(Revised version, April 7, 2006)
(originally published in locally circulated journal Atharva, vol. II, No. 6, Nov. 2007. a monthly of contemporary studies & analyses, Ponda, Goa, India)

Wild panther in Miramar?. How Goa is on the verge of an environmental hara-kiri.

Nandkumar M. Kamat
Department of Botany, Goa University, Taleigao, Goa, India
nkamat@unigoa.ac.in

Introduction:-

' A wild panther (*Panthera pardus*) was trapped from a private residence in Panaji's high class Miramar ward in April 2006"

Miramar-Panaji/Panjim, is on the banks of Mandovi estuary. It is a densely populated area. How the panther reached there? Where it came from?. Is the island of Tiswadi losing its' residual green cover?. The capital city of India's smallest state, Goa, Panjim or Panaji, the 51 st richest town in India by bank deposits has been animatedly discussing this issue. It is indeed a surrealistic experience. Goa is on the verge of a serious environmental crisis. The signs are there on the horizon- destruction of the rich watersheds, pollution of traditional ponds and lakes, deforestation, removal of urban tree cover, cutting of the lush green hills, reclamation of the eco-fragile flood plains of the major estuaries, destruction of the low lying Khazan ecosystem, leveling of the coastal sand dunes, fragmentation of the natural habitats, interference in the natural migratory corridors of the wild animals, overuse of chemical fertilizers, Air pollution, dust pollution, impact of mining and quarrying, alluvial sand excavation, plastic waste, mountains of municipal solid waste, human-wild animal (elephants, monkeys, panthers) conflicts, erosion of wild and agrobiodiversity, gene pools and the most dangerous of all- the ecological and cultural simplification.

An ecological historian's approach

Goa has changed radically in the 20 th century. Four major environmental drivers- mining (post 1945), urbanization (post-1961), Industrialization (post-1971) and tourism (post-1972) have strongly impacted its' ecology and economy in the past 60 years. Understanding the transformation of the ecology and environment of Goa needs an approach of an ecological historian. In this paper the focus is mostly on the developments of the post-second world war period (1945-2005).

Geo-ecological setting of Goa:-

Goa is a small state by area and population but it is a beautiful state. Because it is small and beautiful it is a good model for studying the ecological and environmental history. The starting point of Goa's history is the genesis of the dot called Goa on the drifting continents. This dot has traveled in time from the south of equator to its' present position (N 14^{o} 48^{1} to N 15^{o} 48^{1} Lat. And E 75^{o} 40^{1} to E 74^{o} 20^{1} long.) mid-way along the west coast of India. Geomorphologically greenschist supracrustals overlie a basement trondhjemitic (peninsular) gneiss and are intruded by granites, dolerites and gabbros. The late Cretaceous Deccan traps lie to the Northeast of the state. Laterite covers most formations in this wet tropical climate. Another geologically unique feature of Goa is that it has the ancient crust of earth in the form of the 3.6 billion years old basement rock-the trondhjeimitic gneiss. This can be compared to the age of the oldest rocks on earth found in Greenland, dated 3.9 billion years. The oldest rocks in Goa were

formed before life began on earth, some 3.5 billion years ago. The antiquity of Goa's geological heritage is also found in some of the oldest rocks, such as the Dudhsagar granite, which has been dated at 2565+95 Ma., the Chandranath granite dated at 2650+100 Ma. and the 2395+390 Ma. Canacona porphyritic granite (Dhoundial etal., 1987). All these rocks are time capsules of earth's lithospheric history. They were the part of pangaea supercontinent and later the Gondwanaland. From late Jurassic, 150 million years ago till the split of Gondawanaland 84 milllion years ago the rocks probably shared their boundaries with Madagaskar and Seychelles plates. So, Goa shares a petrological brotherhood with Madagaskar and Seychelles. The Indian plate drifted northward for 100 million years before it had a soft collision with the Eurasian plate during middle Eocene, about 50 million years ago. During the course of continued northward drift, around 69-65 Mya (Late cretaceous), widespread volcanism took place over the Indian landmass and created the deccan trap continental flood basalt province. It is interesting that the flood basalt did not cover Goa. If that were to happen then perhaps the history of Goa would have taken a different turn. Gokul (1985) has observed that during upper cretaceous-Lower Eocene period the area to the south of the present position of deccan trap in Goa should have been a prominent topographic high which restricted the spread of trap flows to the south.

Goa's ecological history is influenced by the western ghats and the Arabian sea

A general mistake which most of the environmental scholars commit is to view the landmass of Goa as an isolated area. Goa is part of the central portion of India's western ghats. Historical geography shows that the boundaries of Goa have changed several times. Today state of Goa is confined to an area of 3702 sq. kms. and occupies a 100 km long and 40 km wide strip (in the widest area) between the Western Ghats and the Arabian Sea. The present landscape of Goa is the outcome of complex natural processes. The genesis of the Goan land mass and the rock strata, the rivers, their basins and their channels are intimately related to two important events- the birth of the western Indian ocean and the rise of the western ghats. The geological history tells us about the origin of the land, landscape, rock strata, minerals. Goa forms part of the Indian Precambrian shield. In this region greenschist supracrustals overlie a basement trondhjemitic (peninsular) gneiss and are intruded by granites, dolerites and gabbros. The late Cretaceous Deccan traps lie to the Northeast of the state. Laterite covers most formations in this wet tropical climate

The history of climate shows us the changing profile of atmosphere and how it impacts the land. The biotic history sketches the history of living species (Table 1 includes the statistics on explored Biodiversity of Goa). The anthropological history tells us about the origin of the first humans and further developments.

The regional disparities within Goa:-

Goa means many things to many people. But there are intraregional variations within Goa. The colonial influence is marginal in the 'new conquest areas' which are also resource rich. The environmental and developmental problems are different in these talukas. Comparatively the 'old conquest talukas' show a more cohesive culture, high degree of urbanization, industrialization and development. The environmental problems of these talukas are different. Then there are ecologically determined cultural factors which separate the settlements and people in the Mahadayi/Mandovi river basin from Zuari river basin. For example the cult of the worship of 'Gajalaxmi' or the goddess of

monsoon and vegetation popular in Mandovi river basin is not found in Zuari river basin. The system of alluvial river silt based rice farming , locally known as 'Puran xeti' is also dominant in the Mandovi river basin. The coastal low lying saline lands known as 'Khazans' are confined to the estuarine belt whereas the terraced plantations known as "moles' and "kamats' are located only on the hillslopes in the midland talukas and in the western ghat foothills. The rainfall intensity varies from west to east. The Sahyadrian Goa is rich in hydrological and biotic resources. There is also a vertical geographical divide. The coastal plains and the estuarine floodplains are separated by the Sahyadrian hills and foothills. For any student of Goa's environment the baseline begins with a good understanding of the natural resources and the cultural ecology. Goans can be called 'ecosystem people' if we use the definition provided by Gadgil & Guha (1992). The best reflection of cultural behaviour of the ecosystem people is found in the Goan folklore. Right from the pre-historic period there seems to be a good understanding of the wild flora and fauna among the inhabitants of the Mandovi and Zuari river basins which drain more than 70 % of the state's geographical area. The zoomorphic petroglyphs of Panasaimol, Kazur and Mauxi show the wildlife knowledge of the pre-historic hunters. It is difficult to identify a distinctly Goan set of environmental ethics but the tradition of worshipping sacred groves and sacred trees proves that ecotheologically and ecospiritually the people were quiet advanced.

The environmental issues in Goa:-

The colonial years:-

There is clear difference in the environmental issues in colonial and post-colonial Goa. In the colonial period under consideration, the economy was based on primary sector. The manufacturing sector was marginal and the contribution from service sector was negligible. Low population pressure, low purchasing power, low consumption meant less pollution. The only source of air pollution was from the burning of the fuelwood and agricultural residue. Industrial wastewater pollution was negligible. The age of largscale use of agrochemicals had not dawned as most of the agriculture was organic. So there was no overloading of the lentic and lotic waterbodies with Nitrogen and Phosphorus leading to eutrophication. However, clean treated water was scarce and the waterborne diseases were dominant. Preventive health surveillance was excellent and the administration could rapidly identify the sources of various epidemics. Urban sanitation was effective. There were checks on food quality sold in markets. The community assets were being managed by the communidades. The landlords also managed the community assets such as bundhs, drainage works, wells under their possession. But they had limited interest in new capital investment in the lands leased to tenants or occupied by the mundkars. There were traditional systems like the "bhous' which looked after the maintenance of the Khazan lands on a cooperative basis. A major environmental issue in colonial Goa was the damage to the coastal Khazan lands due to breaches in the protective embankments. There were problems with coastal management due to erosion of the sea shores. But sincere efforts were made in the 1950's to address these issues. There were stringent penalties for intentional flooding of the fertile paddy fields for the purpose of pisciculture. Complaints against the mining industry were restricted to the movement of the barges which caused erosion of the external embankments of the Khazan bundhs near Mapusa, Naroa and Mandovi rivers . This problem became acute in 1955-56. For the coastal Khazan farmers this was the first exposure to the environmental

impacts of a new industry. There is no data available about the deforestation caused by the opening of the private mining leases during this period (1946-1961) and the consequent rise in the sediment flow in Mandovi and Zuari rivers. But a rough estimate could be made from the volume of the Iron ore exported-from 60 thousand tones in 1946 to six million metric tones in 1961. A hundred fold rise in the ore export meant removal of an overburden by two hundred times. Most of the 'massive dead ore reject dumps' which are seen in the mining belt between Advalpale-Bicholim to Sanguem have their foundation in this period. The Portuguese administration did not take any steps to impose any environmental guidelines for sustainable mining. But they had made it mandatory to seek the permission of the Mamlatdar and the Captain of ports to remove sand or any part of the earth. Their policy of granting of the mining leases to all and sundry created a mini "iron ore prospecting' rush in Goa. The primary sector of Goa paid a heavy price for this policy. There was no understanding of the externalities associated with unregulated mining activity.

The Post-colonial years:-

The post colonial years are significant on account of the impact of four major environmental drivers- Mining, Urbanization, Industrialization and Tourism. All these drivers converge on a single focus-" Human interference in the ecosystems'. Table 2 outlines the threat perception for different ecosystems. The ecological and environmental impacts of mining became apparent only after 1970's. For a detail chronological treatment of these issues readers may refer to Chapter 8 in Claude Alvares's 'Fish, Curry and Rice, A sourcebook on Goa, its' ecology and life-style' (The Goa Foundation, 2002). The present environmental discourse regarding mining shows that perceptions differ sharply between various stakeholders. Whereas villagers in Sattari and Sanguem are vehemently opposed to the opening of new mining leases, in areas declared as sanctuaries some people view mining as an economically beneficial activity. The mining labour unions have also adopted an ambivalent stance towards the problems faced by the agricultural proletariat. The big players in mining have improved their environmental record and have also obtained the ISO certification for environmentally sound mining practices. Generally the debate and the controversies have centered around issues like- the deforestation and loss of wildlife, habitat fragmentation, air and noise pollution, the high levels of dust in the environment, the location of the reject ore dumps, the sediment flow polluting the waterbodies, the depletion of local groundwater table, the hazards created by ore transportation and the erosion of infrastructure like the roads. There seems to be an economic tradeoff to compensate for the environmental deterioration. People may not be worried about the long term effects of the pollution if they get generous financial support to build a religious structure or a community hall. The labour shift has also resulted in abandoning of the fields and the mining area has seen a boom in the service sector. People are caught on the horns of dilemma- they would lose the economic affluence, direct and indirect employment if environmental issues are fought aggressively and apolitically. And if they only focus on improving the environmental quality there is fear of division in their ranks and closure of the mines. The panchayati raj system under India's 73 rd constitutional amendment has been empowered to tackle such issues through the medium of 'Gramsabha"-the general council of the villagers. But the village panchayats in the mining belt have consistently failed to take up the issue of 'environmentally friendly sustainable mining' within their jurisdiction. The village

panchayats are empowered to convene multistakeholder meetings to address all the issues related to environment and development. But seldom these powers have been invoked. Either there is political interference or implied threats from the state apparatus. Mining has been generating more than Rs. 1000 crores foreign exchange earnings on average per annum besides contributing a social capital RS. 250 crores per year. About 15000 people are directly employed. Another 30, 000 are employed in ancillary activities. Thus 45, 000 people in mining industry makes it one of the largest labour lobby in the state of Goa. The Government of India has done very little to help the state of Goa to restore the degraded mining areas where mining activity has stopped. Union government agencies like the Indian bureau of Mines show scant interest in enforcing their mandate for sustainable mining. The main importers of Goa's Iron ore are Japan, People's republic of China and South Korea. Even these countries have not demanded environmentally acceptable mining operations. Japan is a big donor for environmental projects. Most of the Japanese aid for ecorestoration projects in Asia and India, through bilateral or multilateral channels has been diverted to other areas. Despite Japan being the oldest importer country of Goa's Iron ore , it has not shown any interest in helping Goa for eco-rehabilitation projects in the mining areas. The Goan Iron ore exporters have set up their own foundation which carries the task of implementing some welfare projects in the mining areas.

The Saleli revolt- How neglected Social, ecological issues precipitate a crisis

So far, the discourse against mining in Goa has been limited to the impacts of Iron ore mining companies. But large scale and often illegal stone quarrying for basalt and laterite is leaving ugly ecological and environmental footprints. The agitation by the ryots of Saleli village in Sattari, North Goa district against the highly polluting stone crushers in 2005 initially did not move the authorities. The Goa state Pollution control board gives the consent to operate the stone crushers. The local village pnachayats are supposed to give the No Objection certificate after verifying the site and the possibility of public nuisance from such activity. In December 2005, a private stone quarry operator in Saleli village was brutally lynched by a mob. There was apparently opposition to his new stone crusher. But there was also another dimension behind the violence-the unresolved land ownership issue. The ryots who rebelled were not entitled to the ownership of the lands which they had been cultivating. There was already a degree of frustration and helplessness among the people as they continued to witness the expansion of the basalt quarrying business. Their sacred hills were taken over. The watershed was bulldozed and the pristine springs vanished. Ultimately when the quarries reached the 'Devarais" (Sacred groves), the villagers decided that they had too much. What followed after the Saleli homicide was an eye opening lesson for the whole state of Goa. It was a paradigm shift. No more environmental issue would be now studied in isolation. "Saleli" could happen again-that's what people talk as if Saleli is a symbol of some malady.

The Shelvona dumping yard issue

High grade Iron ore brought from Karnataka for the beneficiation of the Goan Iron ore has created the problem of heavy dust pollution at Sanvordem dumping yard. The government looked for alternatives. A site at Shelvona on the banks of Zuari river is proposed to be acquired but the issue has raised dust as there are powerful political role players supporting and opposing the Shelvona project. This issue appears as another flashpoint indicating how the mining is impacting the grass roots level politics in Goa.

There is certainly no unanimity among the mining companies about the selection of the Shelvona site. As they are divided the politicians and the media is also towing different lines according to their loyalties. In very near future, this issue would emerge as a test case for the mining industry, the local people and the Government.

Towards sustainable mining:-

The main problem of open cast iron ore mining in Goa is the huge amount of overburden. For every metric tone of Iron ore two metric tones of overburden has to be removed. This has resulted in accumulation of more than a billion tones of overburden which is piled up in 'dead' and "active' dumps. Actually this overburden has good amount of Iron (less than 55 % but very rarely below 40%) and Aluminium. But at the present level of technologies it is not exploitable. New technologies like bioleaching and biohydrometallurgy may take a few years to break even. Alternatives for the use of the ore reject which has some clay have been suggested. Excellent adobe bricks could be manufactured from the ore reject using some binders. Economic and engineering models have been worked out by a Goan engineer Mr. Fernades but somehow this idea has not caught up. Besides at the Goa University this author has also been experimenting with novel techniques such as biomining and bioleaching to solubilize the metallic ores, so that the low grade ores could be utilized. These experiments are however at preliminary stage and need further research.

The main issues in discourse on mining and environment

There are diverse opinions and lobbies which debate these type of issues, here, the expression " people" refer to the inhabitants of the mining area of Goa, in a belt spread over 600 square kilometers, from Advalpale to Neturlim, running parallel to the western ghats..

1. Farmers are opposed to mining but would be satisfied with compensation
2. Farmers are not satisfied with compensation, but need their area to be free from mining or ecologically restored
3. Workers are opposed to the closure of mines or lay-offs and have no public stand on environmental hazards from mining
4. Truck operators are opposed to closure of mines and are insensitive to the dust pollution
5. People are opposed to open transport of the ore which causes massive dust pollution
6. Farmers oppose mining but often are contented to forego cultivation if a mining company offers a good compensation in lieu of the discontinuation of the farming operations or the damage caused.
7. People in the wild life sanctuaries are divided over mining. Those who have good plantations or farms are opposed to mining and those who are unemployed or landless are in favour. Those who hope to borrow loans from the banks to operate ore carrying goods trucks also see new mines as a windfall opportunity. There is a vertical divide between the ecological stakeholders and the economic stakeholders.
8. People expect the mine owners to be generous for their social, cultural, religious and educational needs and may ignore the environmental hazards if these needs are met

9. People view media owned by the mine owners as partial towards mining and less sensitive towards environmental concerns
10. People expect media owned by other non-mining interests to take up their grievances
11. The mine owners are concerned about the extortionists and opportunist elements and the troublemakers who may instigate the locals over environmental issues
12. The mine owners and the mining companies claim that they have made substantial investments in social capital formation, by way of charity and by contributing to the growth and development of the educational, cultural, sports sectors.
13. The labour unions view the mining v/s environment, mining v/s agriculture controversies with calculated indifference and have no clear defined policy to stand with the affected people. In very rare cases the interests of the mining workers and farmers have come together.
14. People in mining area expect judicial activism over environmental concerns of mining and are prepared to approach the judiciary for intervention
15. Environmental issues related to mining have no priority during any elections as compared to people's needs of roads, bus stands, playgrounds, water, power supply, employment etc.

The environmental issues associated with urbanization:-

Rapid urbanization is another issue which has generated a lot of controversy in Goa because of the large scale land conversions, lack of urban amenities like sewage disposal systems, slums, health problems, pollution, congestion, traffic bottlenecks etc. In 1950 Goa had only 13% urban population. There was a marginal rise in 1960. But in 1971 the urban population showed a quantum jump from 14. 80 to 25.56%. Again in 1981 it went up to 32.03, followed by 41.01 in 1991 and 49.77 in 2001. he latest estimate shows the urban population to reach 54% by March 2005. The 2002 National census put Goa at the top of the list of highly urbanized states. Among the 11 talukas of Goa, Salcete, Bardez, Marmgoa and Tiswadi show a very high trend of urbanization. Incidentally these four talukas are also highly globalised. Most of the wealth of Goa is also accumulated in these four talukas

Box 1 shows the characteristics of these talukas .

Box 1 The Old conquest talukas are highly urbanised

•Tiswadi, Salcete, Bardez, Mormugao are highly globalised
•High rates of urbanisation with 29 out of 45 census towns
•Technological and capital intensive work culture
•Show heavy economic, social, cultural and environmental impacts of tourism and contribute substantially to the foreign exchange earnings
•These have high consumerism and are exposed to latest consumer goods and services
•Nurseries of urban sprawl and slums

The urban sprawl in these talukas has put considerable pressure on the agricultural lands. These talukas also have the ecologically fragile sand dunes and the low lying khazan lands. Urban malaria, hepatitis have emerged as new health problems in the cities like Panaji and Margao. Uncontrolled building activity has taken a heavy toll of the old heritage structures. Urban wetlands have been encroached. Sand dunes have been flattened. Salt pans have been reclaimed. Traditional drainage systems have been blocked. Panaji experiences incessant flooding in past few years. Construction activity on the unstable slopes of Altinho has caused landslides. More than eight million litres of sewage is discharged in the Mndovi river without any secondary treatment. The Mandovi estuary is heavily polluted. A large number of scrapyards is another menace which the urban Goa experiences. The environmental issues which concern urbanization include the following:-

1. Air and water pollution 2. Solid waste management 3. Sewage treatment 4. Traffic congestion 5. Encroachment of open spaces 6. Growth of slums and scrapyards 7. Illegal constructions 8. Improper and insufficient drainage and flooding 9. Landslides 10. Rise of new epidemics due to contaminated water supply 11. Mosquitoborne diseases

These problems have been precipitated by politicization of the urban developmental regulatory bodies like the Town and country planning board, the Planning and developmental authorities (PDAs,) and the municipal councils. Goa still does not have a policy for ensuring sustainable urbanization despite an unanimous recommendatory resolution to that effect passed by the legislative assembly of Goa in 2002. There is no implementation of the 73 rd and 74 the constitutional amendments which devolve powers to the local bodies. The recent (Oct.-Dec. 2005) agitation over the issue of an ordinance giving sweeping powers to the government in spatial use in village panchayats indicates the clash of the two forces- the urban centered real estate speculators and land developers' lobby on one side and the village bourgeoisie , hesitant to lose their power and importance as well as opportunities to strike deals for a price. Since the village panchayats have no expertise and knowledge about sustainable spatial planning, the present chaos may continue harming the ecology and environment in the process of unregulated urbanization.

The tourism sector as a powerful socio-economic and environmental driving force

For a detail critique of Tourism sector in Goa from environmental and social angle, Claude Alvares's above cited source book may be consulted. The lonely planet publication "Hello goodnight' by David Tomorey, also offers an interesting perspective from a foreigners viewpoint. Tourism brings about Rs. 2500 crores to the foreign exchange kitty of the Government of India. The tourists spend annually about Rs. 5000 crores in Goa. But for strategic reasons the Goa government has been projecting only Rs. 650 crores as income from tourism. More than two lakh people derive their employment from tourism during the tourist season and hence the stakes are very high. The tourism sector has positively boosted the economy of coastal Bardez and Salcete. But with it cultural, social and environmental concerns have also arisen. These could be classified as following:-

1. Change of land use for tourism purpose
2. Labour shift from primary sector
3. Depletion of the ground water table
4. Pollution of water resources

5. Destruction of the mangroves, Khazans and salt pans
6. Shift of traditional fishermen to water sports business
7. Solid waste pollution
8. Emergence of mosquitoborne diseases
9. Entry of HIV/AIDS
10. Rise in alcoholism, gambling and crimes
11. The menace of narcotics trade
12. Real estate speculation driving up the land prices
13. Incessant noise pollution due to trance parties
14. Entry of international crime syndicates
15. Paedophilia and other sex-related deviant lifestyle
16. Growth of peripheral slums

There seems to be a fair degree of social sanctification and an economic trade-off by the local people which has resulted in the movement against mass tourism and its' ill impacts getting very limited grass roots level support. This can be seen in the gramsabha of the village panchayat of Anjuna, supporting and condoning the famous weekly 'flea market' as it fetches revenue for the panchayat and employment for the locals. As long as there is support for tourism at local level the environmental and social concerns may be side tracked in Goa.

Industrialization as a driving force:-

Industrialization in Goa acclerated after the entry of Ciba-Geigy's santa Monica plant (now Syngenta) , Birla industries Zuari fertilizer plant, and the Madras Rubber factory's moulded Rubber tyre manufacturing unit in the 70s. After 1975 there was accelerated growth of industries as new industrial estates were established. The government acquired mostly less fertile and rocky or swampy, uninhabitated land to set up these estates. There was no sound environmental location or siting criteria. Many of these estates are located in precious watersheds and cap huge groundwater aquifers. This has resulted in the depletion and pollution of the water resources. By end of 2002 Goa had 148 medium and large industries and 6469 small scale industrial units. About 50, 000 workers were employed in these industries.

The popular agitations over pollution from Zuari fertilizer plant, Ciba Geigy's (Syngenta) air emissions and the location of the Thapar and DuPont's Nylon 6, 6 fiber plant helped to create awareness among the local people about the hazards of unsustainable industrialization. The 'NIMBY" (Not In My Backyard) syndrome caught the imagination of the people. There was initial opposition to a glass fiber production plant which was then tamed. There was agitation against the location of the Metastrip factory which shook Goa a few years ago. Ultimately the factory came up and was operational with improved pollution control devices. The public opinion over polluting industry is so strong in Goa that the politicians don't fail to assure that they would admit only non-polluting industries in Goa. There have been a number of controversies over power and water guzzling units such as steel furnaces and metallurgical industries. The people near Cuncolim industrial estate are agitated over the metal recycling factories. There are specific environmental issues near every industrial estate. None of the industrial estates have modern common effluent treatment plants. A few factories have good wastewater treatment facilities. But generally the environmental quality in the industrial estates is very poor. The state pollution control board has proved ineffective in

monitoring pollution and enforcing its' mandate under the central and state legislations. A review of the environmental issues related to industries and industrialization would show the following:-

1. People expect jobs but fear depletion of the natural resources
2. Industries cause local groundwater depletion
3. Industries are not taxed for using groundwater
4. Pollution of groundwater is not monitored
5. Solid waste disposal is a major concern in the industries
6. Air and particulate matter pollution from pig iron plants is a major concern
7. People are not educated about hazardous industries and the hazards
8. Village panchayats have very little say in selecting industries within their jurisdiction
9. People have no faith in the Goa state pollution control board
10. Growth of slums and scrapyards near the industrial estates has affected the local people
11. The locational criteria prescribed by government of India are not followed in locating industrial estate
12. No industrial estate has an environmental management or disaster management plan

The Goa Chamber of commerce and industries and the Small Scale Industries association of Goa have taken some laudable steps to sensitize the industries about the compliance of environmental norms. Pressure from NGOs like The Goa Foundation has also acted as a deterrent. The local media has also highlighted the specific issues of industrial pollution. All this has resulted in giving Goa an image of 'selectively industrializing state' as compared top other states in India where all types of industries are welcomed.

Conclusions:- The model of development used in Goa is unsustainable as it may gradually erode the quality of life if ecosystems are interfered with and the life support systems are destroyed. The challenges for Goa's environment are many but these are rarely burning issues during elections. The solution is a basic paradigm shift (see Most optimistic scenario) in accepting a model of sustainable development of the state with focus on enhancing the quality of life of all the people while caring for the environment. Some more information and scenarios are included in the box items 2-7 whereas box 8 includes my vision for the state of Goa-a new social deal to correct all the environmental ills and their social and cultural impacts..

Box 2

Tofflerian scenarios
for the Goan society on a time scale of 10-25 years.

1. Business as usual (BAU):-If things just continue to drift….
2. Most Optimistic (MOM):-If there is a radical paradigm shift, a new vision
3. Worst Case (WC):-If democratically elected mafias rule Goa

Box 3

BUSINESS AS USUAL SCENARIO (BAU)

•Rising social and urban crimes
•Unchecked and unregulated urbanization
•Collapse of waste disposal systems
•Birth of urban mafias
•Severe water pollution
•Emergence of new epidemics
•Psychiatrically stressed society
•Rising educated unemployment
•Ethnic backlashes/riots
•Growth of xenophobic/parochial ideas
•Neglect of the old, sick and vulnerable sections
•Emergence of violence prone, cruel, sadistic and sick society

Box 4

MOST OPTIMISTIC SCENARIO (MOM)

•Evolution of a broad political and social consensus on the future of the society
•A pro-active, socially sensitive, assertive, visionary political leadership and a vigilant mass media
•Acceptance of the principles of environmental governance and sustainable development for state planning
•Emergence of powerful non-political/apolitical citizens' advocacy groups, educated voters' councils and youth forums
•A policy for sustainable urbanisation
•Full functional literacy
•Comprehensive social security package
•A caring government
•Stress on crime prevention and community policing
•Decentralized counseling facilities
•Zero tolerance policy for slums
•Appropriate habitats for the urban and rural poor
•Decentralised public sanitation and waste management
•Eradication of vector-borne epidemics
•Focus on preventive and social medicine

Box 5

WORST CASE SCENARIO (WC)

0. **New social conflicts, riots, sophisticated crimes**
1. **Phenomenal growth of urban slums**
2. **Severe water scarcity**
3. **Spread of drug resistant pathogens**
4. **Poor air quality and more deaths**
5. **Bioterrorist attacks**
6. **A distorted sex ratio**
7. **Severe educated and rural unemployment**
8. **Collapse of village panchayati raj**
9. **Increase in life style related diseases and new viral epidemics**
10. **Rising psychiatric illnesses**
11. **Political and social anarchy**

Box 6

The disturbing mortality picture

The largest killers

0. **Diseases of circulatory system**
1. **Diseases of respiratory system**
2. **Infective and parasitic diseases**
3. **Diseases of digestive system**
4. **Neoplasmas**
5. **Nutritional/metabolic, immunity diseases/disorders**
6. **Diseases of urinary system**
7. **Ill defined conditions**

Box 7

The ill informed civil society

12. **The rainfall in Goa is** mildly acidic
13. **The fog is turning into a** chemical smog
14. **Local water samples are not checked for dissolved heavy metal compounds, nitrates, phenolics and agrochemicals**
15. **No food safety and quality checks for Fish, fruits, poultry, meats and vegetables**

Goa needs a new social deal

•Planning for sustainable development
•Ensuring environmental 'glocal' governance
•Empowering local communities and citizens' advocacy groups
•Ensuring ecological security
•Social security cover for all
•Building an informed society
•Life style education
•Focus on psychiatric health
•Family counseling
•Suicide prevention program
•Appropriate career and vocational guidance
•Health, nutritional and sex education package for students
•Empowering the women's groups
•Strengthening and redefining the Parent teachers' associations
•Safety net for the unorganised and marginalised sections
•Tribal and OBC welfare programmes
•Public-Private partnership for social good
•Private sector to focus on sanitation, waste management, health education and professional psychiatric counseling
•Private sector to bring in the best international expertise for social sector development
•Outsourcing of certain government services

table 1 Explored Biodiversity of Goa

Taxa	*Catalogued No*
FLORA	
I. Microbes	
a. Viruses	30
b. Yeasts	250
c. Bacteria	150
d. Actinomycetes	25
e. Fungi	
- Terrestrial	400+
- Aquatic	80
- Marine	78
II Algae	
- Terrestrial	15
- Fresh water	156
- Marine	50
III. Bryophytes	15
IV. Pteridophytes	48
V. Angiosperms	1750
VI. Gymnosperms	1
FAUNA	
I. Invertebrata	
- Protozoa	NA
- Porifera	NA
- Coelenterata	NA
- Platyhelminthes	NA
- Aschelminthes	NA
- Nematoda	10
- Annelida	NA
- Arthropoda	112
- Arachnida	30
- Crustacea	82
- Mollusca	
Bivalvia	28
Gastropoda	63

Cephalopoda	02
- Echinodermata	NA
II. Protochordata	
- Hermichordata	NA
III. Vertebrata or Chordata	
- Pisces	205
- Reptilia	49
- Aves	357
- Mammalia	45

* NA - Not Available

Table 2 - Threats perception-ecosystems and biodiversity of Goa

Type of Ecosystem	**Existing and perceived Threats**
Continental Shelf	Supertanker traffic, oil pollution, bilge washings, overfishing, depleting fisheries stocks, agricultural run-off, red-tides. Sediment plume with heavy metal oxides, clay colloids, sewage
Beaches and sand dunes (4000 hectares)	Mass tourism, water sports, constructions, sand removal, solid waste, sewage discharges, dumping of constructional debris, exotic weeds, land levelling
Intertidal rock pools (Vagator, Anjuna, Palolem, Verem)	Oil pollution, solid waste, sewage
Estuarine islands (Tiswadi, Divar, Chorao, Jua, Cumbarjua, Corjuve, Capao, Rane's Jua, Saint Jacinto)	Breaches in embankments, flooding, exotic weeds, dumping of waste, cutting of mangroves, destruction of watersheds

Marine islands (St. George, grande, pequeno)	Cutting of trees, fires, solid waste
Mangroves (2000 hectares, 9 tidal rivers)	Oil pollution, dumping of plastic waste, constructional debris, fire, deforestation and land reclamation, exotic weeds
Khazans (saline coastal paddy fields spread in 8 talukas over 17,000 hectares)	Damage to bundhs, sluice gates, flooding, illegal pisciculture,soil erosion, land filling and reclamation, solid waste dumping, scrapyards
Riverbanks and floodplains (about 5000 hectares)	Encroachments, blast fisheries, solid waste and sewage disposal, oil pollution
Lateritic grasslands (plateaus)	Deforestation, housing, industries, fires, exotic weeds
Forests (1250 sq. kms.)	Deforestation, mining, quarrying, dams, roads, kumeri cultivation, monoculture plantations, artificial breaks, exotic weeds, fires, floods, soil erosion, poaching
Myristica swamps in western ghats	Human interference, solid waste, fire
Lotic freshwater (rivers)	Alluvial sand mining, Sediment from mining rejects, high turbidity, oil, grease, heavy metals, nitrates, sewage, solid waste, blast fisheries
Lotic freshwater (springs, fountains)	Watershed destruction, housing, industries, Washing of vehicles, sewage
Lentic freshwater(natural lakes)	Eutrophication, reclamation, encroachments, impact of religious practices (immersion of idols)
Caves (limestone, lateritic)	Mining, slope instabilities, solid waste
Salt pans (agors)	Oil, PHC, heavy metals, sediments, solid waste, flooding, erosion
Wind blown cliffs	Deforestation, quarrying, constructions
Waterfalls	Quarrying, deforestation

http://www.goacom.com/goafoundation/biodiversity/