations of people with little purchasing power, a serious flaw, since the bulk of the Indians remain poor, and it is these largely poor people who, our Constitution tells us, are sovereign in our democracy. Indeed, world over this flawed philosophy of economic growth for its own sake has fostered rent-seeking, such that economic gains of the beneficiaries of this philosophy are often excessive and in no way proportional to their social contributions (Stiglitz 2012). Consequently a small proportion of the population has cornered the bulk of the wealth and political power, and democracy has been perverted from a one person-one vote to a one rupee-one vote system in which the powerful are continually engaged in distorting the economy and polity to enhance their own, often unjustifiable, gains. The resultant undesirable consequences include [a] exhaustive use of natural resources, [b] unacceptable pollution loads, [c] failure to build human capital because of misuse and abuse of science and technology, persistent malnutrition, poor health care, and high levels of unemployment and under-employment, and [d] an erosion of social capital with violation of democratic rights and attendant social disaffection and strife.

Mutual Aid

This rent-seeking, this cornering of disproportionately high benefits by a small section of the society, goes against the very grain of humanity. Our sociality is rooted in extensive and long-lasting reciprocal exchanges, favours done and favours received, amongst members of any social group. This glue of mutual aid is responsible for the effective manner in which human societies function (Kropotkin 1907, Trivers 1971, 2002). Our language permits us to go beyond the limited here-and-now world of other animals and create mental models of the working of the world, and understand cause-effect relationships. While other living beings must depend on slow genetic change to respond to challenges posed by their physical environment, their prey, their

predators, their parasites and their competitors; humans, with their highly flexible behaviour and a tremendous capacity to learn, can respond very rapidly through behavioural and cultural change and have, as a result come to dominate the biosphere and have profound impacts on the physical environment as well (Pinker 2010).

Grounded as our social life is in reciprocal exchanges, in give-and-take, many human traits have evolved to keep track of social credit and debit, to continually monitor if reciprocal exchanges are fair, or if there is free-loading, sponging, even blood-sucking. We are constantly striving to ensure fairness of exchanges in goods and services, and of information. But with a very flexible language humans are not only adept at generating good information and build a sound body of knowledge on its basis; humans are also consummate liars. People not only help each other by supplying good information, but cheat each other by lying and deception. Our constant quest to ensure fair exchanges has therefore given rise to the very human feelings of gratitude or betrayal, and our notions of ethics, of immoral or criminal behaviour. We are constantly judging whether our fellow human beings are fair or unfair, reliable or unreliable, honest or dishonest, truthful or liars, just or unjust, kind or cruel (Trivers 2002).

So what economists term rent-seeking, making gains incommensurate with one's social contributions, is something we humans have evolved to resent, to constantly guard against. That is why Joseph Stiglitz, the Nobel Prize winning economist who has so relentlessly pursued issues of inequality is concerned with the fact that the world is functioning today in such an "unfair" fashion.

Of Science and Democracy

Humans, although immersed in networks of mutual aid, are, at the same time, extremely selfish animals. So there is a continual tussle, in minds of every individual, as well as in the collective consciousness of the society between the imperatives of being fair to each other, of pursuing broader social good on the one hand and the urge to benefit at the cost of others, to sacrifice social well-being in pursuit of narrow self-interest on the other. As man has accumulated knowledge, and

used it to devise more and more effective tools and extract more and more resources from nature, he has been freed from the need to live from day-to-day on what he or his kin could gather. With these material gains humans have been able to generate and accumulate surplus, beginning, ten thousand years ago, with stored grain and herds of livestock, to huge deposits of black money in Swiss Banks of the present times. Some people have thereby come to acquire the ability to force others to give in exchange much more than is given in return back to them. This has expressed itself in various forms of social hierarchy, of authority, of systems of governance.

These systems of governance have ranged from primitive democracies in small bands of hunter-gatherers, to only moderate accumulation of power in the hands of authorities in social formations such as *Ganas* in which Gautam Buddha was born, to relationships of extremely unequal exchanges as in the medieval Indian caste society or the slave labour-based cotton plantations of American South. That these inequities have given way to more equitable arrangements in recent times is related to the imperatives of modern science and technology.

Students of human evolution consider the success of *Homo sapiens* to be grounded in our elaboration of the "cognitive niche", in our special ability to share and elaborate knowledge. But since it takes no more effort to make an untruthful statement as a truthful statement, systems of knowledge are exceedingly susceptible to accumulation of statements that do not represent objective reality. A famous example is that of Aristotle, a man of profound learning, whose works include palpably false statements such as that women have fewer teeth than men. Aristotle's authority was accepted for many, many centuries; indeed the Church declared any contradiction to his teachings to be heresy, to be punished by no less than burning during the period of inquisition. Knowledge stagnated in such authoritarian times, when kings, supported as divine rulers by the church, also ruled with a heavy hand.

But Europe, threatened by Black Death and exhaustion of its forests and minerals desperately needed good objective knowledge for practical purposes such as navigating the oceans. The authorities were

therefore forced to loosen their stranglehold, albeit gradually, around Galileo's time and a system of anchoring knowledge firmly to the bedrock of empirical facts came to be put in place. Further growth of knowledge demanded rejection of all authority, other than that of objective reality, and all statements to be open to questioning by anybody and everybody who has the inclination to raise questions (Dampier 1931). This is how scientific enterprise gradually came to be elaborated; an enterprise that J. D. Bernal, founder of modern molecular biology, terms as an organized enterprise of skepticism (Bernal 1939).

As Europeans, equipped with modern science and science-based technologies came to overwhelm other societies, the resources flowing from all over the world to Europe created societies with much more equitable access to resources and an inclination to reject authority in the spirit of the resoundingly successful enterprise of science. French Revolution therefore talked of "Liberty, Equality, Fraternity" in 1790's, even as Europeans were actively engaged in the slave trade, and continued to practice slavery for many decades thereafter. Nevertheless, democracy gradually took roots in Europe and in Neo-Europes of North America and Australia over the 19th century. It has found near-universal acceptance only after the winding up of European colonial rule following the Second World War.

Rejection of authority and promotion of fair exchanges amongst equals are key features of democracy as well as of science. Naturally, the two go hand-in-hand. History has shown that science, as the world's most democratic enterprise, flourishes best in the free atmosphere of democracies. It was stifled by both of 20th century's preeminent dictators, Hitler and Stalin. One may therefore expect Indian science to be at a great advantage over that of the Chinese science. Regrettably there is considerable evidence that it is in fact falling behind. This is obviously related to the on-going suppression of science and of democratic freedoms in India.

Nature Worship

Humans have built models of non-human world on patterns of the human world. In such models, humans are viewed as members of

'community of beings'. Mountains and rivers, trees and fish, crocodiles and monkeys are all our companions in such a community. Human ethics is grounded in fair exchanges amongst members of human communities and extension of these notions to the community of beings is an important source of humanity's religious feelings. Naturally, primitive religions take the form of nature worship. These practices are at the root of ecological concerns of all societies (Gadgil 1989, Gadgil and Guha 1992).

Thus, democracy, science and ecology are all grounded in a common set of values emphasizing fair exchanges, fair play, just and honourable treatment, action, or conduct amongst equals.

Ecosystem People, Biosphere People

Relationships of people to other members of the society as well as to the natural world have changed, often radically, as humans have developed increasingly greater abilities to understand the working of nature and manipulate it through science and technology, building up a continually growing stock of ever larger and more complex and more diversified artifacts, ranging from stone axes to guided missiles, from bamboo rafts to oil tankers, from stone inscriptions to Wikipedias. In the process, different segments of human societies have acquired very different relationships to each other as well as to their environmental resources. Dasmann's (1988) pioneering work provides an excellent starting point for understanding these. Building on it, we may classify people into four major categories, (i) autonomous ecosystem people, (ii) subjugated ecosystem people, (iii) biosphere people or omnivores and (iv) ecological refugees. Ecosystem people are people with limited access to sources of energy (other than human and livestock muscle power) and to the more sophisticated artifacts. They gather or produce most of the resources they consume from their immediate surroundings, from the forest, scrub, rivers or seas and from low-input cultivation. In some of the more inaccessible corners of the world, such as Sentinel Islands in the Andamans, the ecosystem people are still autonomous. However, over most of the earth they have been subjugated by the omnivores and have very limited control over their own resource base of natural and semi-natural ecosystems. They gather and produce little

that can fetch value in markets and have very limited access to produce of intensively managed and industrial ecosystems.

The biosphere people or omnivores as Ram Guha and I prefer to call them owe their dominant position to their elaboration of and extensive control over knowledge, artifacts and additional sources of energy (Gadgil and Guha 1995, Gadgil and Rao 1998). They engage in energy-intensive agriculture, animal husbandry, aquaculture, or in organized services or industrial production and generate much that is of value in the markets. They have large ecological footprints thanks to their substantial purchasing power; their resource catchments are vast encompassing all of the biosphere – hence, their designation as biosphere people by Dasmann - bringing to them goods and services from all over the earth. This confers on them the ability to take over resources in demand by the ecosystem people, catalyzing transformation of natural and semi-natural ecosystems into those managed intensively to meet omnivore demands, including as sites for industrial enterprises, or as dumps of pollutants. In some special cases natural or semi-natural ecosystems are conserved for recreational purposes, from which ecosystem people are sought to be excluded, in forms such as National Parks.

In the process, they often deprive subjugated ecosystem people of access to their traditional resources; thereby converting them into ecological refugees. Ecological refugees are then people with attenuated access to resources of natural and semi-natural ecosystems, but with little purchasing power to access products of intensively managed and artificial ecosystems, including industrial enterprises. They often end up constituting the unorganized labour force in tracts of intensive agriculture and urban settlements.

In this framework, India today may be viewed as a mosaic of omnivores, some one-sixth of our population constituting the wealthy and the upper middle classes, largely urbanites engaged in organized sector, but also large landholders, fertilizer and pesticide merchants, JCB owners and sugar barons of rural India. The rural peasants and landless labourers, herders, fishers, forest produce gatherers and artisans constitute the subjugated ecosystem people. The ecological

refugees are exiles from myriads of development projects and people whose livelihoods have deteriorated as artisans have lost access to resource bases such as bamboos; as herders have been deprived of their common grazing lands; as fishers find no more fish in polluted waters; and as peasants have seen their wells go dry and crop productivity decline with air pollution. These ecological refugees constitute a cheap labour force for omnivore enterprises ranging from road and building construction, to quarrying and sand mining and harvesting sugar cane, or eke out a living as hawkers and domestic servants(Gadgil, 1996; Gadgil and Guha, 1995).

On the Appetite of Omnivores

Omnivores rule the world today. They have priority over access to world's material, energy and informational resources and, unlike ecosystem people tied to specific localities, have no stake in the health of the environment of any particular locality, other than in close proximity to their first or second homes. Four years ago, I stayed in a residential school for orphaned children just five kilometers from the Thermal Power Station of Parali Vaijnath in Parbhani district of Maharshtra for two nights. Thanks to the power plant, the school is in a locality bearing the brunt of air and water pollution. In the sweltering heat of the summer, the students were studying hard for the exams. But there was power shut-down of nineteen hours a day from five o'clock in the morning to midnight. The power generated close by was presumably flowing to Mumbai, the omnivorous capital of India, where wealthy families reportedly consume as much as 2 lakh rupees worth of electricity in a single day, and Indian Premier League (IPL) cricket stadiums never suffer power shortages.

Green Energy

The Indian omnivores are utterly convinced that they are "entitled" to the same wasteful, resource intensive lifestyle as the omnivores of the United States, regardless of the environmental and social costs that this is imposing on the lands and waters, plants and animals and ecosystem people and ecological refugees of our country. So there is no push for energy conservation, and no talk of moderating our energy

demands. The whole drive is towards enhancing energy production through every available route. One of these is the so-called *green* wind energy. A company named ENERCON has set up wind mills in Pune district on the crest of Western Ghats just south of Bhimashankar Wild Life Sanctuary, famous for the presence of the Giant Squirrel, the state animal of Maharashtra. This is the northern-most stretch of evergreen forest on the Western Ghats and its southern continuation in Mahabaleshwar has been constituted as an Ecologically Sensitive Area as far back as 1999. The Indian Board for Wild Life had resolved in 2002 that a zone of 10 km next to all Wild Life Sanctuaries and National Parks should be constituted into Ecologically Sensitive Areas. In 2006 Indian Parliament has passed the Scheduled Tribes and other Traditional Forest Dwellers (Rights over the Forest) Act, hereafter referred to as Forest Rights Act (FRA) according to which no development activity should be undertaken without first settling the individual as well as the community rights of these people, and this whole area has Mahadev Koli ST villages and Traditional Forest Dweller Dhangar settlements. When the wind mill project was mooted, the concerned Range Forest Officer had faithfully recorded the presence of significant plant resources as well as extensive populations of wild life species including Giant Squirrel in areas where the windmills have come up after being cleared in 2009. Some Gram Sabhas and Gram Panchayats also refused to give consent to the project.

The green wind energy projects are exempt from Environmental Clearances but require clearances from Forest Department in accordance with 1980 Forest Conservation Act, FCA. While other Environmental laws such as Air or Water Pollution Act are never implemented, the FCA is implemented with great vigour. The vigour manifests itself when the request is for clearance of a road or electricity line for a rural or tribal settlement, the subjugated ecosystem people of the country. Such demands are summarily rejected. When the request came from ENERCON, the IBWL stipulation of 10 km ESA was set aside, FRA was shelved, some Gram Panchayats' *No Objection Certificates* were apparently forged, RFO's honest submission was suppressed and the concerned Forest Conservator gave a palpably false statement and promptly cleared the project (Western Ghats Ecology Expert Panel WGEEP 2011).

The project is being executed with scant regard for safeguarding the environment. The roads to hill-top have resulted in large scale landslides, choking up springs supplying irrigation for agriculture, silting two large reservoirs on Bhama and Arala rivers, depositing rubble on paddy fields and a Medicinal Plant Conservation Area, and have illegally taken over whole hillsides with open collusion of the forest department. There is no electricity coming to local villages, nor have they benefited from any jobs other than those of a small number of watchmen. All this has been formally recorded by a petitioner in the Mumbai High Court and verified and recorded in the report of the WGEEP. The Government reaction has merely been first to suppress the WGEEP report and then to marshal all its resources to mislead people about the contents and consequences of the report (Gadgil 2013 a,b,c).

The opposition to the ENERCON project has had an interesting history. Given the suffering it is imposing on the people without benefiting them in any way, political leaders potentially stand to gain popularity from opposing the project. It is rumoured that the project, supported through large government subsidies, is being pushed by some leaders of the parties currently ruling in Maharashtra. One of the opposition leaders from the area initially raised a series of strong and seemingly valid objections. He then suddenly withdrew them without any detailed justification. Indeed the project is backed by a whole network of workers of all political parties going down to village level.

Reportedly these lower level political workers share in the funds routinely being misappropriated from public schemes. In fact, I had an interesting experience when the Panchayat Raj was launched in Karnataka in early '80s, with an energetic drive by a public spirited politician, Abdul Nazir Sab. I was fascinated and was in touch with many socially active people who were elected in the very first round. One of these was a farmer friend of mine elected to Uttara Kannada Zilla Parishat. He told me in great surprise that the day after his swearing in the local PWD Junior Engineer dropped in and handed him an envelop containing ten thousand rupees. The Engineer explained that he was now a part of the ruling clique and would be regularly receiving his monthly bribe so long as he remained in power, absolutely regardless

of political affiliation. The local level political workers also receive many other benefits such as being awarded Government contracts for digging wells which need not be dug, and contracts for supplying water by tankers as the village wells dry up with stoppage of ground water recharge as the sponge of river sand-bed is stripped off by illegal sand mining businesses, run, of course, by none other than local level political workers, and perhaps most attractive of all, encroaching on public land with impunity.

The whole political establishment is thus a cartel united in taking resources away from the ecosystem people of the country, sabotaging the social compact that we had forged while setting up the world's largest democracy.

Dealing with Complexity

The world today is shaped by science and science based technologies, and we expect all assertions to be logical and supported by scientific evidence. Science has had a resounding success in the realm of understanding and controlling simpler physical and chemical systems so that we can with confidence land our Chandrayan on the moon. But more complex systems are far less tractable. Their models are highly simplified and verification of predictions on the basis of replicated experiments is often out of question. The models of complex systems may therefore miss out key variables and come up with misleading conclusions, and predictions that can go astray. Further the empirical evidence required to determine the forms of various relationships and values of various parameters may be very weak, and assumption of wrong forms of relationships and wrong values may lead to serious mistakes.

Blunder of Bharatpur

Consider the case of Keoladev Ghana Bird Sanctuary at Bharatpur in Rajasthan. The Bharatpur wetlands which are famous for the large heronries in the rainy season and the enormous flocks of migratory birds visiting in winter, was one of the first wildlife sanctuaries to be created after independence by Pandit Jawaharlal Nehru at the instance

of his friend, the distinguished ornithologist, Dr Salim Ali in the 1950s. Salim Ali had worked for years at Bharatpur, ringing thousands of migratory birds. Bharatpur had been subject to grazing by buffaloes and other uses such as collection of khus grass by local people for centuries, and had remained a biodiversity rich habitat. However, Salim Ali felt, even though this feeling had no empirical evidence to support it, that the habitat would greatly benefit from a cessation of buffalo grazing and was backed by experts of the International Crane Foundation.

These recommendations led to the declaration of the locality as a National Park in 1982. The rigid regulations applicable to a National Park called for total cessation of livelihood activities of local people and consequently buffalo grazing was banned without any alternatives being offered. There were protests; seven people were killed in the firing that followed, but the ban was enforced. This intervention led to a totally unexpected outcome. It turned out that the buffaloes were keeping check on a water loving grass *Paspalum*. When grazing stopped this grass grew unchecked, rendering the wetland a far worse habitat for the waterfowl, the prime objective of the National Park management. Clearly the model that Salim Ali had in mind for this complex ecosystem was missing out some important variables (Vijayan 1987).

The numbers of Siberian cranes visiting Bharatpur have also been declining. Residents of the village Aghapur adjoining the National Park have an intriguing suggestion recorded in their People's Biodiversity Register in this regard. They believe that Siberian cranes earlier had better access to underground corms and tubers, their major food, because the soil used to be loosened while digging for khus roots. Since this collection was stopped on declaration of National Park, the soil has been compacted reducing the cranes' access to this food. This entirely plausible hypothesis is grounded in long term historical observations of which the local people are an important repository. Such observations and inferences based on these are a significant input to sciences of complex ecological systems and scientists are well advised to put such folk knowledge to good use in all humility (Gadgil 1996, 2000, Gadgil et al 2000, Gadgil et al 2006, Jain 1997).

Dismal Science

Human societies are, if anything, even more complex and their scientific study is fraught with dangers of making expedient assumptions and arriving at facile conclusions. Economics claims to be a science, albeit a "dismal" one in contradistinction to "gay or life-enhancing sciences". So propositions of economics too must be firmly grounded in empirical facts and sound logical deductions. This is hardly the case. Joseph Stiglitz, an eminent economist, winner of 2001 Nobel Prize and a former Chairman of Economic Advisory Council of Bill Clinton has recently written a well-researched book titled the "Price of Inequality" that documents in great detail how many, supposedly scientific propositions that have been guiding American economic policy are grounded neither in reliable empirical observations, nor in sound logical deductions (Stiglitz 2012). He subjects to very skeptical scrutiny the core propositions of the advocates of free market economy. These contend that free markets ensure economic efficiency and lead to economic growth with wealth flowing down to all segments of the society. Stiglitz provides considerable empirical evidence demonstrating that this is simply not so. These incorrect, but widely accepted propositions lead to the prescription that state interventions in the free play of markets should be minimized, that governmental expenditure should be pruned to the maximum extent possible and that the benefits of such reductions should be passed on to the wealthy by reducing their tax burden, because it is the wealthy who will invest their savings most efficiently in fostering further economic growth. Stiglitz provides considerable empirical evidence against these assertions and demonstrates that all this leads to is rent-seeking, or making unfair gains, and cites a large number of striking examples of rent-seeking from US experience. These include [1] successful resistance by coal industry to incorporating depletion of non-renewable resources into economic accounting and consequent reduction in high levels of subsidized rates enjoyed by the industry, [2] successful resistance by British Petroleum of liability to pay full damages caused by oil leakages due to their own negligence, [3] successful attempt by drug industry to ensure that the Government does not purchase drugs at rates arrived at through proper open market competition, [4] successful attempts by military contractors that the Government unquestioningly accepts

the exorbitant rates quoted by them, [5] iniquitous management of student loans programmes that ensures large profits to private educational institutions benefiting from Government investment in educational infrastructure but providing poor quality education leading to youth becoming indebted for life because of unfair terms of loan repayment, [6] illegal foreclosures on house mortgages that cannot be resisted by victims because of the high cost of legal action, [7] unfair sanction of large bonuses by bank executives to themselves mischievously taking advantage of Government bail-out payments when, in fact, the irresponsible banks should have been allowed to go bankrupt according to all tenets of free-market economy.

So the prescription that market forces ought to be permitted free play appears to be in the same league as Salim Ali's obviously ill-founded conclusion that banning grazing at Bharatpur will improve the habitat for the water birds. Stiglitz mentions how so accomplished an economist as Milton Friedman simply shut his mind off when Stiglitz tried to communicate that markets simply do not operate the way Friedman assumes them to do, and giving free rein to them merely encourages rent-seeking and is socially undesirable. Since Friedman's propositions seem to imply that omnivores are well advised to ignore environmental considerations or pay heed to what the majority of people want, his prescriptions have been embraced by Indian policy makers of the day with all fervour. The result is quite likely to be as disastrous for the country as Salim Ali's prescriptions were for the Bharatpur wetland (Shrivastava and Kothari 2012).

Employment and Malnutrition

Setting aside the economic theory for the moment, let us look at what the data tell us. The expectation is that the currently rapidly growing economy would be creating substantial number of new jobs. But, behaviours of complex systems are full of surprises and the national level empirical data suggests that the current pursuit of economic growth is not at all accompanied by higher levels of employment generation. The most reliable information on this count comes out of National Sample Survey. According to the statistics 63 million new jobs were created during the period 1999-2004. It was expected that at least 50

million new jobs would be created 2004-09. However the number of new jobs created was a meager 1 million (Mehrotra et al 2012). Notably no account is being taken in all this statistics of jobs once existing in the unorganized sector that are destroyed by environmental degradation. For instance, the Chemical Industry hub at Lote employs around 11-12 thousand people, while the loss of employment amongst fishing community due to water pollution has been estimated at around 20 thousand (WGEEP 2011).

It is no surprise that the current pattern of economic growth will lead, not to an enhancement, but a reduction in employment opportunities. For economic growth is now largely based on enhancement of productivity by employing more modern technologies. These involve automation, which is increasingly rendering human intervention redundant. Hence, a scooter factory near Pune now produces twice as many scooters per day, employing only half the labour force. So the tiny minority in control of technologies and capital to deploy these expensive technologies is in a strong position to bargain in the labour market at the cost of the vast majority of people.

Not that those who control technologies have necessarily made any major contributions to development of technologies either, they are just clever at managing market forces. Stiglitz cites as a case in point, Bill Gates, contrasting his prestige and wealth with that of Alan Turing, whose seminal work on the Turing machine laid the foundation of modern day computing, but who, persecuted as a homosexual, ended his life in suicide. Stiglitz also singles out for stinging criticism American bankers who have benefited tremendously from the facility of instantaneous world-wide transfer of financial resources, but whose unscrupulous, and on occasion, criminal conduct has now plunged the world in a grave financial crisis.

So empirical facts do not support the favoured model of economic growth with its claims of creating employment or reducing poverty, and its attendant evils such as malnutrition. These are concealed by plain fraud; cooking up data. For instance, the programme of providing mid-day meals in schools is an important component of the national effort to ensure that the children do not suffer from malnourishment.

Regular records are therefore maintained of indicators of levels of malnourishment by the authorities. Regrettably, the mid-day-meals programme suffers badly from corrupt practices and the desired results are not being obtained. This is being concealed by providing fake statistics. Thus, the statistics compiled from state level educational institutions shows that at the all-India level the proportion of malnourished school children declined from 28% in 1993 to 17% in 1999 and further to 8% in 2006. This dubious statistics may be compared with the results of the much more careful National Family Health Survey (NFHS), a large-scale, multi-round survey conducted in a representative sample of households throughout India. The NFHS results indicate that proportion of malnourished school children declined from 53% in 1993 to 47% in 1999 and had remained pretty much static at 46% in 2006 (Saxena 2012). A recent study by International Food Policy Research Institute suggests that fully 50% of world's malnourished people are citizens of India. In ecological terminology those suffering malnourishment are either subjugated ecosystem people or ecological refugees.

Our Social Compact

Nehru approvingly quotes Kalhana's *Rajtarangini*, a medieval narrative of Kashmir's rulers which states that a ruler's duty is to observe *dharma* and to ensure *abhaya* for the populace. On achieving independence we sealed a social compact with the people of India by developing and adopting a very progressive democratic constitution. The *dharma* of the Indian secular state obviously has to be to promote the basic objectives and values of this Constitution: Sovereignty, Socialism, Secularism, Democracy, Republican Character, Justice, Liberty, Equality, Fraternity, Human Dignity, and to safeguard the rights of freedom of expression, assembly, and beliefs, and the right to earn a livelihood. This will, of course, guarantee *abhaya*, freedom from fear, for the people. We obviously seem to be straying from the course, for very recently, the Justice Shah Commission mentions in its Report on Illegal Mining in Goa that Part IV, Section 24 of the MM(DR) Act, 1957 was not observed at all. "But no inspection has been carried out resulting into *fear-free* environment which has caused loss to the ecology, environment, agriculture, ground water, natural streams, ponds,

rivers, biodiversity, etc." (The report of Shah Commission 2012). So *abhaya*, freedom from fear, has been ensured, not for the people, especially the subjugated ecosystem people and the ecological refugees, but for the mine owners and managers and their allies amongst bureaucrats and politicians who have been violating laws and human rights with complete impunity.

This is the currently favoured path of development — development by exclusion, by impositions, even coercion, and conservation also by exclusion, by impositions, even coercion. This is accompanied by falsification of facts, thereby striking at the very root of science. It is accompanied by exhausting natural resources and permitting unbridled pollution, thereby violating ecology. It is accompanied by sabotaging the many constitutional provisions to devolve democratic decision-making powers, and tolerating, even aiding and abetting lawlessness (WGEEP 2011).

As Joseph Stiglitz points out such a narrow minded exclusionary approach sets aside the broader systemic perspective essential to finding answers to such a complex problem as development of India's multi-faceted society. As he points out, what we must aim at is a harmonious development of nation's four capital stocks: not just man-made capital that GDP takes into account, but natural capital, human capital and social capital as well.

Colonialism: External and Internal

India remains a biomass-based civilization, with a sizeable proportion of people dependent for protein-rich food on natural fish and shellfish populations, for calories on production of low input, organic manure based agriculture, for fuel on agricultural residues, dung and fuelwood, for fodder on grazing on common lands, and for drugs on wild plant resources. Our organized industries and services sector has generated minimal employment when compared to our vast population, so that a healthy base of environmental resources is vital to the livelihoods of a significant majority of Indians. A wholesome environment is, of course, essential to the health and well-being of all humans, which is why not only do the poor protest despoliation of

their environment, but the advertisements for housing for the wealthy trumpet views overlooking unspoilt forests, rivers and sea-beaches.

In pre-British times the state merely stepped in to expropriate surplus in the form of taxes, largely in kind, leaving local governance entirely to people. With communities tied to particular localities and with an expectation that their economies will change very little over time, there was strong motivation to use the environmental resources in a prudent fashion and India had a wealth of practices of conservation of nature and use of renewable resources in a sustainable fashion. These included protection to keystone resources like trees of genus *Ficus* like peepal and banyan, maintenance of sacred groves and sacred ponds, estimated to have covered at least 10% of India's landscape and waterscape (Gadgil 1996). There were other traditions of prudent use such as the Goan Gavkari system which involved good management of the extensive estuarine lands for salt-tolerant paddy and fish and shellfish production as well as of community forest lands (Couto 2005). The extensive network of irrigation tanks of South Indian peninsula was also carefully maintained by the local communities (Wade 1986).

The British brought in an entirely new approach, with Francis Buchanan, a Surgeon with East India Company commissioned to document the resources of territories newly conquered from Tipu Sultan, declaring that the sacred groves were merely a contrivance to keep the East India Company from claiming its rightful property (Buchanan 1807). The British colonial rulers naturally had no interest in prudent, sustainable use of India's natural resources; they merely wanted to organize an efficient system of draining them. In 1867, Dadabhoi Naoroji, one of the first Indians to be trained in the tradition of modern science, ably put forth the thesis that the cause of India's poverty was this drain engineered by the colonial rulers; and not the inevitable operations of economic laws (Naoroji 1878). Rather, he claimed that the bleeding of India was a complete perversion of economic laws, entailing the pitiless expropriation of India's resources within the country, and their completely unjustifiable drain to England. R.C. Dutt (1902), the pioneer of Indian economic history protested that taxation raised by erstwhile Indian kings was like the moisture sucked up by the sun to be returned to the earth as fertilizing rain. But the moisture

raised from Indian soil now descends as fertilizing rain largely on Great Britain, and not on India.

Development as Freedom

People not only treasure a healthy environment, they also long for dignity. As Dr Ambedakar emphasizes, self-respect is the most vital factor in human life. This is also an important theme of Amartya Sen's book, *Development as Freedom*, in which he asserts that development must be viewed as a process of expanding real freedoms that people enjoy, freedoms such as of access to adequate food, clean water, unpolluted air, shelter, education, health care, and gainful employment (Sen 1999). Sen insists that above all, development should lead to an enhanced capacity to engage in social, political, and economic decision making. This is implicit in Mahatma Gandhi's concept of an India comprising of self-reliant village republics (Gandhi 1909). However, in the modern day, highly connected world, no human community can possibly remain isolated, yet should ideally retain substantial autonomy in decision-making. This is captured in the now widely accepted Principle of *Subsidiarity*, first developed by the German theologian Oswald von Nell-Breuning (1951) in early 20th century. This principle holds that government should undertake only those initiatives which exceed the capacity of individuals or private groups acting independently. Functions of government, business, and other secular activities should be as local as possible. If a complex function is carried out at a local level just as effectively as on the national level, the local level should be the one to carry out the specified function. The European Union has now formally accepted subsidiarity as guiding its operations.

India's drive towards democratic devolution is an expression of full acceptance of these values and our 73rd and 74th Amendments to the Constitution assign an important role to local self-governments, Panchayats and Nagarpalikas in taking a variety of decisions, in particular, those relating to management of natural resources. The Extension of Panchayat Raj to Scheduled Areas (PESA) Act of 1995 takes this further, assigning a vital role to Gram Sabhas, as does the Forest Rights Act (FRA) of 2006.

But we are sabotaging these democratic initiatives. It can therefore be argued with considerable force that what seems to be in operation today is 'internal colonialism' that is draining the resources of the countryside and polluting it, not to enhance the well-being of population at large, but to profit a small minority of the Indians that constitutes the omnivore class, who, in turn, are strongly tied to the omnivores of the globalized world. Our so-called development is not oriented towards बहुजनसुखाय बहुजनहिताय but towards अल्पजनसुखाय स्वल्पजनहिताय coupled to बहुजनदु:खाय बहुजनघाताय . So, the omnivores, insulated as they are from the effects of degradation of India's countryside, are positing a palpably false contradiction between environment and development.

On the other hand, India's local communities, the subjugated ecosystem people, have a genuine stake in preserving the health of their own ecosystems, in safeguarding their local environments and should rightfully serve as its stewards. With a strong motivation, and in constant touch with the ecosystems in their day to day pursuit of livelihood activities, they can effectively guard against environmental abuses. Our Constitution and the laws enacted by our Parliament in fact empower them to act in this fashion. We only need to implement these, and safeguard our democracy (Gadgil 1993, Gadgil and Rao 1998).

Barefoot Ecologists

People living close to nature possess a substantial understanding of the working of the natural world acquired over generations, and continually refreshed and augmented in the course of their day-to-day pursuit of livelihoods. The experience of a group of Bengaluru based ecologists investigating the fate of wild *amla (Phyllanthus emblica)* populations on the nearby B. R. T. Hills provides an interesting case history. Their hypothesis was that the regeneration of *amla* is governed by the amount of fruit collected for commercial use, and that the low levels of regeneration in recent years were related to excessive harvests of fruit. So they laid out statistically well-designed experiments to test the influence of different levels of harvests of fruit. The local Soliga tribal people told them that these experiments would yield no results of interest, because, according to their understanding of the ecosystem

based on many years of first hand observations, the levels of regeneration were primarily influenced by forest fires. *Amla* seeds require fire to germinate well, and the Soligas felt that low levels of regeneration were related to suppression of forest fires in recent years. The scientists did not initially give credence to this suggestion and continued their experiments. Only later did they come to the conclusion that the Soligas were indeed entirely right. Thus, long standing historical observations of the local ecology, of which the people are a repository, can be an important ingredient of scientific management. Making local communities as partners in scientific management can therefore help us do better justice both to science as well as ecology. Establishment of such a partnership with the barefoot ecologists of the country can make an important contribution to building up the nation's human capital as well (Gadgil 1996, 2000, 2007, 2008, Gadgil et al 2006).

Political Cartels

The Government of Maharashtra, and those of the other states and at the center as well, are quite evidently being run by members of a unified political cartel dedicated to serving the omnivore interests. Parts of Maharashtra had been reeling under serious draught with the failure of the monsoon in 2012. Contributing to the scarcity of water for farmers is the large scale misappropriation of funds for irrigation projects in which leaders of the ruling front, along with members of all other political parties seem to be involved. The legislative assembly session in March 2013 was therefore expected to see opposition take the ruling party to task for its failure to adopt effective measures against the draught. Instead the first several days of the session were consumed by protests and counter-protests by members of all political parties against a Police Officer for fining an MLA who was speeding on Mumbai roads, leading to a group of MLAs from a variety of political parties beating up the Police Officer concerned right inside the Legislative Assembly. In the end, a distinct impression was created that no politician of any hue was worried about the suffering of people from the draught; all they were concerned with was protecting their own rights, including that of beating up policemen if the policemen dared to question them (Times of India 2013).

Hamare gamv me ham hee Sarkar!

So Maharashtra has a Government hell-bent on sabotaging rights of local communities to promote Corporate interests. Regrettably, the Corporates have decided to push for and take full advantage of an economic growth at all costs approach, instead of adopting a broader perspective in long term social interests. Yet, local struggles can yield positive results as has happened with Gond and other local communities of Gadchiroli district of Maharashtra that have won Community Forest Rights under the Forest Rights Act over extensive areas. These communities have coined a slogan in tune with the ideas of subsidiarity: "*Dilli – Mumbaime hamara sarkar, hamare gamvme ham hee sarkar!"* We have our governments in Delhi and Mumbai, we are the Government in our own village! The assignment of Community Forest Rights to these motivated villagers is promoting prudent resource use in the long term interest of the resource base as well as far greater economic returns to the local community. Notably enough, the communities have spontaneously decided to set apart 10% of the Community Forest Rights areas as strict nature reserves. The people, especially the youth are motivated to assess the resource base carefully, plan its sustainable use and conservation, work out the potential of local level industrial processing and appropriate marketing strategies. This poses a major scientific and technological challenge and I am personally enthralled at this opportunity of working closely with highly motivated people with a rich store of practical ecological knowledge in a scientific and technological enterprise (Bokil 2012, Das 2011).

Niyamgiri

Regrettably, Gadchiroli is a rare exception, as witness the developments in the case of the controversial VEDANTA mining lease on the upper reaches of the Niyamgiri hills in Orissa. This issue was carefully examined by an official committee headed by Dr. N. C. Saxena, formerly Secretary (Planning Commission). I quote below from this report (Saxena et al 2010).

The VEDANTA site, the forested slopes of the Niyamgiri hills and the many streams that flow through them, provide the means of living

for Dongaria Kondh and Kutia Kondh tribes, classified as 'Primitive Tribal Groups' that are eligible for special protection. The Niyamgiri massif is important for its rich biodiversity. It also plays the critical role of linking a whole series of forests and wildlife sanctuaries. The two Kondh communities regard the Niyamgiri hills as sacred and believe that their survival is dependent on the integrity of its ecosystem. The VEDANTA site is amongst the highest points in the hills and it is considered especially important as a sacred site.

The proposed mining lease (VEDANTA) area is used by both Kondh communities and is part of their Community Forest Resource as well as their habitat, since they depend on it for their livelihoods as well as socio-cultural practices. Mining operations of the intensity proposed in this project spread over more than 7 square km would severely disturb this important wildlife habitat and inflict severe ecological damage. Several perennial springs flow from below the top plateau, which is a part of the proposed mining lease site. VEDANTA area is one of the main sources of Vamsadhara river which would make mining on this plateau a hydrological disaster.

Mining, if permitted, will directly affect almost 20 per cent of the world population of the Dongaria Kondh community. The mining operations will destroy significant tracts of forest lands. Since the Kondh are heavily dependent on forest produce for their livelihood, this forest cover loss will cause a significant decline in their economic well-being. The entire VEDANTA area is clearly the Community Forest Resource area as well as the habitat of the two Primitive Tribal Groups and their villages, as defined in the FR Act.

These villages have been vested with recognizable community and habitat rights by GoI under section 4(1) of the FRA, and the procedure laid down in section 6 of the FRA must be followed by the district authorities. These rights should have been formalized as soon as the Act came into being on the 1January, 2008. As per the Preamble of the FR Act, forest dwellers are 'integral to the very survival and sustainability of the forest ecosystem'. Therefore, in law, forests now include forest dwellers and are not limited to trees and wildlife. Since the MoEF is charged with the responsibility of implementing the Forest

Conservation Act, it has to ensure that both forests and forest dwellers are protected. Section 5 of the FRA has authorized the Gram Sabhas to ensure that their habitat is preserved from any form of destructive practices affecting their cultural and natural heritage. MoEF, as the authority under the Forest Conservation Act, cannot override the statutory authority under the Forest Rights Act, viz. the Gram Sabhas.

From the meeting with the senior officers and the Chief Secretary, it was apparent that the district administration has been reluctant to act fairly and firmly under section 6 of the Act to formalize the rights of Kondh over the VEDANTA area, as the state government has already decided to transfer the said land for mining. Hence, it was not keen to recognize community and habitat rights of the Primitive Tribal Groups over the VEDANTA area. This is in spite of the undisputed fact that, as dictated by the FR Act, government authorities have no discretionary rights to ignore these rights. Not only is the transfer of community resources for mining without seeking their informed consent unfair, it is also illegal after the enactment of the FR Act. The administration has also failed to consult the PTGs and other forest dwellers about the impact of mining on their lives after the passing of FR Act. Their consent for diversion of land has not been taken.

Despite the reluctance of the district administration and state government, several Gram Sabhas have passed resolutions claiming community and habitat rights over the VEDANTA area and forwarded the same to the SDLC, as provided in section 6(1) of FRA. From the evidence collected by the Committee, we conclude that the Orissa government is not likely to implement the FR Act in a fair and impartial manner as far as the VEDANTA area is concerned. It has gone to the extent of forwarding false certificates and may do so again in future. The VEDANTA Company has consistently violated the Forest Conservation Act, Forest Rights Act, Environmental Protection Act and the Orrisa Forest Act in active collusion with the state officials. Perhaps the most blatant example of it is their act of illegally enclosing and occupying at least 26.123 ha of Village Forest Lands within its refinery depriving tribal, dalits and other rural poor of their rights.

The Saxena Committee report concludes with a grave warning:

> *"In view of the above this Committee is of the firm view that allowing mining in the proposed mining lease area by depriving two Primitive Tribal Groups of their rights over the proposed mining site in order to benefit a private company would shake the faith of tribal people in the laws of the land which may have serious consequences for the security and well being of the entire country."*

The Governments, adamant in their support of the miners, did not heed this warning, and the matter went up to the Supreme Court. The Supreme Court in its judgment delivered in April 2013 has upheld the rights of the Gram Sabhas to decide on the assertion of Community Forest Rights and to reject State Government's clearance of bauxite mining. The Supreme Court has further held that religious and customary rights of tribals should be protected in addition to their individual and community rights under FRA by the government while granting permission to mining companies to set up venture in their areas.

A Government of Contractors, by Contractors, for Contractors

Social capital, reflected in prevalence of a sense of fairness/ unfairness in the society and the resulting social harmony/ disharmony is a vital component of nation's capital stocks. One striking manifestation of our failure to build social capital is the violence afflicting India's tribal heartland. A tragic demonstration of this was the Naxalite attack on the Chhattisgarh Congress rally in May 2013 in which some of the state's top political leaders were killed (Chaturvedi 2013). Vigorous television debates naturally followed, and demonstrated a notable divergence of views. A retired Director General of the Border Security Force insisted that while dealing firmly with Naxal violence, the society must also examine and eradicate the root cause; the widespread anger and dissatisfaction amongst the tribal people. He said that this can be dealt with only by empowering them as we were constitutionally honour bound to do by implementing the provisions of both the Extension of Panchayat Raj to Scheduled Areas (PESA) Act of 1996 and Forest Rights Act (FRA) of 2006. He pointed out that Central and State Governments, belonging to both UPA and NDA

were guilty of failing to implement these very progressive constitutional provisions which extend democracy to the level of gram sabhas. Other civil society representatives strongly supported him. But senior political leaders of both UPA and NDA refused to respond to this significant point, and kept on talking as if all that was necessary was to build more and more roads, hospitals and schools. The civil society members pointed out that all these are shoddily constructed, and after they are constructed fail to be staffed by qualified and committed teachers and doctors. It would appear as if the entire political establishment is a cartel focused wholly on creating opportunities for awarding more and more contracts. Indeed, as an old school friend of mine, who has served in very senior positions with the Government of India, told me: We have a government of contractors, by contractors, for contractors.

Plachimada Experience

The cause of doing justice to science, democracy as well as ecology can be well served by collecting and making widely available good information of relevance to the interests of the country's ecosystem people, preferably as a collaborative effort of the local and the scientific / technical communities. But our base of the pertinent information, for example, on agricultural, horticultural, livestock and fishery production is weak; that on employment in unorganized sector even weaker. For instance, fishing and shell-fishing in the river Ganga is a major economic activity. Yet no proper information at all is available on the fish and shell-fish yields, on the number of people employed, on the income generated, or on the protein resources thus made available. In recent years sand mining, fuelled by the current building boom, has become a major activity over large tracts of Ganga. Yet there is absolutely no information being collected on the extent of sand being mined, on the number of people employed in mining and as a result going out of fishing, on the income generated in mining and as a result being reduced in fishing, or on the protein resources being decimated through the impact of sand mining. Nor is this activity taxed. So all of these figure in no way in the GDP figures or the poverty statistics being touted around (Gadgil pers obs, Sinha per com).

A rare instance of a case where impacts of industrial activity on the capital of natural resources and on the livelihoods of people has

been carefully assessed comes from Plachimada, a Panchayat in Palakkad district of Kerala where a Coca Cola plant is located. The Coca Cola plant has severely polluted as well as depleted ground water in the area, leading to drying up of wells, loss of agricultural productivity and concomitant negative impacts on livelihoods. The state government agencies had collected no pertinent information on what was happening. But Kerala has made substantial advances in decentralized governance and the Plachimada Panchayat has stood its ground, forced a proper scientific inquiry into the losses suffered by the Plachimada residents and gone ahead and rescinded the license of this global soft drink major. Notably enough initially none of the political parties backed people's demands, but came round when confronted with a groundswell of the sentiment. While cancelling the license, the panchayat evoked its constitutional rights, which in Kerala have been affirmed by state legislation as well. As local elected government, it has argued, it has the duty to protect the well-being of its subjects. So it has the right to cancel — or refuse permission — to anything that affects its subjects adversely. The panchayat's reasoning is important: it establishes the crucial link between governance and managing local natural resources. After all panchayats have been constituted precisely for this reason. The company, on its side, contends that the panchayat is a subordinate of the state government and thus cannot operate out of its domain, since the state government has granted the license for Coca Cola to operate. The state high court rejected this argument and dismissed the company's writ petition. In the meantime, a state government constituted Technical Expert Panel has estimated the economic loss suffered by the residents of Plachimada at ₹ 260 crores and the state legislature has gone on to unanimously pass a bill named "Plachimada Coca Cola Victims Relief and Compensation Claims Special Tribunal Bill 2011". Kerala Governor forwarded the bill for Presidential assent on March 30, 2011. Regrettably, the President of India has not yet signed the bill and the people are not being compensated for their losses. In the meanwhile, Coca Cola, which owes the Government 84 crores in back taxes, has been awarded an Income Tax exemption of Rupees 5 crores (WGEEP 2011, Prasad pers. com).

Of Blueprints and Green-houses

Of course, people will go on interfering in the natural world, moulding it to their own taste. But, there are two diametrically opposite approaches to the challenge of managing this change; the blueprint approach with centralized authorities specifying in detail what should be done, and the greenhouse approach flowing from an acceptance of the principle of subsidiarity. According to this principle, functions of government, business, and other activities should be as local as possible. If a complex function is carried out at a local level just as effectively as on the national level, the local level should be the one to carry out the specified function. In the context of natural resources, the function will often be carried far more effectively at the local than the state or national level, hence that is where it should be located. The Greenhouse approach to resource management flows from this perspective, and involves furnishing helpful knowledge, creating enabling conditions and then leaving it to those close to the ground to assess the situation and work out the details. The Western Ghats Ecology Expert Panel (WGEEP) embraced the greenhouse, while Dr. Kasturirangan's High level Working Group (HLWG) adopted the blueprint approach. The blueprint approach reflects current practices of development by exclusion, by imposition, by coercion along with conservation also by exclusion, by imposition, by coercion. This has created a dichotomy with reckless development, destructive of nature as well as livelihoods, as witness the mining scam of Goa, almost everywhere, and thoughtless conservation, as witness the strident protests against imposition of Project Tiger, elsewhere (Gadgil 2013a,b).

WGEEP proposed instead a greenhouse approach marrying conservation to development, moving away from "Develop recklessly – conserve thoughtlessly" pattern towards one of "Develop thoughtfully – conserve thoughtfully". This requires full involvement of local communities in fine-tuning of development- conservation practices to locality-specific contexts. Western Ghats, with their rich natural heritage, high levels of environmental awareness and well entrenched democratic institutions are an especially appropriate region of the country to attempt to make such a transition towards an inclusive, caring and environment friendly mode of development.

Clearly, a uniform set of regulations cannot be promulgated for the entire Western Ghats region, and a graded approach, partitioning the Western Ghats into regions of high, moderate and low sensitivity is called for. Since our National Forest Policy mandates that two-thirds of hill regions should be maintained under forest cover, WGEEP suggested that about 60% of the region (including the Protected Areas), should be covered by Zone of High Sensitivity, and at least 25% should be set aside as a Zone of Low Sensitivity. Committed as we were to the greenhouse approach, we did not provide any rigid prescriptions as to the boundaries or the regulatory and promotional activities to be undertaken in any specific locality in these zones. Instead WGEEP proposed that the final demarcation of the Zones and fine tuning of the regulatory as well as promotional regimes must be based on extensive inputs from local communities and local bodies, namely, Gram Panchayats, Taluka Panchayats, Zilla Parishads, and Nagarpalikas, as was done for Goa Regional Plan 2021 (RPG2021). RPG2021 involved a compilation of a comprehensive, spatially referenced, database on land, water and other natural resources of Goa state; this information was then shared with all Gram Sabhas and their suggestions as to the desired pattern of land use obtained, consolidated and used as a foundation for the preparation of the final plan (Ribeiro, personal communication, WGEEP 2011).

WGEEP therefore called for immediately translating its report in all the regional languages, circulating it to all the gram sabhas, obtaining their considered feedback, and only then making final decisions in the true democratic spirit. In its place, the Government first suppressed the WGEEP report, and then merely uploaded it on the web, ensuring that vast majority of the citizens of the Western Ghats could not access it. There were then systematic attempts to mislead people, in particular, presenting WGEEP as the ultimate rigid blueprint approach, when it had strongly advocated a greenhouse approach. Then came the appointment of the HLWG that has come up with a set of completely rigid recommendations essentially advocating business as usual (Gadgil 2013c).

A Welcome Awakening

But fortunately democracy is alive and in many ways functional, especially in a state like Kerala, notable for its long standing commitment to democratic decentralization, and taking planning down to Gram Sabha and Ward Sabha levels. So when the Kerala Government attempted to pass a resolution in the State Legislative Assembly rejecting the WGEEP report, several MLAs, cutting across party lines opposed it and argued that the report had many very welcome suggestions and needed careful examination, and merited being taken to the Panchayats in Malayalam. With the passage of this resolution, the Kerala Institute for Local Administration, Thrissur decided to call for a two-day workshop of presidents of all Western Ghats panchayats to familiarize them with the content of the report on 6-7 June, 2013. A group of some 13 Panchayat Presidents, all from Idukki district protested that it was wrong on part of KILA to hold such a workshop since Kerala Legislative Assembly had passed a resolution rejecting the WGEEP report. Two MLAs who were present clarified that this was not the case at all, and, in fact, the Assembly had resolved that the report be taken to Panchayats. Following this clarification, a small number of Panchayat Presidents staged a walk-out, while 60 of 73 continued their deliberations over the two-day period (Gadgil 2013d). At the end of the two days they clarified that they had been initially misled, and were now convinced of the merit of WGEEP's approach and most of its recommendations. They explained that they had orders from higher ups in their political hierarchy to oppose the report and therefore could not immediately express their support. However, they felt that what was needed was to communicate the true contents of the WGEEP report to all Panchayat members, so that a proper consensus can be arrived at. This process of organizing workshops for the Panchayat members has now been initiated (Vijayan, personal communication).

This is perhaps as neat an example as any of the Gadgil-Guha inverse law that states that the extent of environmental concern of any elected representative is inversely proportional to the size of her/his constituency. Thus, Gram Sabhas are likely to be most responsive, the Gram Panchayat members a little less, since a few members can be

more readily bribed with cash or facilities such as trucks to carry ore from the mines, the MLAs and MPs are even less and less responsive to environmental concerns as they become more and more enmeshed in the omnivore interests (Gadgil and Guha 1995).

Science and the Natural Capital

In India, the vigour of our democracy, as was so dramatically demonstrated when Emergency ended in 1977, compels the political establishment to enact laws to protect the environment (e.g. Environment Protection Act and Biological Diversity Act) and to empower people (e.g. 73rd and 74th Constitutional Amendments, Right to Information Act and Forest Rights Act). The problem is that such acts are very selectively implemented, so that the Forest Conservation Act which concentrates the power in the hands of the bureaucracy is implemented with vigour in denying permission to villagers to get electric lines, and merrily violated in granting permission to windmills, while the provisions of Water Pollution Act are not implemented at all.

Just as there are good acts to protect the environment, it has been fully accepted in principle that science should be promoted and employed to safeguard and augment the nation's stocks of natural capital. In reality, however, facts are distorted and scientific exercises merrily sabotaged. In fact, the British used their mastery over science and its clearly demonstrated technological successes, not to ground the management of the natural resources in sound science, but merely to assert that their "scientific" ways of managing the country's natural resources were vastly superior to the older Indian systems grounded in folk wisdom.

In Aid of Hegemony

These claims were largely hollow and merely served to establish hegemony of the colonial state. What the British did introduce was a practice of following systematic procedures in undertaking utilization of natural resources such as Forest Working Plans and Detailed Project Reports for projects such as generation of hydroelectric power. However, science is not just a matter of systematic procedures. Rather,

science is a system of continual open scrutiny of the procedures being employed towards any given set of objectives, such as estimation of bamboo stocks and yields that can be sustained, or an assessment of the irrigation potential of a river and of the level of reliability of the results that these procedures lead to. Indeed, skepticism is at the very heart of scientific inquiry (Bernal, 1939). Therefore, three vital ingredients of the scientific enterprise are:

- Open access to all facts and inferences,
- Rejection of all authority other than that of empirical facts, and
- Welcoming all interested parties to question all assertions as to facts as well as logic.

Forest Management

Let us examine the so-called scientific management of forest and wildlife resources of the country in terms of these ingredients (Gadgil 2006, 2007, 2008). In this enterprise there is no tradition of transparency, of sharing of the results, the methodology employed to arrive at them and the logic followed in the deductions. Science must be firmly anchored on the bedrock of empirical facts; and a fatal weakness of so-called scientific forestry is the lack or poor quality of its data base. For instance, I was asked by a Working Group of the Karnataka State Council for Science and Technology, set up in 1975 in response to the complaints by the state's basket-weavers of depletion of bamboo resources of the state by the Paper Mills, to look into this problem and assess afresh the current position. Narendra Prasad and I carried out such an exercise on the basis of the data available from the State Forest Resources Survey, the West Coast Paper Mills and on the basis of extensive field work. The Forest Resources Survey figures were clearly overestimates, and our field studies showed that this was by a large margin, a factor of ten times. In fact, there were some very gross errors. Thus, the area assigned to the township of West Coast Paper Mill still showed high levels of bamboo stocks in a survey undertaken after its disforestation, simply because it had copied figures, number by number, from an earlier Working Plan.

Apart from reliable estimation of the stocks, scientific management calls for knowledge of growth pattern of individual plants. Karnataka Forest Department used a defective model of the growth curve of a bamboo clump and therefore prescribed excessive harvests from smaller sized clumps (Kadambi 1949). Moreover, it prescribed cleaning of the thorny covering that develops naturally at the base of a bamboo clump, especially in the case of *Bambusa arundinacea.* This "*clump cleaning"* operation was meant to decongest the clump and promote better growth of the new shoots. Our studies showed this practice to be actually counter-productive, for the removal of the thorny covering rendered the young shoots readily accessible to grazing by a whole range of animals, including porcupines, wild pigs, and monkeys as well as domestic livestock. As a consequence, the recruitment of new culms to the clumps remained very poor and the bamboo stocks remained stagnant. In fact, the local people were very much aware of this and had evolved harvesting practices that avoided this problem. In spite of our extensive scientific studies highlighting this fact published as a report of the Karnataka State Council for Science and Technology, forest departments all over the country continue to follow the flawed practice of clump cleaning (Prasad and Gadgil 1981).

Hypothetico-deductive Method

The modern scientific method has been termed as the "hypothetico-deductive" method. Hence, a truly scientific enterprise would treat documents such as "Forest Working Plans" as scientific documents to be made available for peer review by all interested parties, not as official documents to be kept away from the public gaze. The yields expected to be realized, and the stocks expected to be left behind after the harvests would be treated as hypotheses to be tested. If the yields do not materialize, or the stocks are not sustained, then a scientific enterprise would acknowledge that there are obvious errors of fact or logic, and attempt to look for and correct them. It would also try to bring on board all interested parties, technical experts, as well as other stakeholders from the civil society, not just the official machinery in the effort to understand the mistakes and correct them.

In its place, all that happens today is that when new plans are prepared, there are occasional remarks on the efficacy of the earlier

Working Plans. To quote one such: "*In the Yekkambi - Sonda area the A coupes under Edie's plan and replacement felling areas under Garland's plan have resulted in total exploitation of all valuable species. Most of the overwood of valuable species had been removed under the so - called "uniform system" over large stretches of reserve forest area in the false hope of inducing natural regeneration of teak and other valuable species. Garland's replacement fellings under uniform system was a total failure as it failed to induce or establish natural regeneration of teak or other valuable species* (Wesley, 1964)."

But such observations are not shared widely and exposed to scrutiny as should routinely happen in any scientific exercise. Clearly, it is imperative that we devise ways of injecting the democratic, inclusive culture of science in the endeavor to safeguard the health of India's environment (Gadgil 2006).

An Exclusionary Approach

Such flawed natural resource management practices persist, in good part because the country's educational, scientific and technological establishment is in no way involved, indeed, often deliberately excluded from the natural resource planning exercises that are carried out in isolation by bureaucratic agencies. For example, forestry establishment strives continually to keep all scientists out of their turf, invoking their duty to guard forest and wildlife resources, and imposing a permit raj. This was brought home to me as a member of the Tiger Task Force appointed by the Prime Minister in 2005 to look into why no tigers were to be seen in Sariska when the authorities claimed a goodish number roamed that forest. Many submissions made to us at once revealed the weakness of the information collected officially, and the resistance put up by the authorities to any involvement of people, many of them highly qualified and competent scientists in wild life research. To quote one such submission, by Raghunandan Chundavat: *"Unfortunately in last three decades no system has been created that encourages or institutionalizes access to available professional research in protected areas nor that takes advantage of the growing body of professionals with expertise in relevant areas who*

work outside the government. We need to change the attitude of our management from a guard protecting jewels to a librarian who is managing library of unexplored knowledge and inviting people for learning. These problems occur now and again because we have failed to create a system, which supports and provides protection to independent research in the country."

This is why we encounter problems such as false claims of numbers of tigers in Sariska Tiger Reserve, and in fact, throughout the country. Authorities of our Tiger Reserves have been attempting since 1973 to come up with exact tiger numbers based on the "total pugmark count", something that is beset with many sources of error (Bengal Tiger, Karanth et al 2003). Such difficulties are universal, especially in the study of complex ecosystems, where all signals are confounded by noise. The scientific skill lies in estimating and minimizing the noise levels. Thus, it is imperative that one estimates the extent of various sources of errors in arriving at tiger numbers. Based on these, one should come up with a range, rather than just one specific number, along with a statement of the likelihood that the actual numbers will fall within that range. Unfortunately, the official information stream has the serious weakness of claiming that there is no question of error, in the official, "authoritative" information being handed out. But if a single number is provided as if that is a precise estimate, there is every danger that any lower number arrived at subsequently would be taken to imply a decline in tiger numbers. If, further, there were a tendency to judge the performance of Tiger Reserve managers on the basis of the supposedly exact number of tigers in the area under their charge, then the managers would be inclined to manipulate the data and project a picture of continually increasing numbers of tigers.

Such a tendency could be checked if there was in place a system of public scrutiny of the veracity of the numbers being declared. However, as with almost all government statistics, no such system has been in operation, so that tendencies to manipulate data have gone on unchecked. An unfortunate consequence of dissemination of manipulated data has been a failure to recognize signs of decline in tiger numbers, till a public outcry forced the authorities to subject official statistics to independent scrutiny. This was done, firstly, through a CBI

enquiry, and subsequently, through the setting up an independent Tiger Task Force by the Prime Minister's Office. The Task Force had access to the information available with the field staff and put together the following picture, clearly indicating deliberate fraud by the officials in estimation of tiger numbers (Tiger Task Force 2005).

Tiger population estimates in Sariska Tiger Reserve							
Year	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Tiger population (official census)	*24*	*26*	*26*	*26*	*27*	*26*	*17*
Tiger sightings by staff[*]	*17*	*6*	*5*	*3*	*0*	*1*	*0*
[*] *Number of distinct animals present as judged by field staff*							

Subsequently, the official agencies had to admit that there had been large scale overestimates of tiger umbers in all states of the country, and that the actual numbers were probably only about one-third of the inflated numbers that had been touted around for decades.

What Purpose does the Educational System Serve?

If the academic community has no role to play in generating relevant information and models to address vital issues such as management of country's forest, wild life and other natural resources, then what role does it play? Milind Sohoni, a Professor of Computer Science at the prestigious IIT, Mumbai has taken a special interest of his own initiative in studying the rural water supply, undertaking extensive field studies (personal communication). He finds that the important exercises of assessing and planning water supplies in no way involve the Engineering Colleges; all the information and technology is developed, in a most unsatisfactory way, by either Government employees, or workers of NGOs, none of whom have any useful training in the discipline. The only technical experts that are called in tend to be foreigners commissioned by Foreign Aid agencies or World Bank; these so-called experts have no understanding of the ground realities whatsoever.

So what does the IIT system achieve? They organize an excellent

screening process, first of admissions and then of grades which permit multinational firms to easily identify capable young people to recruit for their own staff. The courses undergone by IIT students have excessive theoretical content and never address real life engineering problems such as those involved in designing and managing drinking water supplies. The multinational firms recruit the best and brightest students for jobs which do not draw on any of the training the students have received in IITs. The whole system is then one which does not impart engineering education towards any productive purpose.

So much for the role of institutions of higher learning. What of the education going down to the primary, even pre-school level? The strong demand for mastery over the English language ensures that all omnivore children, and many of those from outside the omnivore class as well, are now educated in English medium schools. These schools actively discourage any use of any of the Indian languages with the result that these children are brought up in an English language based culture, a culture that makes them feel closer to the people of the United States than to the ecosystem people or the ecological refugees of India. This cultural indoctrination is further reinforced by the print and electronic media, even cinema. The inevitable result is that the omnivores feel entitled to all that the citizens of the throw-away, wasteful culture of US relish, and are not in the least worried about the costs that this may impose on the nature and people of their own country.

The Silent Valley Initiative

Although the system does not support it, there are some heartening experiences of scientists and technologists fruitfully involving themselves in promoting prudent management of country's natural resources. An early, example and a famous one at that is the independent scientific scrutiny of the Silent Valley hydel project on Kunthipuzha river in Kerala, in 1978, at a time when Environmental and Socio-economic Impact Assessments were not as yet made mandatory. This assessment was undertaken by the now 50 year old popular science movement, Kerala Sastra Sahitya Parishad (KSSP) that has "Science for social revolution" as its motto, and promotes a holistic vision of development (Zacharia and Sooryamoorthy 1994). This led to the hydel project

assessment by an inter-disciplinary team of a physicist, Dr. M. P. Parameshwaran, an electrical engineer, Shri V. K. Damodaran, an economist, Dr. K. P. Kannan and an ecologist, Prof M K Prasad. It brought out several flaws in the arguments of the project proponents and at the same time highlighted the conservation value of the region. One of my fondest memories is participating in a 'People's Parliament' organized by KSSP on a large public ground in Thrissoor that attracted a huge crowd and generated a most lively debate on the pros and cons of the Silent Valley project. The resultant process of a very transparent and participatory deliberation finally led to the constitution of the Silent Valley National Park. Although at that time the National Park proposal had many political opponents, at its Silver Jubilee celebrations in 2011 all parties joined hand in declaring that wiser counsel had prevailed in the establishment of the National Park (The Hindu 2009).

Athirappilly Hydro Electric Project

A worthy successor to Kerala Sastra Sahitya Parishad's careful, interdisciplinary study of the Silent Valley Project is the River Research Centre's (RRC) assessment of the proposed seventh large dam, the 163 MW Athirappilly Hydro Electric project on the 144 km small, but heavily dammed, Chalakudy River. Chalkudy, with her magnificent waterfalls and rapids and her unique biodiversity rich gallery forests has one of the highest levels of fish diversity among Western Ghats rivers. It is clear that the Environmental Impact Assessments prepared for the project, and the Public Hearings conducted were flawed and the High Court has repeatedly set them aside. Indeed, it is not an exception, but very much the rule that EIAs are never objective neutral evaluations of the project, but are deliberately distorted to expedite clearance. Thus in every one of 75 mine related EIAs of Goa that I have examined, there is wrong information on the impact on water resources and on biodiversity, and an assessment of the socio-economic impact is never attempted at all (Gadgil and Dongre, in prep.). As a result, whenever there has been a proper challenge to the EIAs mounted, the Courts have set the clearance aside as in the case of Zaynte Sarvan mines of Goa (Down to Earth 2012).

The people, too, are very much against the Athirappilly project. Thus, at the second Public Hearing on the proposed dam on 15th June

2006 at Chalakudy, more than 1200 people attended, none spoke in favour of the project and, in the 252 written representations submitted to the Public Hearing Panel, the ratio for and against the project was 1:9 respectively. Further, three of the five members of the Public Hearing Panel were against the project and among them two happened to be the Presidents of the Athirapilly Gram Panchayath and the Chalakudy Block Panchayath; representatives of the people of the two Panchayaths who would be affected directly by the construction of dam. Again, ignoring people's wishes is too common an occurrence. In 15 out of 15 Public Hearings relating to Goa mines that I could look at, the officials had violated the guidelines, and the public input was never taken on board to revise the EIA (Gadgil and Dongre, in prep.)

RRC's careful assessment of the project brings out several flaws: there is not enough water to generate the power as claimed, power generation would adversely impact the currently available irrigation from the river, it will adversely affect the scenic waterfall and thereby the thriving tourism business. The Kerala State Biodiversity Board has advised that the project be rejected since it will destroy one of the last remaining examples of a low-level evergreen riverine forests of the Western Ghats and deplete the rich fish biodiversity of the Chalkudy river.

Yet, there is continual pressure from the Government of Kerala for the clearance of the project. So MOEF asked the WGEEP to examine the issue. We visited the proposed dam site, the reservoir area, the primitive tribal settlements and had consultations with members of the public at various levels. In addition to these, the WGEEP organized a technical consultation which was attended to by the experts from the Kerala State Electricity Board, Chalkudy Parisara Samrakhan Samithi, RRC, Kerala Sastra Sahitya Parrishad, Kerala Forest Research institute, Kerala State Biodiversity Board, Tropical Botanical Garden and Research Institute, Nature Conservation Foundation, officers from Kerala State's departments of Irrigation, Tribal Department, and Forest & Wildlife. It may be noted that this was the first time that such a discussion was held between the proponents and opponents of the project. The RRC team raised a number of significant issues at this technical consultation. Notably enough none of the RRC's objections

were challenged by the KSEB (WGEEP 2011). Evidently, the project has many flaws; it will not contribute to meeting energy demands of Kerala; rather it is as if the project will expend 100 units of energy in the construction and operation to generate 80 units. Its only justification can come from the totally unwarranted profits that will be made by the contractors and their cronies, and this is what seems to be being pushed with the greatest vigour in the current regime of a government of the contractors, for the contractors, by the contractors, organized by an all-party political cartel!

Polluters pay? No way!

Stiglitz and many other economists insist that polluters must pay for cleaning up pollution and other related social costs fully to ensure healthy economic growth (Stiglitz 2012). In India today not only is this principle being ignored, but democracy too is being subverted in the process. A case in point is that of Lote MIDC chemical industry hub in Chiplun taluka of Ratnagiri district in Maharashtra. I had an opportunity to understand the situation in some detail in conjunction with the work of the Western Ghats Ecology Expert Panel. During the WGEEP meeting with Government of Maharashtra officials in Mumbai on 30th September, 2010, I enquired if there were any on-going programmes of involving the people in environmental monitoring in Ratnagiri-Sindhudurg districts. I was informed that this function was being performed by a Ratnagiri District Environment Committee chaired by the Ratnagiri District Collector, and additionally there was a very active 'Lote Abhyas Gat' attached to Lote MIDC.

I immediately contacted Ratnagiri District Collector. Apparently the Ratnagiri District Environment Committee existed only in the imagination of the bureaucrats sitting in Mumbai's Mantralaya. However, the Lote Abhyas Gat did exist, and I had a meeting with them on 5th October 2010. It transpired that although the Abhyas Gat was constituted in 2006, only two meetings had been held till that date, the last being in 2008. Representatives from Kotavale, the worst hit village were not included in the Abhyas Gat despite their request. The Abhyas Gat had prepared some norms on effluent discharge, but these were not being followed. It is understood that many industries at

Lote are pumping toxic waste into ground water through bore wells. Apparently, three such cases were brought to light, but there has been no action.

This Abhyas Gat meeting was followed by a field visit to Common Effluent Treatment Plant and some surrounding areas, as well as visits to Dabhol creek and discussions with many community members. It was revealed that the CETP cannot handle the quantity of effluent it is receiving, and its functioning is highly defective. There are other problems too. Around August 2010, toxic wastes were dumped by a tanker in the Boraj Dam which supplies water to Khed town. The town water supply had to be stopped for several weeks, but nobody has been brought to book. There has been significant decline in fish landings from Dabhol creek due to Lote chemical pollution, and severe loss of employment opportunities for members of fishing communities. No proper study has ever been undertaken, but allegedly 20 thousand fishermen have lost their livelihoods, while only 11 thousand jobs have been created in the chemical industry.

With all these problems persisting, all that the Pollution Control Board has done is to transfer the Lote office to Chiplun, rendering any chances of effective action even more remote than before. At the same time, the district administration has been actively suppressing completely lawful and peaceful protests against pollution exceeding all legal limits by local citizens on grounds of law and order by invoking the Police Act. Such prohibitory orders had been promulgated on as many as 191 out of 600 days previous to my visit. We seem to be in a time, to paraphrase Albert Camus, when crime puts on the apparel of innocence through a curious reversal peculiar to our age, and innocence is called upon to justify itself.

Zoning Atlas for Siting of Industries

Nevertheless, some good environment-development related data sets have been created in the country over the years. One such set is the Zoning Atlas for Siting of Industries (ZASI), prepared for most of the districts throughout the country as a co-ordinated effort of Central and State Pollution Control Boards. The exercise was justified by the

GoI agencies themselves on grounds that this information would facilitate proper location of new industrial units which would benefit industrial development by ensuring that industries do not propose new units in unsuitable spots, thereby avoiding undue delays and obviating protests. ZASI adopts a systems perspective, and attempts to evaluate potential cumulative impacts that may cross some unacceptable thresholds. With this in view the reports consider the pollution load-bearing capacity of various parts of any given district, prevalent levels of pollution and levels of permissible additional pollution generating activity.

Ratnagiri ZASI's (Zoning Atlas Division, MPCB 2006) clear conclusion is that no more polluting industries should be located in the Lote MIDC area. Despite this there are plans to set up a new 550Ha Petro-Chemical complex next to MIDC area; a completely inappropriate decision. Regrettably, such short-sighted and scientifically unjustifiable pursuit of industrial growth, has led to the Ministry of Environment and Forests, GoI itself suppressing this vital data set, a data set that was generated at large public expense and much investment of human resources. So even its own WGEEP was not informed of this data set by the Ministry of Environment and Forests, despite specific inquiries for all available data sets, till the Panel learnt of its existence through some local concerned citizens of Ratnagiri district. As a result of requests, the Panel was then provided a copy of the Ratnagiri Zoning Atlas for Siting of Industries, although it failed to access any other, except that of Goa, the only one in the whole country to have been made public due to citizen pressure.

License-Permit Raj

Thus, the whole process of assessment of environmental consequences of various human interventions, making sure that appropriate alternatives are chosen so that adverse consequences are minimized, if not altogether avoided, that interventions are permitted only where their positive consequences substantially outweigh the negative ones, and to monitor that the environmental obligations stipulated while granting clearances are actually being fulfilled has been comprehensively sabotaged. The 'neta-babu' combine has in its place

instituted a License–Permit Raj that merely breeds corruption. This is very graphically documented in the Report of the Justice Shah Commission on Illegal Mining in Goa, which pointedly mentions a number of state and central government functionaries, administrative as well as political, as having been guilty of a variety of misdeeds.

I would like to mention the experiences of a geologist friend of mine who gave up preparing Environmental Impact Assessments for the mining industry when he repeatedly discovered that the clearances had no relationship to the quality and honesty of the scientific assessment, but only to the size of the bribe passed on to the powers that be. He decided that he was a scientist, not inclined, nor trained to serve as an agent of corruption, and quit such assignments.

In such a regime no system of proper on-going monitoring of environmental impacts is in place. The Pollution Control Boards are supposedly responsible, but I have already narrated the Lote pollution and suppression of ZASI incidents above, and the Shah Commission has also pointed to their utter failure to discharge their responsibility.

A Transparent Participatory System of Monitoring

What is needed is a transparent participatory system of monitoring and this is is the function of the Biodiversity management Committees under the Biological Diversity Act, or of the preparation of Environmental Status Reports in the urban areas. However, none of these long-standing legal provisions are operational. Furthermore, the Ministry of Environment and Forests has, on paper, an excellent scheme of district-level *Paryavaran Vahinis*. Under this scheme concerned citizens were conferred authority to monitor environmental degradation such as pollution and deforestation, and report to the District Collector, who would then enquire into the matter. The programme was very effective in districts like Dakshin Kannada during the 1990's and the Steering Committee for Environment and Forests for the 11th Five Year Plan had strongly recommended, though to no avail, that the 11th Plan should revive the programme of district-level Paryavaran Vahinis to promote a broadly participatory process of environmental monitoring and management (Planning Commission 2007).

Obviously, it is such a reform of the process that is needed. Instead, we have a tacit acceptance of the current system of misgovernance and a demand for merely expediting the process of granting environmental clearances. Speeding up can do no good if one is running in the wrong direction, what is needed is clearly a change of the direction!

Conserving Biodiversity

Country's omnivores, who end up taking and then imposing all decisions, not only impose development projects, such as Coca Cola factories that people of Plachimada do not want, but also ill-conceived programmes of nature conservation. BRT hills are a forest covered range in Karnataka to the east of Nilgiris. It is the traditional homeland of Soliga tribals, who earlier practiced hunting-gathering and shifting cultivation. They have protected a large sacred grove on one of the mountain peaks, harbouring a magnificent *Michelia champaka* tree. When this area was declared a wild life sanctuary, Soligas could no longer hunt or practice shifting cultivation. So gathering of honey, medicinal plants and *amla* (*Phyllanthus emblica)* became the mainstay of their subsistence. A voluntary organization, Vivekananda Girijana Kalyana Kendra, has organized them effectively and helped set up a system of regulated collection, processing and marketing of forest produce. A scientific institution, ATREE, has been engaged in a study of the Soliga forest produce collection practices and their impact on resource stocks. They have come to the conclusion that these practices are entirely sustainable. The Soliga earnings had also improved because of their processing industry. Most regrettably, the Forest Department has banned all collection of forest produce for marketing in 2005, forcing Soligas into destitution. Soligas should be conferred these rights under the Community Forest Rights granted through the Forest Rights Act, but these too are not being granted by this area being declared a "Critical Wild Life habitat". Incidentally no proper scientific exercise has underpinned the demarcation of any "Critical Wild Life habitat" anywhere in the country. (ATREE, VGKK)

Adaptive Management

The nature conservation programmes should, of course, be designed on the basis of sound understanding of empirical facts. The careful studies that would lead to these simply do not exist, and as explained above in the context of tiger censuses, the Forestry and Wild Life Establishment does its best to discourage them. So instead of anchoring the management prescriptions on the bedrock of hard facts, they are moored on the quick-sands of prejudice. Even so accomplished a scientist as Salim Ali fell prey to such prejudices and in context of Bharatpur came up with prescriptions that turned out to be completely misguided (Vijayan 1987).

So, given the uncertainties in understanding and predicting the behaviour of complex ecosystems like the Bharatpur wetland, how do we proceed? The modern theory of management of living resources proposes that we should accept severe limitations to our current ability to predict future system behaviour, and focus on providing more limited, context specific prescriptions. Moreover, we should make extensive use of detailed locality and time specific, including historical, information. We should organize a system of on-going monitoring of the situation on the ground and continually feed this information into updating management prescriptions. Such a system has been termed an "adaptive management system" (Walters, 1986, 2007).

Indeed, it is widely acknowledged now that, today, ecologists are in no position to offer any general guidelines for managing biodiversity or forest resources that would be of practical value in the field (Ludwig et al 1993, Slobodkin 1961). Thus, there are no universal laws, for instance, that all human uses would lead to erosion of all forms of biodiversity. Some uses would lead to erosion of some components of biodiversity, other uses to enhancement of other components. Since sweeping generalizations are not feasible, what is required is to try out various options, monitor the consequences, and make corrections as we go along. Such an adaptive approach would firstly attempt to put together all available information, including practical ecological knowledge of local people, to assess what measures might be favourable; for purposes like enhancing the ability of wetlands like

Bharatpur to support water birds. If such an assessment suggests the possibility that an elimination of grazing by buffaloes may be helpful, a decision could be made to explore the consequences of such elimination. This would not involve a complete ban on grazing for all times at all. Instead, it would entail elimination of grazing in some parts of the wetland, initially for a year. The consequences of such elimination would be carefully monitored, preferably in a transparent and participatory manner, by involving local students, teachers and community members, and assessed. If this suggests a beneficial effect, there will be a continuation and perhaps increase in the portion of wetlands where grazing was eliminated. If it suggests a negative effect, the area over which grazing was eliminated would be reduced, and careful monitoring continued over the area on which grazing is regulated to assess if elimination of grazing over two consecutive years turns out to be helpful. There would be a further assessment after two years; and so on. This would undoubtedly be a far better way, both practically and scientifically to manage complex systems like ecosystems.

Indeed, as Slobodkin (1961) puts it, ecologists, and forest and wild life managers, at their best remain naturalists, aided by modern technology and computational devices, but for most practical purposes relying on accumulated experience. Many people of our countryside, too, are engaged in accumulating pertinent ecological experience while pursuing their manifold subsistence activities. The level of detailed ecological monitoring that they undertake out of sheer necessity cannot be matched by any formal scientific or bureaucratic effort, in spite of all our advances in remote-sensing and informatics. What is then needed is to organize a system of utilizing the information being thus continually gathered by the ecosystem people in the task of adaptive management of biodiversity, a task that is now formally assigned to Biodiversity management Committees under the Biological Diversity Act (Gadgil 2000, Gadgil et al 2006).

Ecologically Sensitive Zones

The official nature conservation effort is primarily focused on Wild Life Sanctuaries and National Parks, completely ignoring the many folk traditions of conservation of nature such as sacred groves and

sacred river pools. But the urban, middle and upper class nature enthusiasts have felt the need to marry conservation to development, and in the process have come up with the concept of Ecologically Sensitive Zones, using the powers given to the Union Ministry of Environment and Forests to take all measures necessary for protecting and improving the quality of the environment and to prevent and control environmental pollution under the Environment (Protection) Act 1986. These provisions were invoked in 1989 in the context of Murud-Janjira, a coastal village of Maharashtra. Subsequently, three more ESZs were constituted in the state of Maharashtra, namely, Dahanu Taluka, Matheran and Mahabaleshwar-Panchgani.

The Mahabaleshwar-Panchagani ESZ, governed under the directions of a High Level Monitoring Committee appointed by the Union Ministry has suffered seriously through lack of continuity, as also due to lack of adequate powers. WGEEP has had extensive dialogue with current Mahabaleshwar-Panchagani HLMC members and other activists, as also field visits and discussions with a cross-section of local community members, and a picture of very mixed reactions emerges. People are happy that it has served to reduce the pace of tree-cutting in the area, but have a strong impression that the ESZ is a regime imposed from outside and that it is a regime focused on rigid bureaucratic controls that are subverted by corrupt officials to harass and extort. As an example, WGEEP(2011) has received written petitions complaining that a farmer is obliged to pay a bribe of 20,000 to get permission to dig a bore well on his farm. Mahabaleshwar-Panchagani region has large populations of Scheduled Tribes and traditional forest dwellers. Hence, it was imperative that the Forest Rights Act should have been implemented in these areas in its true spirit in January 2008 itself. Nothing has been done in this regard, and it appears that this is to facilitate extortion. People complain of very old paths to their villages being disrupted by trenches dug by the Forest Department, and I have personally inspected some of these. Allegedly, the trenches are then filled on payment of bribes, to be dug again some time later. The apparent lack of local support for the ESZ is also reflected in the report that at one time activists of the Bombay Environmental Action Group could visit Matheran, one of the ESZs promoted by them, only under police protection (Kapoor, M., K. Kohli and M Menon, 2009).

A Grass-roots Initiative

While this has been the experience of the official effort, WGEEP had the most encouraging experience of 25 Gram Sabhas from Sindhudurg district passing resolutions requesting that their Panchayat areas be designated as ecologically sensitive areas. Notably several other Gram Panchayats in the region have passed resolutions to the contrary, namely, that they do not wish their Gram Panchayat areas to be constituted as ecologically sensitive areas. On further discussion, it turns out that people are trying to balance two evils. They feel that if their Gram Panchayat areas are constituted as ecologically sensitive areas, it would reduce the threat of completely unwelcome mining activities. At the same time they are afraid that if their Gram Panchayat areas are constituted as ecologically sensitive areas, they will come under the stranglehold of the Forest Department, which is also unwelcome. This is a classic example of the syndrome of development by exclusion, and conservation also by exclusion that plagues us today. Only when we put in its place inclusive development as well as inclusive conservation, will we be able to move in the direction of environmentally sustainable and people-friendly development.

False Gods

We live in a world of flux, a world that has been changing ever more rapidly. Prior to the industrial revolution, the Indian society had possibly developed a relatively prosperous agrarian civilization with extensive handicraft-based industrial production and a rather stable social regime, albeit grounded in a highly inequitable caste society. But with the emergence of modern science and science-based technologies Europeans came to dominate the world. The British rulers systematically dismantled traditional Indian systems of resource management and destroyed the handicraft based industrial production, draining away India's resources and impoverishing it. Naturally Indians came to regard assimilation of European science and technology as critical to India's progress. Mahatma Gandhi(1909) disagreed and in his *Hind Swaraj* advocated complete rejection of European science and technology, and revival of fully self-sufficient Indian villages as the basis of progress. While he successfully led India's struggle for

independence, his many actions, such as his support of Tatas in the context of peasant agitation against unjust take-over of their lands for setting up a hydel project, were quite inconsistent with this philosophy (Vora 1994). So after independence his model was completely set aside, and India launched itself on a pursuit of industrialization on the Western model. Meanwhile, the Marxist philosophy had emerged as a significant rival to the Western capitalist model. India adopted a curious mixture of the two, accepting Soviet statism without the accompanying pursuit of economic equality through measures like land reform.

India soon came to be under a very strong influence of the United States of America, and began to dream the American dream with a large number of influential middle class families having many of their members settled in that country, and others educated in the American Universities. This has had its serious negative implications that are perhaps best illustrated by Larry Summers' notorious toxic memo (Summers memo). Larry Summers is a highly influential economist, one-time Secretary for Treasury in the Clinton Administration and President of Harvard University. Perhaps ruminating on the India's weak-kneed response to the Bhopal Gas Disaster, Summers, then Chief Economist at the World Bank wrote in 1991 a Memo stating: *"The measurement of the costs of health impairing pollution depends on the foregone earnings from increased morbidity and mortality. From this point of view a given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages. I think the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that."* India was, of course, foremost amongst the low wage countries he had in mind while penning this memo and today India is indeed a favoured destination of many of the world's worst polluting enterprises that are no longer allowed to function in their own country.

By 1990, the Marxist models were losing their sheen. The Marxist prescription of social ownership of production has not proven to be successful; the resulting dictatorships have concentrated power in the hands of a few and abused it roundly. These abuses have not only included abuses of human rights, but those of environment as well, as

happened so spectacularly in East Germany. So Indians have come to view US as the only model, and continue to do so even after the current economic difficulties. However, as Joseph Stiglitz (2012) documents so ably, what drives the American economy today is *rent seeking*, such that economic gains of many agents are often excessive and in no way proportional to their social contribution. Because of these disproportionately large economic gains a small proportion of the American society has cornered the bulk of the wealth and political power. As a result American democracy has been perverted from a one person-one vote to a one dollar-one vote system in which the powerful are continually engaged in distorting the economy to enhance their own unjustifiable gains. Stiglitz points out that the resultant undesirable consequences include [a] exhaustive use of natural resources, [b] unacceptable pollution loads, [c] failure to build human capital because of declining investments in education, science and technology, poor health care, and high levels of unemployment, and [d] an erosion of social capital with increasing levels of social disaffection and strife.

Yet influential and learned Indians continue to argue that the US model should still be our ideal, and we should ignore the current endemic problems of social injustice, environmental degradation and large scale corruption. The argument goes: After all US had its robber barons once, and what does it matter if we have our robber barons now? US once had high levels of pollution and got over those problems, what does it matter if we have high levels of pollution now? The wheels of history will turn, and we too will come to live in the paradise that the more fortunate American citizens inhabit today. There are several serious problems with this contention. Such facile historical analogies have repeatedly proved to be misleading. We do not have the freedom and the luxury of exploiting the resources of much of the rest of the world that the US has had for centuries and continues to enjoy today. Moreover, US does have its robber barons even today. These include bankers who have robbed people in many ways and then swallowed the public funds that were made available to keep the banks from sinking, and US does have serious problems of pollution even now as with the oil leak associated with offshore drilling of oil. As a result, a large proportion of US citizens are today wondering if they are indeed

living in a paradise, and have been coming out on streets demonstrating against the a government of one per cent, by one per cent and for one per cent.

Alternative Models

But there is another Western model that accepts capitalism and industrialization and is far more democratically oriented and caring of environment than the United States. One such is Germany with its strong environmental movement, with the Green Party constituting a significant political force. Germany is today a state with major commitments to environmental protection, and its entrepreneurs are notable for restrained behaviour and willingness to accept relatively low levels of returns on their financial investments, in stark contrast to the greedy American bankers. Germany is also economically in a far better shape than the US.

I am a strong believer in democracy, that with all its shortcomings is the best available political system for the day, as is capitalism the best available economic system. But as Stiglitz pleads on sound scientific grounds, the market forces must be socially moderated to ensure that environmental costs are fully borne by the entrepreneurs, that common property is scrupulously protected, and concentration of wealth not allowed to pervert the democratic principle of government of people, by people and for people into a government of one per cent, by one per cent and for one per cent. This calls for very active citizen participation, with us moving towards direct democracy. The modern developments in science and technology, with tremendous advances in the means of sharing information, have rendered it possible for citizens to play a more and more active role in all spheres of public life.

At the same time, in modern day India we see all around us examples of how the one-per-cent rule has been promoting lawlessness, subversion of the scientific spirit and abuse of fundamental rights of democratic citizens, accompanied by environmental degradation on a massive scale. Surely, this is not what Pandit Nehru visualized and members of India's intellectual classes have a crucial role to play in setting things right.

Nurturing Natural, Human, Social Capital

Today's environment-development debate is cast in a very inappropriate framework of just two choices. This is a false contradiction; the real issue is not whether India can afford the so-called luxury of worrying about environment, but whether India can afford to slide into a lawless, tyrannical society that abuses the liberating spirit of science. Economics, properly interpreted, tells us that any country should aim to ensure a harmonious development of the sum total of the nation's capital stocks of natural, man-made, human and social capitals. In principle, we have accepted this fully. Democratic values are at the heart of our Constitution, and we have progressively enacted a series of well-thought out laws for empowering people. We have also passed a series of well-thought out laws for protecting the environment. We have embraced the spirit of science, and continue to invest substantial resources in nurturing science and technology.

The real issue therefore is not inadequate laws, but a grave deficit in governance. The laws protecting the environment are not implemented. The constitutional provisions for empowering the people are kept in suspension. Scientific activity that would contribute to protecting the environment and could fruitfully engage the barefoot ecologists of the country as partners in the scientific enterprise is discouraged, even suppressed. Since the political establishment and the bureaucracy malfunction, people see no recourse other than street protests and court cases. This is a huge, huge erosion of our social capital. It goes against the very grain of our social nature, for human societies have evolved treasuring, above all, fair exchanges amongst members of the society.

Yet, we have done well to keep our democracy very much alive, indeed continually strengthen it through measures like the Right to Information Act. The currently prevalent rule from above has deteriorated into a government of contractors, by contractors, for contractors. We must therefore focus on building our democracy bottom up from the grass-roots level, an endeavour entirely in tune with the spirit of our constitution that declares the people of India to be sovereign. Hence, the on-going protests and court cases must be

complemented by organizing people down to the grass-roots level to exercise their democratic rights. This is the only way in which we could fashion a law-abiding, genuinely democratic society that truly imbibes the scientific spirit. A well-informed citizenry fully exercising its democratic rights will surely ensure that environment is properly cared for even as we continue to industrialize, as has happened in Germany and in Scandinavian countries. What we need to concentrate on is implementing that which by all rights must be implemented, and I would like to end by proposing a series of such measures:

- Strictly enforce environmental laws such as Air and Water Acts to control pollution.
- Facilitate, not suppress freedom of expression and assembly of people drawing attention to issues of environmental degradation.
- Empower local bodies, i.e. Gram, Taluk and Zilla Panchayats and Nagarpalikas and Mahanagarpalikas to take decisions on environmental issues.
- Put in place Biodiversity Management Committees(BMC) in all local bodies, fully empowered under the Biological Diversity Act, 2002, to regulate use of local biodiversity resources, to charge Collection Fees and to receive other appropriate incentives. Use the provisions of this Act create a system of payment of Conservation Service Charges for continued implementation of traditions such as protection to sacred groves, and for newer conservation-oriented initiatives (Gadgil and Rao 1994, 1995, WGEEP 2011).
- Initiate registration of crop cultivars as called for by Protection of Plant Varieties and Farmers' Rights Act, 2001, and give grants to Panchayats to build capacity for *in situ* conservation of crop genetic resources. Use the provisions of this Act to create a system of incentives at the farmer level for soil C sequestration on the Australian model (Parliament of Victoria 2010, WGEEP 2011).
- Implement fully the Forest Rights Act. Encourage the empowered communities both to adopt practices of sustainable

resource use as well as to set apart some areas dedicated to biodiversity conservation.

- Reinstate the system of empowering citizens to monitor status of environment under the Paryavaran Vahini scheme.
- Carry out a radical reform of Environmental Clearance process through [a] assigning preparation of EIA statements to a neutral competent body that does not depend on payment by project proponents, [b] making mandatory involvement of local BMCs in the process of EIA preparation, [c] making mandatory taking on board all information submitted and suggestions made during Public Hearings, [d] making mandatory periodic environmental clearance requirement, preferably every five years, [e] making mandatory involvement of BMCs in the process of monitoring of implementation of conditions laid down while granting Environmental Clearances, [f] making mandatory preparation of regional Cumulative Environmental Impact Analyses.
- Enhance the scope of Regional Development Plans to include key environmental concerns and make mandatory involvement of BMCs in developing them.
- Promote full access to all pertinent environmental information, for instance, through freely making available the currently suppressed Zoning Atlases for Siting of Industries (ZASI), and opening up the forest and wild life areas to scientific data collection.
- Take action on organizing an Indian Biodiversity Information System (IBIS) in line with the proposals before the National Biodiversity Authority since 2004.
- Organize a public transparent, participatory database on Indian environment by drawing on student Environmental Education projects as recommended by Curriculum Framework Review, 2005 of the National Council for Educational Research and Training.

References

ATREE. http://www.atree.org/

Banerjee, Srestha, 'Delhi High Court cancels clearance to mining project in Goa', Down to Earth, 2012.

http://www.downtoearth.org.in/content/delhi-high-court-cancelsclearance-mining-project-goa

Bengal Tiger. *https://en.wikipedia.org/wiki/Bengal_tiger*

Bernal, J. D., *The Social Functions of Science,* London, Routledge and Kegan Paul, 1939.

Bokil, Milind, *Gosht Mendha Gavachi* (in Marathi), Mouj Prakashan, 2012.

Buchanan, Francis. *A Journey from Madras through the Countries of Mysore, Canara and Malabar,* C.U.P., 2011, Original Publication 1807.

Chaturvedi, Medha, 'Naxal Violence: Chhattisgarh Massacre and the Systemic Rot', *Institute of Peace and Conflict Studies,* 2013 http://www.ipcs.org/article/naxalite-violence/naxal-violencechhattisgarh-massacre-and-the-systemic-rot-3961.html

Couto, Maria, *Goa: A Daughter's Story,* Penguin Books India, 2005.

Dampier, W.C.D., *A History of Science and its Relations with Philosophy and Religion,* Lynchburg, OH, U.S.A, Commonwealth Book Company Inc., 1931.

Das, Dipannita, 'Mendha Lekha is first village to exercise right to harvest bamboo', The Times of India, April 23, 2011. *http://articles.timesofindia.indiatimes.com/2011-04-23/pune/29466126_1_forest-rights-act-forest-bureaucracy-minor-forest*

Dasmann, Raymond, 'Toward a Biosphere Consciousness', In D. Worster (ed.), *The Ends of the Earth: Perspectives on Modern Environmental History,* Cambridge, Cambridge University Press, 1988, pp. 277-288.

Dutt, R. C., *The Economic History of India under Early British Rule: From the Rise of the British Power in 1757, to the Accession of Queen Victoria in 1837,* Trench and Trübner, Kegan Paul, 1902.

Gadgil, M., 'The Indian heritage of a conservation ethic', in B. Allchin, E. R. Allchin and B. K. Thapar (eds.), *Conservation of the Indian*

Heritage, New Delhi, Cosmo Publications, 1989, pp. 13-22.

Gadgil, M., 'Why we must empower people to conserve biodiversity', Environment Update, No. 1, 1993, pp. 13-17.

——, 'Managing biodiversity', in K. J. Gaston (ed.), *Biodiversity: A Biology of Numbers and Difference*, Oxford, Blackwell Science Ltd., 1996, pp. 345-365.

——, 'Forging an alliance between formal and folk ecological knowledge', in *World Conference on Science. Science for the Twenty- first Century – A New Commitment,* UNESCO, 2000, pp. 94-97.

— —, 'Science and the Right to Information', *Economic and Political Weekly*, Vol. XLI, No. 19, May 13, 2006, pp. 1895-1902.

— —, 'Empowering gramsabhas to manage biodiversity', *Economic and Political Weekly*, June 2, 2007, pp. 2067-71.

— —, 'Let Our Rightful Forests Flourish', Pune, National Center for Advocacy Studies, 2008.

— —, 'Ganga river from Patna till confluence with Son', Personal observation, 2012.

— —, 'Shocking betrayal on Western Ghats', Open Letter to Dr. Kasturirangan, *The Hindu,* May 18, 2013a. *http://www.thehindu.com/opinion/op-ed/shocking-betrayal-on-western-ghats/article4724986.ece*

——, 'Of blueprints and greenhouses: We can only protect the environment effectively if we take the effort to the people', *The Times of India*, May 20, 2013b. *http://articles.timesofindia.indiatimes.com/2013-05-20/edit-page/39392219_1_database-wgeep-western-ghats*

— —, 'The Goa Dossier: Ghats Of Perdition', *Outlook*, June 10, 2013c. *http://www.outlookindia.com/article.aspx?285769.pdf*

Gadgil, M., KILA, Thrissoor, Kerala, Personal observation, June 6, 2013d

Gadgil, M. and R. Guha, *This Fissured Land: An Ecological History of India,* New Delhi, Oxford University Press, 1992, pp. 274.

— —, *Ecology and Equity: Use and Abuse of Nature in Contemporary India,* Penguin India, 1995, pp. 213

Gadgil, M. and S. N. Prasad, 'Vanishing bamboo stocks', *Commerce,* 136 (3497), 1978, pp. 1000-1004.

Gadgil, M. and P.R.S. Rao, 'A system of positive incentives to conserve biodiversity', *Economic and Political Weekly*, VIl. XXIX, No. 32, Aug. 6, 1994, pp. 2103-2107.

——, 'Designing incentives to conserve India's biodiversity', in Susan Hanna and Mohan Munasinghe (eds.) *Property Rights in a Social and Ecological Context.* Washington D.C., The Beijer International Institute of Ecological Economics and The World Bank, pp. 53-62.

— —, *Nurturing Biodiversity: An Indian Agenda,* Ahmedabad, Centre for Environment Education, 1998, p. 163.

Gadgil, M. and Sujeet Dongre, (in prep.) Report of Research Project on Assessing Quality of Environmental Impact Assessment (EIA), Compliance of Environmental Clearance (EC) Conditions and Adequacy of Environmental Management Plan (EMP) of Mining Industry in Goa.

Gadgil, M., K. P. Achar et al. *Ecology is for the People: A Methodology Manual for People's Biodiversity Register,* Chennai, National Biodiversity Authority, 2006. Also available on *www.nbaindia.org*

Gadgil, M., P.R.S. Rao, G. Utkarsh, A. Chhatre, and members of the People's Biodiversity Initiative, 'New Meanings for Old Knowledge: The People's Biodiversity Registers Programme'. *Ecological Applications,* 10 (5), 2000, pp. 1307-1317.

Gandhi, M. K., *Hind Swaraj,* Ahmedabad, Navjivan, 1909.

Jain, S. S., 'Aghapur Village People's Biodiversity Register' (in Hindi), 1997.

Kadambi, K., 'On the Ecology and Silviculture of Dendrocalamus Strictus in the bamboo forests of Bhadravathi division', Mysore, Karnataka Forest Department, 1949.

Kapoor, M., K. Kohli and M. Menon, *India's Notified Ecologically Sensitive Areas: The Story so Far,* Pune, Kalpavriksh, 2009.

Karanth, K. U., James D. Nichols, John Seidensticker, Eric Dinerstein, James L. David Smith, Charles McDougal, A. J. T. Johnsingh, Raghunandan S. Chundawat and Valmik Thapar, ' Science deficiency in conservation practice: The monitoring of tiger populations in India', *Animal Conservation* 6, 2003, pp. 141–146.

Kropotkin , P. A., *Mutual Aid: A Factor of Evolution,* Published by W. Heinemann, El Cerrito, CA, U.S.A., Wonderland Books, 1907.

Ludwig, D., R. Hilbotn and C. J. Walters, 'Uncertainty, Resource Exploitation and Conservation: Lessons from History', *Science,* 260 (2), 1993, pp. 17-36.

Mehrotra, Santosh, Ankita Gandhi, Bimal Kishore Sahoo, and Partha Saha, 'Creating Employment in the Twelfth Five-Year Plan', *Economic & Political Weekly,* Vol. XLVII, No. 19, May 12, 2012.

Naoroji, D., *Poverty of India,* London, Vincent Books, Day and Son, 1878.

Nell-Breuning, Oswald von, 'Vocational Groups and Monopoly', *Review of Social Economy*, September 9, 1951, pp. 90-91.

Parliament of Victoria, *Environment and Natural Resources Committee: Inquiry into Soil Carbon Sequestration in Victoria,* Parliamentary Paper No. 362, Session 2006-10, Victorian Government Printer, 2010.

Pinker, Steven, 'The cognitive niche: Coevolution of intelligence, sociality, and language', U.S.A., Proceedings of the National Academy of Sciences, 107, 2010.

Planning Commission, Report of the Steering Committee for XI Five Year Plan for Environment and Forest Sector (2007-2012), Government of India, 2007.

Prasad, S. N. and M. Gadgil, 'Conservation of bamboo resources of Karnataka', Bangalore, Final report to Karnataka State Council for Science and Technology, 1981.

Prasad, M. K., Personal communication, 2013.

Ribeiro, Edgar, Personal communication, 2012.

Saxena, N. C., 'Hunger and Malnutrition in India', *IDS Bulletin,* 43, 2012, pp. 8-14. *doi: 10.1111/j.1759-5436.2012.00341.x*

Saxena, N. C. et al., 'Report of the Four Member Committee for Investigation into the Proposal Submitted by the Orissa Mining Company for Bauxite Mining in Niyamgiri', submitted to the Ministry of Environment and Forests, Government of India, New Delhi, 2010. *http://www.moef.nic.in/downloads/public-information/Saxena_Vedanta.pdf*

Sen, A., *Development as Freedom,* Oxford and New York, Oxford University Press, 1999.

Shrivastava, A. and Ashish Kothari, *Churning the Earth: The Making of Global India,* U.K., Penguin, 2012.

Sinha, R. K., Personal communication, November 2012.

Slobodkin, L. B., 'Intellectual problems of applied ecology', *BioScience*, 38 (5), 1988, pp. 337-342.

— —, 'Preliminary ideas for a predictive theory of ecology', *The American Naturalist*, Vol. XLV, No. 882, 1961.

Sohoni, Milind, Personal communication, 2013.

Stiglitz, J. E., *The Price of Inequality: How today's divided society endangers our future,* WW Norton & Company, 2012.

Summers Memo *http://en.wikipedia.org/wiki/Summers_memo*

The Hindu, 'Silent Valley National Park is 25 years young', November 1, 2009. *http://www.thehindu.com/news/national/kerala/silent-valley-national-park-is-25-years-young/article41827.ece*

The report of the Justice M. B. Shah Commission of Inquiry on illegal mining in the state of Goa. Ministry of Mines, Government of India, 2012. *http://mines.nic.in/writereaddata%5CContentlinks%5C84683b80ebd346e8b18d5c9e3c2f5267.*

The Times of India, 'Maharashtra legislators beat cop who 'misbehaved' with MLA; House stalled', March 19, 2013. *http://articles.timesofindia.indiatimes.com/2013-03-19/india/37842873_1_maharashtra-legislators-mns-group-leader-policeman*

Tiger Task Force, *Joining the dots*, New Delhi, Government of India, 2005. *projecttiger.nic.in/TTF2005/pdf/full_report.pdf*

Trivers, R. L., 'The evolution of reciprocal altruism', *Quarterly Review of Biology,* Vol. 46, No. 1, 1971, pp. 35-57. *http://www.jstor.org/stable/2822435*

— —, *Natural Selection and Social Theory: Selected Papers of Robert Trivers,* Oxford and New York, Oxford University Press, 2002.

Vijayan, V. S., *Keoladeo National Park,* Mumbai, Bombay Natural History Society, 1987.

— —, Personal communication, 2013.

Vora, Rajendra, *Mulshi Satyagraha,* Pune, Pratima Prakashan, 1994.

Wade, Robert, 'Common property resource management in South Indian villages', Proceedings of the Conference on Common Property, 1986.

Walters, C. J., *Adaptive Management of Renewable Resources,* New York, MacMillan, 1986.

— —, 'Is adaptive management helping to solve fisheries problems?', *AMBIO: A Journal of the Human Environment,* 36 (4), June 2007, pp. 304-07.

Wesley, D. G., *Revised Working Plan of the Yellapur and Mundgod Teak High Forests*, Kanara, Eastern Division, Karnataka Forest Department, 1964.

WGEEP Report, 'Western Ghats Ecology Experts Panel, 2011. *http://cat.org.in/index.php/article/western-ghats-ecology-expert-panel-wgeep-report/*

Zachariah, M. and R. Sooryamoorthy, *Science for Social Revolution? Achievements and Dilemmas of a Development Movement-the Kerala Sastra Sahitya Parishad*, 1994. *library.wur.nl*

Zoning Atlas Division, Mumbai, Maharashtra Pollution Control Board, 2006. Zoning Atlas for Siting of Industries. Ratnagiri District. *http://mpcb.gov.in/relatedtopics/sepp.php*