

Gandhi, Environment and Sustainable Future



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PREFACE

Environmental issues came to the fore in the 1970s. The first United Nations Conference on the Human Environment (1972) was held in Stockholm, Sweden. It brought environment to the centre stage of the global agenda and later led to the establishment of the United Nations Environment Programme (UNEP). In 1983, the UN General Assembly set up the World Commission on Environment and Development, popularly known as the Brundtland Commission. Its aim was to link environmental issues to the findings of the 1980 Brandt report on North-South relations. The Brundtland report entitled *Our Common Future*, published in 1987, established the link between environment and the economy and coined a new term "sustainable development" as the way to ensure economic development that would not endanger the ability of future generations to enjoy the fruits of the earth.

Twenty years after the first global environment conference the representatives from 178 nations, non-governmental agencies (NGOs) and other interested parties (approximately 30,000 in total including members of the media), met in Rio de Janeiro, Brazil, to discuss global environmental issues with implications for appropriate policies to be pursued by national governments. The conference sought agreement on concrete measures to reconcile economic activities with protection of the planet to ensure a sustainable future for all people. The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) was opened for signature at this conference. This conference was a land mark in the history of environment and is popularly known as the Earth Summit. Ten years after the first Earth Summit the World Summit on Sustainable Development , took place in

Johannesburg, South Africa, in 2002, to discuss the issue of sustainable development. The United Nations Climate Change Conference, commonly known as the Copenhagen Summit, was held at Copenhagen, Denmark, in 2009. The Copenhagen Accord, though not legally binding, recognised climate change as one of the greatest challenges of the present. These conferences brought into limelight the challenges in the field of environment and the concrete action needed to mitigate the issues.

It has been acknowledged by environmentalists that Gandhian insights serve as a guide to understand the problem in a proper perspective. It is to be noted that Gandhi has not left any aspect of life untouched. He clearly expressed his views on basic issues relating to life. Though he has not dealt specifically with the issue of ecology and environment one can easily gauge his perspective on issues relating to environment from his basic approach to life. Gandhi led a holistic life which was in tune with principles of nature and environmental friendliness. The searching mind of Gandhi identified the factors disturbing right kind of living. A fundamental discovery of Gandhi is that non-violence is the law that is operating in our life. Therefore, our life style should be completely non-violent. All have to set limits to material comforts which will help them to move towards the path of spirituality. Theories of development do not look life from a holistic perspective. They give emphasis to bodily aspects and altogether ignore the intellectual and spiritual dimensions of life. As a result, our development policies are lopsided, truncated and distorted.

Gandhi realised that industrial revolution is a watershed in human history. His systematic study of process and effects of domination of machines led him to conclude that industrial civilization is a satanic civilization. If we draw a graph of development of industrial growth and superimpose it on a

graph of parameters representing environmental degradation, one will be amazed to see that they are almost similar. To put differently Gandhi identified that the real disease is industrial civilization. Environmental problems that we face today are only symptoms of that civilization. Therefore situating Gandhi securely in discussions on environment is appropriate and significant.

In order to provide a forum for exchange of ideas and sharing of experiences on various issues related to present state of environment from a Gandhian perspective, Institute of Gandhian Studies, Wardha, in collaboration with Gandhi Peace Foundation, New Delhi, and Centre of Science for Villages, Dattapur, Wardha, organised a National Seminar on Gandhi, Science and Environment in Wardha from 14th to 16th March 2009. The Seminar brought together scholars, actors and stakeholders in the respective fields to have a meaningful dialogical round table in order to take stock of the environmental challenges ahead and the strategies to overcome them. This volume is a collection of selected papers presented at the Seminar.

This volume contains articles dealing with Gandhian perspective on environment, sustainability, spirituality, major environmental issues like climate change, nuclearisation, GM technology, crisis in agriculture and farmers' suicides and successful technological innovations that will ensure a sustainable future. This volume has brought together academics, activists and scientists to reflect on the environment for the survival of planet earth. It is hoped that this volume will be beneficial for persons working on gandhiana, environment and technological alternatives.

We are highly beholden to Chandrasekhar Dharmadhikari, Chairman, Institute of Gandhian Studies, Wardha; Radhaben Bhatt, Chairperson, Gandhi Peace Foundation, New Delhi, and Sameer Kurvey, Executive Director, Centre of Science for Villages, Wardha, for the institutional support rendered for the publication of the volume. Our special thanks are due to Surendra Kumar, Secretary, Gandhi Peace Foundation, for his encouragement and initiative in the execution of the project. We acknowledge our debt to John Moolakkattu, Professor, Dept. of Humanities and Social Sciences, Indian Institute of Technology, Madras, for the useful insights in the editing work. Arunima Maitra also extended her support in the editing of the volume. Shrikant Kulkarni of the Institute deserves special mention for his help and constant encouragement. Last but not least, we appreciate the prompt word processing of the manuscript done by Manohar Mahajan of the Institute.

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Introduction

Siby K. Joseph

The State of Environment

The present state of environment is a matter of concern for all socially committed individuals, international organizations and governments all over the globe. Global Warming, Climate Change, Pollution and access to clean water are some of the gravest challenges before the world today. People all over the world are aware of the ill effects of global warming and various steps have been taken to mitigate the emission of green house gases. Most of the national governments have signed and ratified the Kyoto Protocol aimed at reducing emission of green house gases.¹ It is interesting to mention that though the US has signed the Kyoto Protocol way back in 1998, the Senate is yet to ratify it. The latest yearbook of United Nations Environment Programme (UNEP) cautions everybody about the precarious state of environment. Scientists warn that there is still a considerable emission gap of 5 gigatonnes to be closed. The report further states that the need to reduce emissions of black carbon and tropospheric ozone precursors has received comparatively little attention so far.² The prospects of reduction in emission of greenhouse gases look bleak in the near future mainly because of the unbridled growth being pursued by the advocates of the present model of development.

The current state of environment is a disturbing one. It has been evident from the continuous rise in earth's mean surface temperature, which results in the melting of polar ice. The changes that are happening on the climatic front in recent years are at a faster pace compared to the earlier era. The average facade temperature of the globe has augmented more than 1 degree Fahrenheit since 1900 and the speed of warming has been almost three-fold, the century long average since 1970.³ The main gases contributing to green house effect are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The largest producers of these gases are the thermal power plants, transportation by road and air, heavy industries, all of which are indispensable in the present model of development. The depletion of the ozone layer is another pertinent environmental issue which has similar implications.

Both sentient and non-sentient beings are experiencing the ill-effects of global warming and ozone layer depletion. As a corollary to it, there is frequent melting of glaciers. The melting of ice at the Polar Regions has led to a rise in the mean sea level which will engulf low-lying countries. The effect of global warming on the animal kingdom is very evident. Some of the endangered animals which maintain the eco-balance have become extinct or are on the verge of extinction due to their inability to cope with the rapid changes that are taking place on the climatic front. The effect of it on the season cycle needs no description. The fine equilibrium that existed in the seasonal cycle has changed dramatically. The shift in season cycle has become a breeding ground for new diseases which were unknown to humanity. The drastic changes on the climatic front in terms of untimely onset of rains, floods and other natural calamities have created a severe crisis in the agricultural sector. Now the suicide of agricultural farmers in the Indian subcontinent is not limited to a particular region or areas having

less rainfall. The pathetic state of affairs in the agricultural sector is mainly due to the effects of climate change and the introduction of modern agricultural practices which depend on chemical fertilizers genetically modified organisms and market forces.

Another important issue which needs mention is the indiscriminate use of plastic which extended the human footprint even to the remotest parts of the ocean, which poses a potential threat to eco system and human health. This issue was echoed in the latest yearbook of United Nations Environment Programme (UNEP) which said “The Ocean has become a global repository for much of the waste that we generate. Every year large amounts of plastic debris enter the marine environment... A number of scientists are concerned about releases of persistent, bio- accumulating and toxic compounds when plastic debris enters the food chain through ingestion by fish and other marine organisms.”⁴ The environmental issues discussed here are only illustrative and not comprehensive. There are a number of environmental issues which are equally important and needs immediate redressal to avoid the threat of mass extinction. The ever growing concern over environmental issues has been echoed in the various earth summits and the Copenhagen Summit. The inconclusive Copenhagen Summit brought into sharp focus the deep divide between the countries of the North and the South regarding not only the factors behind climate change and who is responsible for it, but also as regards respective responsibilities for management and mitigation.⁵

Gandhi and Environmentalism

The deep ecology and the conservation of mother earth have become the catchwords for environmentalists all over the world. It is interesting to note that Arne Naess, who coined the

term 'deep ecology',⁶ has acknowledged his indebtedness to Gandhi in the formulation of this term.⁷ Many environmentalists acknowledge their debt to Gandhi in understanding the problem from a holistic perspective. In Gandhi's life time, ecological and environmental issues were not matters of serious discussion as now. But Gandhi was deeply concerned about the damages done by modern industrial civilization to the environment which he portrayed in his seminal work *Hind Swaraj* or Indian Home Rule written in 1909.

Gandhi has not built up any theory of environmental philosophy or system which strictly falls within the scheme of present environmental science. Gandhi was deeply concerned with all problems confronted by humanity, and it was quite natural that he expressed his concern on matters relating to ecology and environment. One who scrutinises Gandhi's speeches and writings will be amazed by the deep eco-consciousness rooted in his philosophy of life.

Eco-consciousness embedded in Gandhi's Philosophy of life and Worldview

Gandhian environmental ethics stems from his philosophy of life and his worldview. In the Gandhian world view, human life cannot be divided into watertight compartments such as economic, political, and religious and so on. Human life is an undivided whole. He believed that "One's everyday life was never capable of being separated from his spiritual being. Both acted and reacted upon one another."⁸ He believed in the unity and oneness of all life and its interconnectedness. This relational worldview is equally applicable to animal and plant life. He wrote, "I do not believe that an individual may gain spiritually and those that surround

him suffer. I believe in *advaita*. I believe in the essential unity of man and for that matter of all that lives. Therefore I believe that if one man gains spiritually, the whole world gains with him and, if one man falls, the whole world falls to that extent.”⁹ According to Diwan and Bethea, “In surveying the beliefs of spiritually-oriented cultures throughout time and across geographical boundaries, one single, common assertion emerges: the immutable unity or oneness of life, at all levels and in all manifestations.”¹⁰ Unity and oneness of life is the crux of *Sarvodaya* ideology which can be considered as the underpinning of deep environmental philosophy. Gandhi’s philosophy of *Sarvodaya* is based on the principle of well being of all human as well as sentient beings. Gandhi wrote in the last chapter of his *Autobiography* “To see the universal and all-pervading Spirit of Truth face to face one must be able to love the meanest creation as oneself.”¹¹ In the *Sarvodaya* society of Gandhi’s vision, the organization of the society must be based on the Law of Non-violence or Love. According to Gandhi, “A seeker of the Truth, a follower of the law of Love cannot hold anything against tomorrow.”¹² Gandhi’s ideal of *Aparigraha* calls for a giving up of all possessions. Gandhi had given a new meaning to the verse in *Isha Upanishad* - *tena-tyaktena-bhunjeethah* (enjoy the wealth by renouncing it). He said “Earn your crores by all means but understand that your wealth is not yours; it belongs to the people. Take what you require for your legitimate needs and use the remainder for society.”¹³ It calls for the application of doctrine of trusteeship and everyone should use the resources of nature with a sense of *aparigraha* for the common welfare of the people.

The *sarvodaya* society which Gandhi visualised is free from undue exploitation of nature. In such a society every one has to perform *Yajna* to lead an ideal life in tune with nature trying to return whatever he or she takes from nature. Gandhi

explains his concept of *Yajna* as follows: “*Yajna* means an act directed to the welfare of others, done without desiring any return for it, whether of a temporal or spiritual nature. ‘Act’ here must be taken in the widest sense, and includes thoughts and word as well as deed. ‘Others’ embraces not only humanity, but all life..... *Yajna* having come to us with our birth, we are debtors all our lives, and thus for ever bound to serve the universe.”¹⁴ It is clear that Gandhi’s concept of *Yajna* is not merely engagement in bodily labour. It gives an opportunity for an individual to repay the debt one owed to the society.

Gandhi had profound concern for nature and all living beings including plants and animal kingdom. He led a life which was essentially non-violent giving due respect to nature and its creations. There are many telling passages in Gandhi’s life which show his commitment for environmental protection. Let us cite an incident from his life. It was painful for Gandhi to see large numbers of leaves plucked at night for him while only few were necessary. He lamented, “Trees are living beings just like us. They live and breathe, they feed and drink as we do and like us they need sleep. It is a wretched thing to go and tear the leaves of a tree at night when it is resting! And why have you brought such a huge quantity? Only a few leaves were necessary.... We should feel a more living bond between ourselves and the rest of the animate creation.”¹⁵ He made a conscious effort to use the resources of nature to the bare minimum in an attempt to conserve natural resources even if it is available in abundance. His attitude was that one should not take even a single thing from nature when it is not actually required. Gandhi placed before humanity a lifestyle which was in tune with the environment. The application of Gandhian principles will allow human beings to satisfy their basic needs without harming interests of fellow beings. Gandhi stated that

“the earth provides enough to satisfy every man’s need but not for every man’s greed.”¹⁶ This well known dictum of Gandhi reminds us that man cannot infinitely exploit nature to satisfy his unlimited wants.

Gandhi’s philosophy of life provides a sustainable development paradigm which is symbiotic with nature and ecosystem. In Gandhian frame of reference economy, ecology and spirituality are interrelated. That is why Gandhian economy is often referred to as ‘economy of environment’.¹⁷ Anyone who is interested in understanding Gandhi’s philosophy of life should carefully read his criticism on modern Western civilization which promotes the present model of development, and is largely responsible for the grave environmental crises. Therefore, it is vital to look at the environmental crises through the lens of Gandhi’s philosophy of life.

Notes and References

- ¹ . The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), aimed at combating global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and came into force on 16 February 2005. Currently, there are 193 Parties (192 States and 1 regional economic integration organization) to the Kyoto Protocol to the UNFCCC. For more details See http://unfccc.int/kyoto_protocol/items/2830.php
- ² . United Nations Environmental Programme, *UNEP Year Book 2011:Emerging Issues In our Global environment*. See <http://www.unep.org/yearbook/>
- ³ . <http://www.globalwarming.org.in/>
- ⁴ . United Nations Environmental Programme, *UNEP Year Book 2011:Emerging Issues In our Global environment*, Executive Summary, p.vii, See <http://www.unep.org/yearbook/>
- ⁵ . The 2009 United Nations Climate Change Conference, commonly known as the Copenhagen Summit, was held at Copenhagen, Denmark, between 7 December and 18 December. The conference included the 15th Conference of the Parties (COP 15) to the United Nations Framework Convention on Climate Change and the 5th Meeting of the Parties (COP/MOP 5) to the Kyoto Protocol. The Copenhagen Accord was drafted by the US, China, India, Brazil and South Africa on December 18, 2009. The document recognised that climate change as one of the greatest challenges of the present and action should be taken to keep any temperature increases to below 2°C. It was "taken note of", but not "adopted", in a debate of all the participating countries the next day, and it was not passed unanimously. The document is not legally binding and does not contain any legally binding commitments for reducing Carbon dioxide (CO₂) emissions.
- ⁶ . Deep ecology is a philosophy of nature which demands deepening of our love for natural world and its empowerment and protection along with identification of human being with nature. Arne Naess points out that-‘Our ecological ideas are not enough to protect the earth, we need ecological identity, ecological self’.
- ⁷ . Thomas Weber, Gandhi ,Deep Ecology, Peace Research and Buddhist Economics, *Journal of Peace Research*, Vol. 36, No. 3,1999,pp.349-361.
- ⁸ . Nirmal Kumar Bose (ed.), *Selections from Gandhi*, (Ahmedabad: Navajivan, 1996), p.25.
- ⁹ . *Ibid*.
- ¹⁰ . Romesh Diwan and Shakti Bethea, “Spiritual Living, Gandhian Economics and Well-being” in M. P. Mathai, M. S. John and Siby K. Joseph (ed), *Meditations on Gandhi*, (New Delhi: Concept, 2002), p.114.
- ¹¹ . M. K. Gandhi, *An Autobiography or The Story of My Experiments with Truth*, (Ahmedabad: Navajivan,1993), p.420.
- ¹² . M. K. Gandhi, *From Yeravada Mandir*, (Ahmedabad: Navajivan, 1992), p.15.
- ¹³ . R. K. Prabhu and U. R. Rao, *The Mind of Mahatma Gandhi*, (Ahmedabad: Navajivan, 1996), p. 193.
- ¹⁴ . M. K. Gandhi, *From Yeravada Mandir*, op. cit., pp. 31-2.
- ¹⁵ . M. K. Gandhi, *In Search of Supreme*, (Ahmedabad: Navajivan, 2002), Vol. 1, p. 246
- ¹⁶ . Pyarelal, *Towards New Horizons*, (Ahmedabad: Navajivan, 1978), p.12

¹⁷ . See Siby K. Joseph “The Principles of Gandhian Economy :Integrating Spirituality and Ecology”,*Gandhi Marg*, Vol.28, No.30, October-December 2006,pp.309-320.

Gandhian Vision of Environment

C.S. Dharmadhikari

The present crisis which we are facing on the front of environment is man made one. It is the result of undue exploitation of nature by human beings to serve his selfish ends. Human beings thoughtless action has resulted in the increase or concentration of greenhouse gases, mainly of carbon dioxide, which led to an increase in the temperature of the earth and rise in the sea level. This is precisely what we call global warming. To put it differently the man-made emission of green house gases is the cause of global warming. A variety of environmental problems now affect our life. I need not have to explain the various problems as all of you gathered here are familiar with problems like climate change, global warming, ozone layer depletion, pollution of air, water and soil, hazardous nuclear waste, de-forestation and so on. These problems are not limited to a particular country or a particular continent. As a result of the globalization and the greed of market forces there is hardly any country left untouched by major environmental problems.

The protection of environment is a global challenge and it has been voiced in international organisations like United Nations. Let me cite the well-known report of the United Nations *Only One Earth* published in 1972 which tells us that, “the emotional attachment to our prized diversity need not

interfere with out attempts to develop the global state of mind which will generate the rational loyalty to the planet as a whole. As enter the global phase of human evolution, it becomes obvious, that each man has two countries, his own, and the planet earth. Now that all habitable parts of the globe are occupied, the careful husbandry of the earth is *sine qua non* for the survival of the human species and for creation of decent ways life for all the people of the world". The global environment outlook and the urgency of the situation have been reflected in the various reports published by the UN and various Earth Summits. I would like to draw your attention to a speech made by a 12 year old girl Severn Suzuki. She spoke to thousands of world leaders at the Earth Summit in Brazil in 1992.

"Hello, I'm Severn Suzuki speaking for E.C.O. - The Environmental Children's Organization.

We are a group of twelve and thirteen-year-olds from Canada trying to make a difference:

Vanessa Suttie, Morgan Geisler, Michelle Quigg and me.

We raised all the money ourselves to come six thousand miles to tell you adults you must change your ways. Coming here today, I have no hidden agenda. I am fighting for my future.

Losing my future is not like losing an election or a few points on the stock market. I am here to speak for all generations to come.

I am here to speak on behalf of the starving children around the world whose cries go unheard.

I am here to speak for the countless animals dying across this planet because they have nowhere left to go. We cannot afford to be not heard.

I am afraid to go out in the sun now because of the holes in the ozone. I am afraid to breathe the air because I don't know what chemicals are in it.

I used to go fishing in Vancouver with my dad until just a few years ago we found the fish full of cancers. And now we hear about animals and plants going extinct every day - vanishing forever.

In my life, I have dreamt of seeing the great herds of wild animals, jungles and rainforests full of birds and butterflies, but now I wonder if they will even exist for my children to see.

Did you have to worry about these little things when you were my age?

All this is happening before our eyes and yet we act as if we have all the time we want and all the solutions.

I'm only a child and I don't have all the solutions, but I want you to realise, neither do you!

You don't know how to fix the holes in our ozone layer.

You don't know how to bring salmon back up a dead stream.

You don't know how to bring back an animal now extinct.

And you can't bring back forests that once grew where there is now desert.

If you don't know how to fix it, please stop breaking it!

Here, you may be delegates of your governments, business people, organisers, reporters or politicians - but really you are mothers and fathers, brothers and sister, aunts and uncles - and all of you are somebody's child.

I'm only a child yet I know we are all part of a family, five billion strong, in fact, 30 million species strong and we all share the same air, water and soil - borders and governments will never change that.

I'm only a child yet I know we are all in this together and should act as one single world towards one single goal.

In my anger, I am not blind, and in my fear, I am not afraid to tell the world how I feel.

In my country, we make so much waste, we buy and throw away, buy and throw away, and yet northern countries will not share with the needy. Even when we have more than enough, we are afraid to lose some of our wealth, afraid to share.

In Canada, we live the privileged life, with plenty of food, water and shelter - we have watches, bicycles, computers and television sets.

Two days ago here in Brazil, we were shocked when we spent some time with some children living on the streets.

And this is what one child told us: "I wish I was rich and if I were, I would give all the street children food, clothes, medicine, shelter and love and affection."

If a child on the street who has nothing, is willing to share, why are we who have everything still so greedy?

I can't stop thinking that these children are my age, that it makes a tremendous difference where you are born, that I could be one of those children living in the Favellas of Rio; I could be a child starving in Somalia; a victim of war in the Middle East or a beggar in India.

I'm only a child yet I know if all the money spent on war was spent on ending poverty and finding environmental answers, what a wonderful place this earth would be!

At school, even in kindergarten, you teach us to behave in the world. You teach us: not to fight with others, to work things out, to respect others, to clean up our mess, not to hurt other creatures, to share - not be greedy.

Then why do you go out and do the things you tell us not to do?

Do not forget why you're attending these conferences, who you're doing this for - we are your own children.

You are deciding what kind of world we will grow up in. Parents should be able to comfort their children by saying "everything's

going to be alright', "we're doing the best we can" and "it's not the end of the world".

But I don't think you can say that to us anymore. Are we even on your list of priorities? My father always says "You are what you do, not what you say."

Well, what you do makes me cry at night. You grown ups say you love us. I challenge you, please make your actions reflect your words. Thank you for listening."

So far we don't have answers to the questions raised by young Suzuki. Similarly, Gandhi has placed certain questions before humanity and showed the direction in which humanity should move forward. Those who would like to know the path of Gandhi should read his seminal work *Hind Swaraj* published in 1909. This booklet is severe condemnation of western industrial civilization which is one of the major causes of environmental degradation. It represents Gandhian vision of environment and development. He wrote in *Hind Swaraj* "We notice that the mind is a restless bird; the more it gets the more it wants, and still remains unsatisfied. The more we indulge our passions the more unbridled they become. Our ancestors, therefore, set a limit to our indulgences. They saw that happiness was largely a mental condition. A man is not necessarily happy because he is rich or unhappy because he is poor. The rich are often seen to be unhappy, the poor to be happy. Millions will always remain poor. Observing all this, our ancestors dissuaded us from luxuries and pleasures." This vision is essential to overcome the maladies of consumerism which leads to the exploitation of nature. The guiding principle of our civilization was reverence for all forms of lives including the vegetation and the animal kingdom. We had certain traditions or religious values which protected our mother Earth. It was forbidden to take food without offering water to *tulsi* plant. Similarly cow was considered as a sacred animal.

Animals were considered as members of our family and society. It is significant to note that in the Constitution of India it is the fundamental duty of a citizen to protect environment. Article 51-A (g) of 42nd Amendment Act of 1976, Section 11 of the Indian Constitution states that "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures". The earth is known as '*Vasundhara*' or '*Vasumati*'. *Vasu* literally means wealth. To make our lives gratifying and blessed we can judiciously use wealth, but we do not have any right to exploit it. The reverence for human life first, then animals, and then for nature is known in our ancient lore as '*Vibhuti Yoga*' – the worship of all, and relationship with everyone that makes life rich. We believe in '*Advaita*', that is, oneness, harmony, co-ordination and mutual co-operation of all creation.

With the advent of modern industrial civilization the whole scenario has changed. There is a drastic change in man's attitude towards nature and environment. The last century was a century of conquering nature. All the resources in nature were looked upon from a commercial angle with an eye on market. The 'standard of spending' is equated with the 'standard of living'. Unfortunately people are in a mad rush to exploit nature. The moot question is whether nature is our ally or enemy. The very word 'exploit' is volatile. If we treat nature as our enemy, the man cannot survive on this planet. If we destroy all our wealth and resources the future generation will not forgive us. We must treat the question of protection of environment on a priority basis. We have to stop the destruction of mother Earth, otherwise we are only left with the task of postmortem. We are not masters of Mother Earth and its resources. We are only trustees. In fact we have borrowed non-renewable resources from our children and deprived the future

generation to access the same resources. The supreme courts of USA and India have declared that Government is trustee of the natural resources and not owner of it. The public trust doctrine in our country has grown from article 21 of the Constitution of India i.e. right to life. In the case of *M.I. Builders Pvt. Ltd. Vs. Radhey Shyam Sahu and others* (AIR 1999 SC 2468) the Supreme Court of India clarified:

“Mahapalika is the trustee for the proper management of the park. When true nature of the park, as it existed, is destroyed it would be violative of the doctrine of public trust as expounded by this Court in *Span Resort Case* (1997 (1) SCC 388). Public Trust doctrine is part of Indian law. ...

In the treatise "Environmental Law and Policy: Nature, Law, and Society" by Plater Abrams Goldfarb (American Casebook series- 1992) under the Chapter on Fundamental Environmental Rights, in Section 1 (The Modern Rediscovery of the Public Trust Doctrine) it has been noticed that "long ago there developed in the law of the Roman Empire a legal theory known as the Doctrine of the public trust." In America Public Trust doctrine was applied to public properties, such as shorelands and parks. As to how doctrine works it was stated: "The scattered evidence, taken together, suggests that the idea of a public trusteeship rests upon three related principles. First, that certain interests - like the air and the sea - have such importance to the citizenry as a whole that it would be unwise to make them the subject of private ownership. Second, that they partake so much of the bounty of nature, rather than of individual enterprise, that they should be made freely available to the entire citizenry without regard to economic status. And, finally, that it is a principle purpose of government to promote the interests of the general public rather than to redistribute public goods from broad public uses to restricted private

benefit... With reference to a decision in *Illinois Central Railroad Company v. Illinois* (146 U.S. 387 [1892]), it was stated that the court articulated in that case the principle that has become the central substantive thought in public trust litigation. When a state holds a resource which is available for the free use of the general public, a court will look with considerable skepticism upon any governmental conduct which is calculated either to reallocate the resource to more restricted uses or to subject public uses to the self-interest of private parties. This public trust doctrine in our country, it would appear, has grown from Article 21 of the Constitution.”

In the judgment of Civil Appeal No. 1251 of 2006 the Supreme Court of India expressed similar views as follows:

"The responsibility of the state to protect the environment is now a well-accepted notion in all countries. It is this notion that, in international law, gave rise to the principle of "state responsibility" for pollution emanating within one's own territories [Corfu Channel Case, ICJ Reports (1949) 4]. This responsibility is clearly enunciated in the United Nations Conference on the Human Environment, Stockholm 1972 (Stockholm Convention), to which India was a party. The relevant Clause of this Declaration in the present context is Paragraph 2, which states:

The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Thus, there is no doubt about the fact that there is a responsibility bestowed upon the Government to protect and

preserve the tanks, which are an important part of the environment of the area.”

Gandhi was one of the greatest worthy sons of the last century who boldly declared that God is Truth. The humanity has to understand his experiments with truth and non-violence so that we may survive or otherwise in the words of Martin Luther King Jr, we may ignore Gandhi at our own risk. One should remember that science is not confined to laboratories which are equipped with expensive apparatus. The goal of science is to find truth behind a phenomenon and not to find out the ways to exploit the resources of nature.

Gandhi's vision of life call for application of truth and non-violence in all walks of life. Gandhi said: “Non-violence is not a garment to be put on and off at will, its seat is in the heart and it must be inseparable part of our very being”. His concept of non-violence was an all encompassing and a positive one. It is not merely a ‘live and let live’, formula, but it involves a principle of ‘Live and help others to live’, and these others should include human beings, animals and nature. Gandhi's concept of non-violence was not a negative one. It is a dynamic and positive approach to ‘Life’.

Gandhi visualised a non-violent economic order based on equality and justice. He advocated a simple life which fulfils basic necessities of life and is in tune with nature. It is not a life of poverty or insanity. On the contrary it is a meaningful life of fulfillment and happiness. It is well known that Gandhi's economic ideas revolved around *Swadeshi* and *Khadi*. *Khadi* is not a piece of cloth. It is a symbol of decentralisation of production and distribution. It stands for a non-violent lifestyle. The application of the principle of decentralisation leads to a life of simplicity in which there is hardly any scope of

amassing unnecessary goods of the market. This checks the exploitation of natural resources and helps in maintaining the delicate balance or equilibrium of nature. What applies to Khadi equally applies to *kutir udyog* and *gramodyog* products.

Village sanitation was an important item of his Constructive Programme. Our villages and cities have turned into heaps of dirt and disease due to lack of proper sanitation facilities. By promoting the village sanitation and research in the field Gandhi wanted to make our villages pollution free. Gandhi's concept of bread labour has also deep ecological implications and sustainability. Every able bodied citizen must devote time and energy for manual labour and ensure sanitation.

Gandhi was the first man to introduce the concept of service to nature in order to enrich nature. Gandhi said "the earth provides enough to satisfy every man's need but not for every man's greed." The environmental wisdom of Gandhi is ingrained in this *mantra*. He lived a life which was in tune with environment. That is why he said "*My life is my Message*". His life was full of examples of his love for nature, environment and all that exists.

This seminar should not end with mere academic discussions and highlighting the issues in the field of environment. The success of the seminar depends on the practical application of alternatives proposed here. The technical solutions to the problems proposed by the scientific community in the seminar should be disseminated at different levels so as to reach the common man. There is a need for rethinking on the part of planners and policy makers to look at problems from a holistic perspective.

I strongly believe the future of mankind depends upon adopting non-violence as the principle of life which is a happy union of science and spirituality. I call it S+G that is Science plus Gandhi. That alone can save our environment and ecosystem.

3

Integrating our Ideals for Sustainable Realities

Anil K. Lyall

1. Introduction

For the last four decades – a good part of my useful life span – I have not been convinced about the ‘glamorous and highly beaten’ western path of economic and social ‘progress’ (especially at the personal and family levels), its indicators, spread, and ‘blind aping’ by India (read Bharat) and its influential components. Often debating between evolution and revolution, leadership from the top or from the bottom and likewise, the path chosen has been one of application of science and technology, knowledge and skills for the betterment of people with utmost ethical and environmental consequences. And yet, for all I know in our land of ancient wisdom but lost tracks of *karma* and *dharma*, islands of excellence in creative and spiritual domains exist side-by-side all possible conceived ills. We seem to know the answers but do not have the willpower, courage and synergy to do so. We shall explore this to some extent in this article.

Right through the ages, conflicts among men have been common for food, resources, power and lust. Only few exemplarily individuals have stood way above these conflicts, and they have been our great, wise people aptly

called sages or Mahatma. Just to name a few – Mahatma Buddha, Sant Kabir, Vivekananda, Emerson, Thoreau, Tolstoy and Gandhi. This listing is not to decorate our walls and to practice what is ‘un-Gandhian’, it is only to go deeper and cross-refer for further *Revisions and Improvements*. Time has come that the East and West must meet so that the divided earth can stay together as a sustainable unity.

Mahatma Gandhi’s teachings, message, actions were neither the first in this direction, nor be the last. Our wisdom lies in seeing him and all the others as our Role Models so that we can go through the current crisis of values, character, planet’s health and our own very survival. Bapu, in few words, was an embodiment of great will power, strict values and discipline, deeply religious and humanitarian because he thought and lived holistic in this creation as an organism of the nature or God. That is precisely why we need to remember him, follow some of his ideals and frame a sustainable development path for our own good.

2. **Unprecedented Juncture: *Crisis or Challenge as Man Makes/Takes it***

All crises are man made. Nature only throws challenges on us. Our respect to her turns the challenge into blessing and disrespect into a disaster. We do not like wake-up calls. India, as a nation, and literally every country on the globe repeatedly has been going through periods of severe shortages of food, water & habitat, and increased violence, corruption, thefts and scams, and now deep economic crises and seemingly uncontrollable environmental disasters termed global warming and climate change. At the root of all these difficulties lies man himself – his character and

values that are the causes of insatiable greed and lust for material wealth, bodily comfort and power to lord over whatever he can see. This happens at a very heavy cost to mother earth and his own emotional and spiritual deprivation.

In the recorded history of man, perhaps, the present shall be witnessed as a hiatus. Riding on the twin giants of science and technology, man often lost his way on social, political, technical and economic grounds, but took it in his vain pride as competition and survival of the fittest. Earlier, he often walked across the face of the earth many places and left behind deserts in his footsteps. Not suddenly, but predictably, ignoring the sane advice of wise and moral saints, he finds that he has reached the gates of an ecological disaster. Too shocked that his wealth and knowledge are no match to civil and cultural values for further sustenance, he is numbed into inaction. If he persists, he would follow the bacteria that make the wine, who eventually die in its own waste. In geological history, many species have gone extinct after attaining disproportionate, unmanageable dimensions. Global warming, climate change may be partly nature's own ways to warn this unique species, the *Homo sapiens*, but man-to-man conflicts, immoral lifestyles, and an earth robbed of its soil cover and forests, fresh water, coal, oil and mineral resources is man's own doing. Blaming large complex population is of no use, because all of us are proving to be equally unwise and cruel to our fellow beings and own mother earth.

This is not to say that there are no natural environmental extremes. The western science and technology driven education has enabled us to learn a lot about our planet, its

composition, dynamics, forces, carrying capacity, etc. And, all of us should unanimously be thankful to this human quest for knowledge. But unfortunately, lots of unwise and crafty individuals have exploited this noble approach of science. They have fuelled man's head with the notion that he (read 'West') can conquer the nature, which includes all the fellow human beings. In God's (nature's) kingdom that is the earth's environment, it does not happen to be so. Usage of Science and Technology to love the nature and live in balance with her has given way to scientific materialism, greed and lust.

Would Obama be able to follow some of the ideals of Martin Luther King? The latest address of Gordon Brown appears to be a veiled repetition of Bush-Blair legacy at this critical juncture.

Over-consumption and destruction of living and non-living resources is no more a debate, the worry is, what happens next? Everything is affected esp. oil, water, food, marine fisheries, wildlife, and inequalities and conflicts at human level. Extreme environmental predictions are not liked by any one of us but extremes of ecological and food crises exist in many parts of the world. The bigger worry, therefore, is the increasing human inequality and conflicts with proliferation of arms of all hues. Who is responsible behind these growing inequalities and arms production is a moot question. The human race is seriously inflicted with jealousy and hate, often perpetrated by irresponsible leaders who later find the situation to get out of their control.

Continuing on our current path of materialism, consumption, exploitation, theft and robbery of both the

fellow beings and the mother earth, a catastrophe of fearful dimensions is unavoidable and sure to occur to the human family.

Natural history is replete with examples of species who defeated their natural enemies, surged in population, and then, having exhausted the resources upon which they depended underwent sudden death.

We have all heard about environmental threats arising from global warming, acid rain, ozone destruction, massive species extinctions, and so on. Now the realization is occurring that the oceans will rise by up to 3 meters and flood particular cities. Unpredictable severe weather may set in, so that the 100-yr high floods may occur every 10 years or more often, with accompanying droughts in distant areas. A major part of our coastal wetlands with damaging impacts on the fisheries and economies of coastal communities may be lost to the sea. In other areas, the shoreline would retreat significantly. Global warming could both reduce hydroelectric potential and increase vulnerability to floods.

In coastal areas, salt-water intrusion could affect underground fresh water, power generation and increase the electricity needed for cooling. To meet increasing electricity needs, if conventional (thermal) power plants are used, they would further reinforce global warming. Finally, with the new weather patterns and climate zones—unknown and unpredictable - global warming is likely to disrupt established agriculture and forestry in unimaginable ways.

So what does this all mean and what should we do?

Reasoned analysis supports neither optimistic nor pessimistic predictions about our environmental future. We have the capacity to implement available effective solutions and devise new ones. The globe sure needs good political leadership, which must spearhead such solutions. We are at an historic juncture and the future could go either way. We stand at our species' ecological moment of truth with a 30-year delay.

The situation calls for almost totally different, revolutionary changes of our thoughts and actions. This close-to-U turn is likely to be tedious and painful, as it requires new concepts, perspectives, skills, implementation techniques and an overall involvement of the humankind. There is only one planet to live on, which has to be based on cooperation, not conflict, and sustainable values. A process to seek dynamic equilibrium between man and his environment through appropriate technology needs to be initiated, so as to avert destructive imbalances, which have been created by unbridled application of scientific materialism.

Significant moral and ecological disaster has already occurred. What happens in the next decade or more has already started. We must concentrate on preventive aspects of today's undesirable processes, release human energy to work for regional and local development programmes, which sustain a frugal yet culturally rich lifestyle with desirable values.

A path of technology needs to be adopted keeping in view the number of people, their lifestyle, governing psychological, climatological and earth-resource factors. Chasing unhealthy models based on inequality, hatred,

competition, wasteful consumption, unabated deforestation, use of fossil fuels and minerals, or the Indian ape-like neoculture with a blind-eye to the people, land and climate have already proved unfit for India, nay, the Earth.

A synthetic approach combining the rich cultural heritage, low-material and high-spiritual aspirations, with complete understanding of nature to avail ecological benefits, the tropical climate, biological cycle must be framed and propagated to the masses to remove poverty. Physical and mental health indices are indicators of a country's long-term wealth rather than the pure economic indicators, e.g. GNP, per capita income.

3. Sustainable Development: *Eco-Eco Golden Rule*

To the politically oriented and the laymen, the idea of sustainability may date back more than 30 years, to the scientists-philosophers and our sages it has been known since ever.

Adopted by IUCN in 1969, it was a key theme of the 1972 UN Conference on Human Environment at Stockholm in 1972. The concept was coined explicitly to suggest that it was possible to achieve economic growth and industrialization without environmental damage. The thinking was progressively developed through the World Conservation Strategy (1980), the Brundtland Report (1987), and the UN Conference on Environment and Development in Rio (1992). Many books have appeared over the past 30-odd years warning about the impending ecological and human problems and calling for change. The 1990s was even termed as the "turn around decade". Yet, the accompanying rapid economic growth made the situation even worse! We have failed to measure up to the

threats; the UN almost wrapped up the issues in a whimper, titled Global Compact to encourage some ecologically sustainable and human behaviour by the corporates.

The spate of disasters of 2005 and 2006, severe hurricanes and cyclones, flooding, droughts, were considered as alarm bells of climate change due to global warming. In 2008, some of the foremost western environmental thinkers have expressed their visions and concerns about sustainable future, sharing a common theme: *the world is running out of time to deal with a set of seemingly overwhelming environmental threats*. Gus Speth, a leader of environmental governance proposes nothing short of an economic and political revolution to get us out of the mess.

Exactly a decade ago, writing for a UN report, Chris Nelder had written:

“As we look deeply into the question of how to make a better world, every direction leads to one essential fact: most of our current activities are not sustainable. ...In our current market dynamics and resource utilization, we are, by definition, seeing to our own demise.Our global transition to sustainability will have to be fundamental and profound, and undoubtedly a little painful. For most citizens of the world--and particularly for those in first world countries--it will mean tangible changes for every single one of us. The sooner we act, however, the less painful it will be.”

Paul Hawken in his seminal 1993 book, *The Ecology of Commerce* defined sustainability:

“Sustainability is an economic state where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations. It can also be expressed in the simple terms of an economic golden rule for the restorative economy: Leave the world better than you found it, take no more than you need, try not to harm life or the environment, make amends if you do.”

He further showed that the current path of commerce resembled more a march to self-destruction than to a "restorative economy." We have exceeded the "carrying capacity" of the planet, have moved farther from self-reliance, and are adopting downright *predatory* demand for foreign resources.

And, the recent events on Wall Street have reminded us of the need for both caution and regulation to correct market failures and fully understand the new financial products that the market constantly creates and that now threaten to bring it to its knees.

Why has this been so? Reasons are a plenty: the lack of political champions, inadequate financial resources, the lack of vision, and the sheer scale of the challenge itself. Add to this: uncontrolled population growth, lack of character-and-man-building education, abuse of science, resources, materials, and capital of all forms, underlined by violence, competition and conquest over nature.

Thus, there is 'forced' opportunity to open up a new chapter on development, economy, equity and environment. We ought to address, at the same time, the human needs

and aspirations of the poor of developing world, and the over-consumption in the industrialized world. Developments in ecological restoration offer novel and inspiring opportunities.

The core of mainstream sustainability thinking has become the idea of three dimensions, environmental, social and economic sustainability. These have been drawn in a variety of ways, as 'pillars', as concentric circles, or as interlocking circles (Figure 1). The IUCN Programme 2005-8, adopted in 2005, used the interlocking circles model to demonstrate that the three objectives need to be better integrated, with action to redress the balance between dimensions of sustainability (Figure 1 c).

4. Indian Context: *Urgency is the Keyword*

My own preference for sustainability continues to be a man-centered depiction owing to his unique capacities and status in the universe (Fig. 2). Accordingly, our above-described present woes are straight attributable to man and his interactions with the fellow beings and Mother Nature, herein this article I equate her with omnipresent universal God. Adding my current observations, I have retained our 1979* version for man, technology and nature in Indian context.

(* Paper presented at AIMA's Sixth National Competition for Young Managers held at Bombay on December 18, 1979. See Anil Lyall, et al., 1979, *Managers' Concerns in the Next Decade*, Indian Management, Oct. 1980, pp.12-23.)

i) Man

[1979 version] The Indian people have been variously described. Whereas the individual intelligentsia, cultural values have generally been appreciated, we have been

criticised as collectively incompetent, managerially ineffective and technically dependent people.

Qualities, such as, innovation, experimentation and creativity survive suffocatingly. The respect for a fellow being, life in general, society in particular, remains so low that the country is plagued with the worst kind of political processes, gross indiscipline, low moral values, and at individual levels, insecurity, frustration and degradation of mind and soul.

Our difficulties lie in the pursuit of a languid managerial system, which is widening the social chasm every day. People's aspirations and planners' capability to deliver the goods do not balance. Our institutional network is no longer relevant to cope with the social needs. The fruits of growth do not reach the masses. The educational system needs a complete reorganisation without delays. A new pattern should emphasize national character building, need and task-based learning with practical applications. It must fulfil Indian requirements, a life that India chooses in harmony with ecology, nature and resources. [*end 1979 version*]

[*2009 Addition*] Our population has exploded to 130-crore level, and for gross political reasons – vote banks – no one seems to talk about it. Our heads hang in shame as on every UN Human Development Index we fair most poorly. The Indian still shines and more so in distant western world. We pride in serving the world ignoring our land and people. We prefer to flee away from our realities.

Cultural values are continuously decimated as the ills of western culture are adopted and glamourised. We are a

nation of fatigued 'praja' ruled by strong, corrupt nexus of politics-bureaucracy-business-crime. Notional economic wealth in terms of Sensex is frequently generated, busts and scams uncovered – no lessons learnt, no actions taken.

Easy, corrupt means of wealth accumulation, display and power wielding are rampant. Tolerance, understanding and adjustments with fellow beings are replaced with hatred, jealousies and worst kind of crimes for lust and greed. J&K, Assam continue to burn in violence of hatred, which also raises its ugly head often in all states, like, Punjab, Delhi, Gujarat, Maharashtra, Bihar, etc. Terror attacks are a daily happening. Violence of all kinds occurs at family and community levels, public places, even in schools and courts. Corrupt money appears in courts, parliament, schools and hospitals; land and livelihoods are snatched. We have become an aggrieved society devoid of values and character, corrupt governance, lawlessness, indiscipline and irresponsible behaviour and actions.

The Indian brain has sure shined at mental maneuverings, microelectronics, IT and their applications locally and globally. As a result, the electronic media has grown commendably and offers us a great hope, only if it adopts strict code of ethics. Its control by 'old-thought' corporate and short-lived memory requires transformation to make it more effective for human good. Mobile communication and Internet working call for caution as they may be on the verge of abuse. Masses, even educated ones, continue to be so ignorant as to believe estuarine fresh water and stone sucking water (by surface tension) as divine miracles.

There appears to be little hope, except that the ‘soul’ is undefeatable! [*end 2009 Addition*]

ii) Technology

[1979 version] For the masses we have bullock carts and ploughs. The urban lot suffers in congested cities with crises of water, power, transportation, housing, pollution, while the elite talks about space research, travels in private cars and jet planes, and negotiates warplanes and nuclear reactors. For a developing country, the technology paths could be no more confused. Or is it that decision makers’ attitudes, science and education are much West-oriented, disregarding the masses, resources, and climate and ultimate life patterns?

The concept that a higher resource utilisation means prosperity must change. Instead, our consumption of non-renewable energy and resources must be considered as a measure of failure. Our selected life patterns, values and technology must equitably distribute non-renewable resources (NRR) to the entire population.

Future technology selection, which must be apolitical, must account for: who requires, how much, what kind, for what purpose and for how long? People are more important than goods; hence, technology, energy and economic activity are means, not ends. Growth potential in the social, cultural and spiritual spheres is unlimited, but resource-crunching material growth is inherently limited. The future must seek sustainable levels of growth and distribution. Thus, a model based on high emphasis of energy consumption and NRR utilisation cannot meet the test of time. No developing country can survive on a capital-intensive, high technology and risk approach. Mankind

would have to sustain itself on self reliant eco-development models where energy from sun, wind, tides, waves would be appropriately deployed with optimum consumption of NRR to make life richer culturally, not just economically. *[end 1979 version]*

[2009 Addition] IT, that too limited to software programming, and export of engineering, management and medical graduates appear to be our technological marvels. The brain drain has enriched the global (read western) enterprise for their use and abuse a.k.a. globalisation of the last two decades, an expansion of 'Reagonomics'. We have forgotten our ideals and saints; only the money and MNC cultures speak. Many concrete and glass monstrosities have come up, Bangalore and Gurgaon outstanding ones, without due consideration of the process and infrastructure. We copy and pride in aping MNCs, the scientific thought and technology plagued with inherent corruption. We build, re-build, repair the same structure umpteen number of times using lowest of the skills and least amount of money, oblivious of the fact that natural resources are consumed in multiple amounts and still we end up with substandard structures – utter cruelty and disregard to nature's resources, energy and human labour – not to talk of our character and integrity.

There is phenomenal expansion of 'modern' (west-aped) India and the chasm with the hinterland has widened so large that our farmers commit suicides. Our crises of water, power, transportation, housing, and pollution have grown much bigger than any apparent benefits in education, health, food and shelter. We are now global because we have exported our men and women and therefore, we can import necessities and luxuries alike. We have 'captured'

markets in movies, cricket, fashion garments, jewelry, and also the food – depriving our poor. Luckily, it is the domestic markets and public sector investments, along with our poverty, which have saved us a bit from the current economic downturn.

Our crude oil requirements and imports at high prices have continuously been increasing, both in quantity and percent share. Because of heavy involvement of foreign expertise, the offshore oil experience has made little impact on other marine industries and defence or the coastal zone. We remain a nation of agents and labour suppliers. The deep Godavari gas that was promised for 2004 is yet to reach our shores. Renewable energy remains to be a boon for foreign manufacturers of wind turbines and photovoltaic (PV) cells. Yet, we regularly send our mission to Antarctica and maintain a station – for what and for whom? There is a hype to go for nuclear power, in a miniscule way at unknown price. A manned mission to Moon is planned, while our satellite data remains unprocessed and unused for water, farming and forestry.

Delhi is a ‘proud’ city littered with more cars than all metro-cities combined. Wisdom prevailed and we do have a metro-train with foreign participation that works. But the metro model is yet to be replicated in other sectors. The traffic on Delhi roads, for that matter in any large city, barely moves, yet our commitment to personal transport is strong. At this stage of fossil-fuel use, reserves, prices and atmospheric carbon, introduction of another personal car (nano) and expansion of our air transport sector show our stubborn attitude to follow the old economy or the hard-energy paths.

On the health front, all UN reports would show that little, if anything is right for the mass population. Lack of drinking water, dry riverbeds, waste disposal, mosquito menace and polluted air make the entire country highly vulnerable to serious disease and epidemic. The threat is enhanced by increasing HIV-Aids. Apparently, linear expansion of above paths is unsustainable. [*end 2009 Addition*]

iii) Nature

[1979 version] In our country of sacred Ganga and divine Himalayas, a complete stock of Nature's gifts of rivers, fertile plains, wind, sunshine, rainfall, mineral, forest and ocean wealth, their vagaries and extreme events remains incomplete and little understood. We have yet to establish an equation with Nature. Extreme events – floods, droughts, famines, cyclones, and landslides - keep taking a heavy toll of life and property of poor people. Not that these events are exclusive concerns of India, their worldwide recurrences have shown that humanity is vulnerable to climatic variations and also the climate is vulnerable to acts of humanity.

Whether it is cyclones in Andhra, dam failure in Gujarat, landslides in Assam, the abuse of land by unmindful exploitation and occupation has brought untold miseries to people themselves. The process must be stopped. Each calamity consumes a large proportion of the GNP of developing countries, averaging about 2%.

It is facile to shift the blame onto victims for over-population or onto the social system for its inequalities. Engineering projects and management channels are equally responsible for they are easier to manipulate. A national policy must come into force for better understanding,

respect and utilisation of nature's gifts to mankind, and for appraising and coping with environmental extremities. [*end 1979 version*]

[*2009 addition*] We stand today as 'utter failure' on the front of water management, quite similar to our performance on character-and-man building education, population explosion, and unsustainable technology paths. Clean drinking water is today not accessible to most of our people. The Himalayan glaciers are shrinking and we continue to be in slumber because the warmer temperature brings us more meltwater. The monsoons rains cause serious floods because the fertile plains are heavily silted. Plenty of excess water all across the country, except for Gujarat, goes into the sea. We fight like small children over ancient, British water-sharing mechanisms, unscientific boundaries and jurisdiction, or talk about impossible mega-schemes. Sixty years after independence, it is a pathetic state of affairs on land and water management. Even a single watershed is not effectively managed. Talk of Ganga and Yamuna Action Plans (GAP and YAP), curious eyebrows are raised on the soundness of schemes, expenditure and results obtained.

Our understanding and response to monsoons is still dismal. Repeated flooding every monsoon is rampant in the eastern states, e.g. UP, Bihar, Bengal and Assam. Our biggest cities, like Mumbai, Surat, Chennai, Vizag get submerged for days after heavy rains and cyclones. Recovery from Latur, Bhuj and Uttarkashi earthquakes has been slow and painful; the tsunami was a real testing ground. Yet, our National Disaster Management exists more on paper than being ready for action on ground.

Of all these, the farmers' suicides are our biggest disgrace, along with land acquisition disputes, disappearance of forests and wildlife. Scant hope can be expressed when the protectors themselves turn into predators. [*end 2009 Addition*]

5. Moving to Sustainability: *Holistic and Organic*

India is a sun-blessed country between Himalayas and the oceans; we worship Sun, our biggest nuclear reactor placed safely faraway. Our natural bounties driven by Sun, such as, water, soil, organic growth and energy are renewable and quite large provided we understand and respect the nature's cycles. Combined with wise use and recycling of non-renewable resources, we have to define a balance of our needs and the land's carrying capacity. To practice, the task is hugely complex. It is not for the faint hearted, as it requires dramatic reform of our domestic institutions and courage to deal with the international ones. The modern technological civilization, propelled by market forces and politics, has bestowed an unprecedented material estate to its wielders. The industrialized "west" has used science to power over matter, over life on earth, even over man himself.

The problems that confront us are numerous, few standouts are often recognised: population, resource scarcity, and environmental degradation. However, underlying these is our basic vision of life, values, individuality and mentality. Our unsustainable usage of resources, and our continuing accumulation of waste, points up the basic flaw in our current system: it operates in a straight line; our current system of manufacturing and using products is a one-way street. Except for the solar energy,

our earth system is a closed one - what goes "out" eventually must come back "in."

We have to pause and think: what moral responsibilities we owe to the future of humans and nature?

On the subject of international governance of the environment, David Runnalls, President, IISD, in his Nov./Dec. 2008 article narrates a complete tale of our gloom. The international regimes for environment have been very active but not effective for a variety of reasons, such as, small secretariats, inadequate budgets, compliance regimes, lack of accountability and little intent of honoring the agreements.

There are no shortages of ideas for fundamental reform, ranging from a rejuvenation of the obsolete UN Trusteeship Council or special sessions of the UN Security Council. However, there is a lack of consistent political leadership.

Sustainable development is crying out for political leadership. Enough experience on all aspects of the issue has been gained over the past 20 years, the costs are considered to be affordable. Yet history tells that these ideas do not move without U.S. leadership. It is hoped that concurrent to solving the US financial crisis, the President of USA will also take up the climate change agenda and the strategies for sustainable development needed to prevent it.

Therefore, in the meantime what do we do? Dennis Church in a 1991 article puts it almost in a Gandhian way. If the central problem is that we are consuming and destroying the natural resource foundation of our communities, the solution is to build sustainable

communities. Quoting William Ruckelshaus, he says, that “..economic growth and development must take place and be maintained over time, within the limits set by ecology in the broadest sense -- by the interrelations of human beings and their works, the biosphere and the physical and chemical laws that govern it. Our species may be pushing up against some immovable limits on the combustion of fossil fuels and damage to ecosystems”

Building sustainable communities means striking a unique bargain with nature -- a pact of coexistence and co-evolution. It means recognizing that our future health, safety and prosperity are utterly dependent on the continued health of the living Earth. If building sustainable communities is the solution on a conceptual level, the solution on a practical level involves making literally hundreds of changes in how we do business -- changes in technology, technique, and behavior. Even a cursory review of products, practices and techniques available today, and of research and development work currently underway, provides abundant reason for hope about the future.

A Renewed Beginning: *The Bottom Upward Approach*

Our commitment to the ideals of well-being of humankind and environment with faith in nature/God lead us to the path of enlightenment, no matter how far we have traveled on the ‘old’ materialistic, exploitative path. The ‘new’ path has to be firmly anchored to the fertile soil of thoughts and wisdom of our sages and mahatmas. Our new organization diagrams (triangles) should be inverted so as to look like real trees, with the most responsible management obtaining its nutrition from fertile soil of values & ethics and feeding and supporting the entire tree. Our development processes should mimic nature. The path

recognizes the solar energy as our only 'living' income. We have stripped off our savings, and should start building them up through extensive forestation and green cover; water will follow. On other non-renewable resources, we have borrowed foolishly from our future generations; let us stop it by learning need-based consumption, re-cycling and restorative green economy.

In the 'old' process, maximum damage has been inflicted on our character; we became predators, robbers, scamsters, etc. Let us transform NOW. We start with an apology to the future generations for our ignorance and greed, and promise them to help on man-and-character building education, restoring ecology, and aligning the development process in balance and harmony with nature. Lots of idealistic words; Yes, there has to be a 'new' beginning.

The 'new' process starts with several shifts from thought level to action, feedback and amends. (fig. 4). Initial co-existence with the 'old' and transformation has to be non-violent, peaceful yet convincing enough to be rapid – may we compare the desired synergy with an algal bloom? Before this can occur, optimum conditions need to be recognized by the organism, and that can be through 'new' education and training in values and ethics; only thereafter, eco-harmonious evolution will take place.

The 'new' eco-eco path needs to start simultaneously with shift to renewable, solar-based energy and amends to restore through need optimisation, conservation, cooperation and not competition, we have to mimic nature, cybernetics and organic systems, on this finite planet. Simple, truthful living within one's means, that is carrying

capacity of earth, exercising control on population, conflicts, wastage and environmental rejuvenation are the keywords for such sustainable lifestyles. Food, clothes and shelter are accepted basic necessities. Fundamental to these are our quest for knowledge, value-based moral character for peaceful living and resource sharing as per needs; hence, religious, scientific, creative (arts), technologic (crafts) and management (organizational) education in that order must precede before one could qualify for administrative (governance) skills. Teaching and man-and-earth resource building skills should be our ultimate goals for improving our future – the right kind of human gifts to next generation.

Such a futuristic sustainable Community of Ark, founded in 1948 in France by Lanza del Vasto (1910-81), has recently been visited and narrated by Siby Joseph. Following the Gandhian principles, the community is founded on principles of truth, love and tolerance, simple life based on manual labour using little electricity. Residents numbering over 50 have chosen simple life (voluntary poverty) but enjoy well-being and solidarity. They are trained in one of the basic skills to provide food, clothes and shelter, work about 8-hours a day with regular breaks to ponder. They regularly pray, meditate, work with physical exercise, singing, dancing and celebrations.

Important to note here is as to how organic replication and growth of such community can be induced?

Today's need is to recognize that life and nature revolve around energy, and its appropriate use for all the processes, summarized as food and activity. *Karmayoga* says: Activity is pleasure is happiness. And so is food. Our

unique powers include: knowing, creativity, love and responsibility. Science is bliss, its abuse is curse. Living on our income, i.e. daily solar energy, we have to organise our activities within nature's cycles – one's output is other's input. Therefore, wise application of renewable energy is the mind of sustainable lifestyle while the heart of matter lies at values and ethics.

In sustainable context and within the nature's realm, our basic necessities of food, clothes and shelter can be fulfilled in infinite number of ways, provided we do not turn to be gregarious. Our basic needs also extend to communicating, sharing and archiving our knowledge, enhancing it by travel, protecting ourselves adequately against intolerable weather extremes, and carrying out a variety of such activities as to please us and fill with happiness. Joy is life, and Life is joy; and so is the Truth.

For the 'new' lifestyles, fossil fuels are out. Energy through daily solar insolation is sufficient to meet all our needs. This unbound, renewable energy is available in so many eco-compatible forms: human and animals, biomass and biofuels, direct and indirect solar, e.g. light, heat, wind and water. Telecommunications, microelectronics and soon, the nanotechnology are areas of appropriate minimal energy use which can further be researched and improved using renewable sources of energy, if we commit to do so. Within this framework, we can provide as many 'green' components of good life as the mind can imagine. Vain and ego should have no place in 'new' world.

For using the 'new' energy for our food, shelter, clothing, communication and transport – all at minimal need levels – we need to define 'new' education, imbibing

our children with values and ethics, so that we change from scientific materialism into scientific idealism. Similarly, we need 'new' commerce that should include 'new' economics, 'new' markets and 'new' businesses. Let markets and businesses be free but never value-free. Integrity in economic life is as important as in personal life. What makes for the good company makes for the good society. So has said Gordon Brown, and let me hope he speaks as a 'new' political leader.

The alternatives to fossil fuels are many, and they have been explored and tested: wind energy, tidal energy, hydropower, geothermal, biomass, solar hydrogen gas, solar photovoltaics, and so on. Assessment of these alternatives against fossil fuels is incomplete in absence of the real costs of latter, whereas sustainable forms of energy do accurately internalize their costs. With the application of green taxes over time, the costs of using fossil fuels should rise, giving the necessary boost to research and usage of renewable energy.

Optimisation of energy and water usage in buildings, agriculture, manufacturing, construction and transportation, and conservation of all resources offer unlimited opportunities to future science. One may always remember that such an effort is people's movement, and participation of individuals, groups and local governments is essential to success

The 'new' economic success should also mimic nature and be equivalent to biological success. Unethical, 'old' energy businesses should transform. Competition should be for product quality and prices, not among human beings for survival or supremacy. To encourage healthy and

sustainable productivity, concepts such as ‘green’ tax and ‘real ecological’ costs should be worked out. Incentives for eliminating waste, recycling, and restoring ecology also need to be encouraged. I am always fascinated by Islamic principles of bread for everyone, and Riba (no interest or rental of capital and assets, reserving reward for work). After recent financial crisis, banks have also shown interest in adopting asset-backed bonds Sukuk.

Thus, activities toward greening of the earth, reforestation, water, soil, food, and waste management, re-use and re-cycling should be the ‘new’ sustainable businesses. Some of the principles enumerated by Hawken include the following. Converting principles to practice is the real challenge.

- Replace nationally and internationally produced items with products created locally and regionally.
- Take responsibility for the effects they have on the natural world.
- Do not require exotic sources of capital in order to develop and grow.
- Engage in production processes that are human, worthy, dignified, and intrinsically satisfying.
- Create objects of durability and long-term utility whose ultimate use or disposition will not be harmful to future generations.
- Change consumers to customers through education.

A word on present education: The present education system hardly caters to a small population with inherent concentration in urban areas. In schools, mini-scholars and in colleges potential unemployed graduates are produced.

The courses need to be practical, task or job-oriented or need-based at both the levels. The sanctity of college education has further eroded by political interference, mass copying, indiscipline and strikes. The net result is non-availability of required skills and entrepreneurship. The ambitious talent migrates out and the others end up with desk jobs as officers with no sense of dignity of labour. A bold attempt with sweeping reorganisation and reorientation is required.

6. The Task Ahead: *Managing Change*

Having talked about the urgency of moving to ‘new’ soft or renewable energy path of sustainability, human and environmental well being in Indian context, the obvious is to initiate such communities and livelihoods in different socio-economic and agro-ecological settings. The core elements in fostering sustainable livelihoods are: the dynamics of the human and natural resource bases; strategies for poverty reduction and the promotion of well-being; the reduction of risk and the need to initiate coping behaviour; and the promotion of positive adaptation to change.

Identifying human self as an ongoing emergent individual, it would be logical to start a sustainable community around us, both physically and virtually – in the present time of Internet technology the spread of the latter can be highly rewarding. The suggestions made here are preliminary, require deliberations and synergistic support of every one.

Our composite aim is initiating sustainable development at local, moving to regional level, combining ethics & values, science and environment. The goal is peaceful co-

existence and transformation from 'old' to 'new' eco-eco lifestyle. Tentatively, a four-stage process of setting up a Think Tank, Advisory/Consultancy Bodies, Project Set-up and Demonstration Units, and finally a self-replicating organic Organisation of manageable dimensions is conceived.

The number of areas of activities for such transformation is really large. These include: man himself, his comprehensive education and skill based training, energy, water, soil, agriculture & forestry, food, clothing, shelter, habitat, materials, minerals & metals, enterprise, infrastructure - transport, communications, governance, etc. Within each area of activity, there are subareas too. Presently, I suggest five main domains for the organized thinking and action. Once the action is complete, the organism should be self-reliant, yet open and communicative, and responding to external stimuli and internal process functions. These five domains would be: 1. The Foundation – comprising values, principles, ethics, education basics, character, feedback and revisions (improvements); 2. Projects (I) – for energy or the living income and its distribution; 3. Projects (E) – for green and restorative ecologic economy; 4. Youth Energy – education and skills for the young; and 5. Agents for Change – organization development, synergy and interaction with people, organizations, governments, and watchdog.

Domain 4 shall be most futuristic and sensitive for developing skills in basic necessities (food, clothes, shelter) and support activities, such as, energy income, transport, habitat, manufacturing, construction, recycling and waste management. Domain 5 would effectively generate synergy among all like-minded individuals, groups and

organizations, such as those working on ideals of Gandhi, Ramakrishna and their international equivalents. It would combine effort at local to universal levels including *Satyagraha* against those who have stolen in name of our sages and Mahatmas’.

With these preliminary suggestions, I close my talk and place brief conclusions.

7. Conclusions

Better late than never. Even a miniscule effort can change the world if its time has come. Using the bottom-upward, local to regional, it is appropriate to build sustainable communities and invest our limited resources in soft energy paths, electronics and mass transit technology. The talk would be incomplete without a last profound emphasis on values.

Here, I may quote farmer poet Wendell Berry:

"The world that environs us, that is around us, is also within us. We are made of it; we eat, drink and breathe it; it is bone of our bone and flesh of our flesh. It is also a Creation, a holy mystery, made for and to some extent by creatures, some but by no means all of whom are humans. that we leave it undiminished, not just to our children, but to all the creatures who will live in it after us."

Finally, Jerry Kohlberg puts it this way:

"Around us there is a breakdown of...values in business and government...It is not just the overweening, overpowering greed that pervades our business life. It is the fact that we are not willing to sacrifice for the ethics and values we

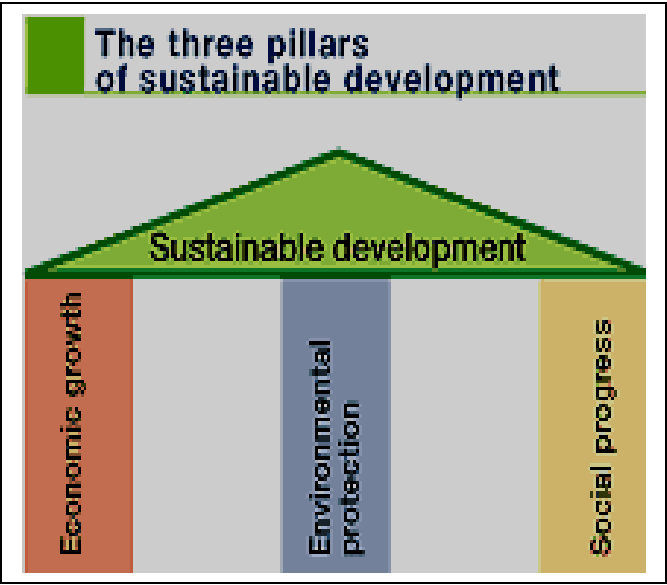
profess. For an ethic is not an ethic, and a value not a value, without some sacrifice for it, something given up, something not taken, something not gained. "

Man-and-character building education and appropriate technology choices today will avoid 20/20 hindsight tomorrow.

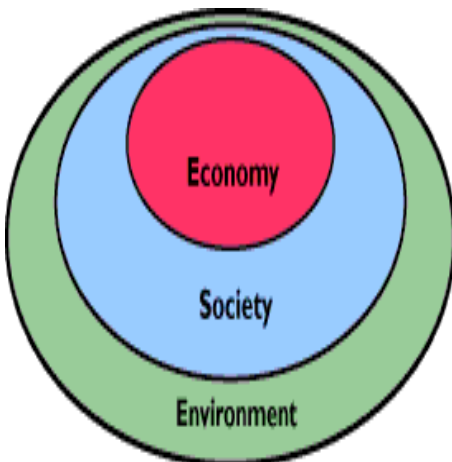
Figure 1. Three Visual Representations of Sustainable Development:

Pillars, Circles, Interlocking Circles

A. Pillars



B. Concentric Circles



C. Overlapping Circles

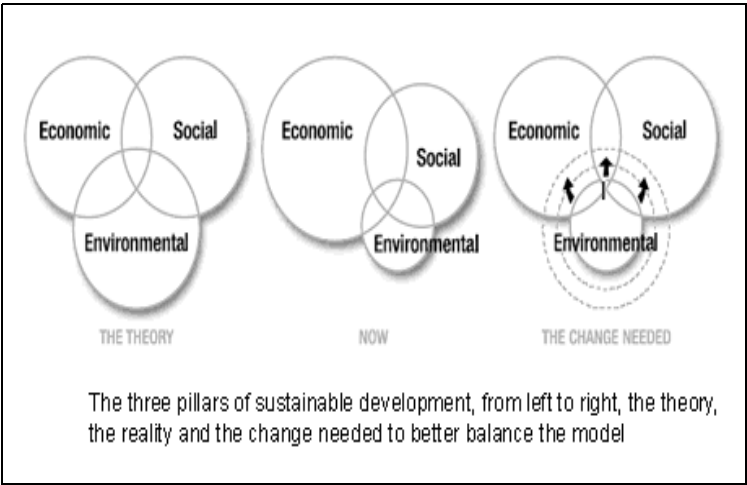


Fig. 2: Interactions at their Extremes and in Balance.

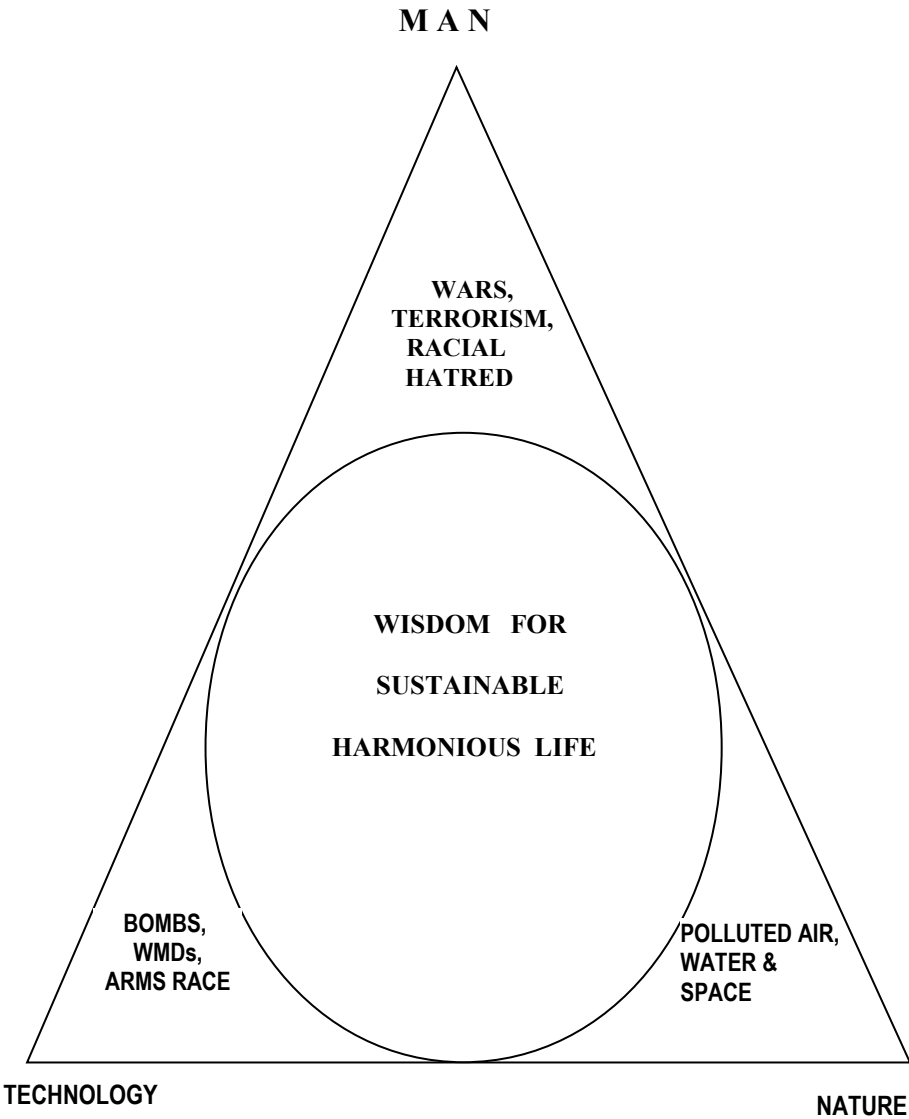


Fig. 3

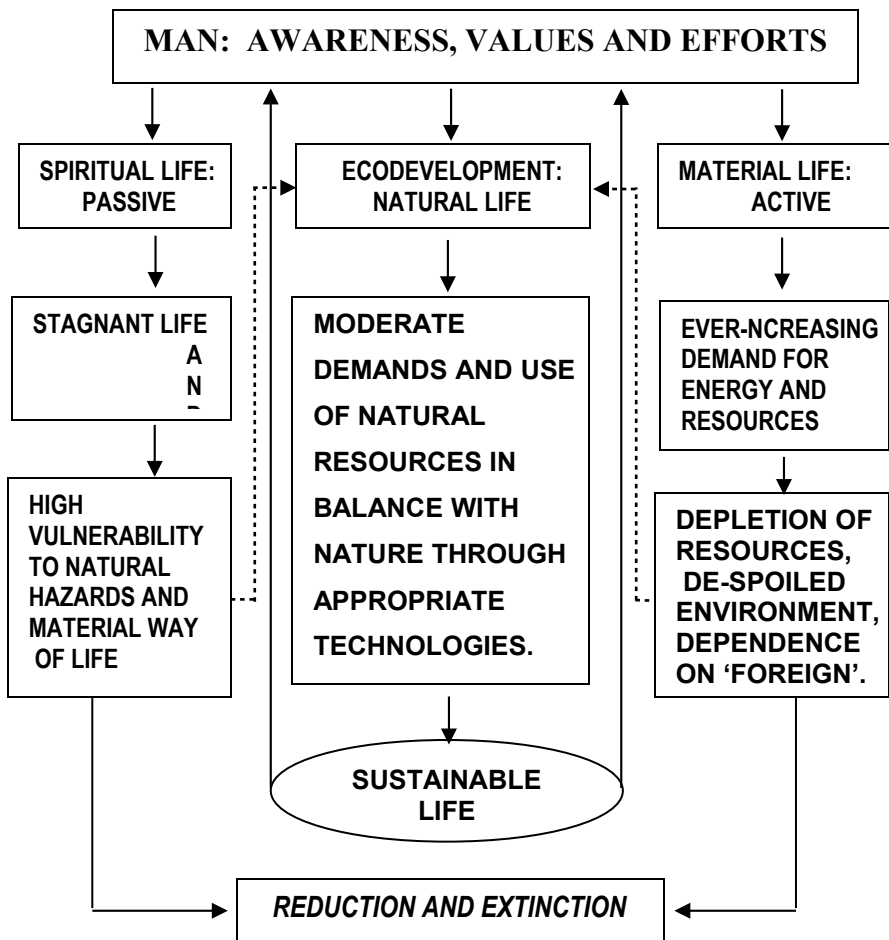


Fig. 4

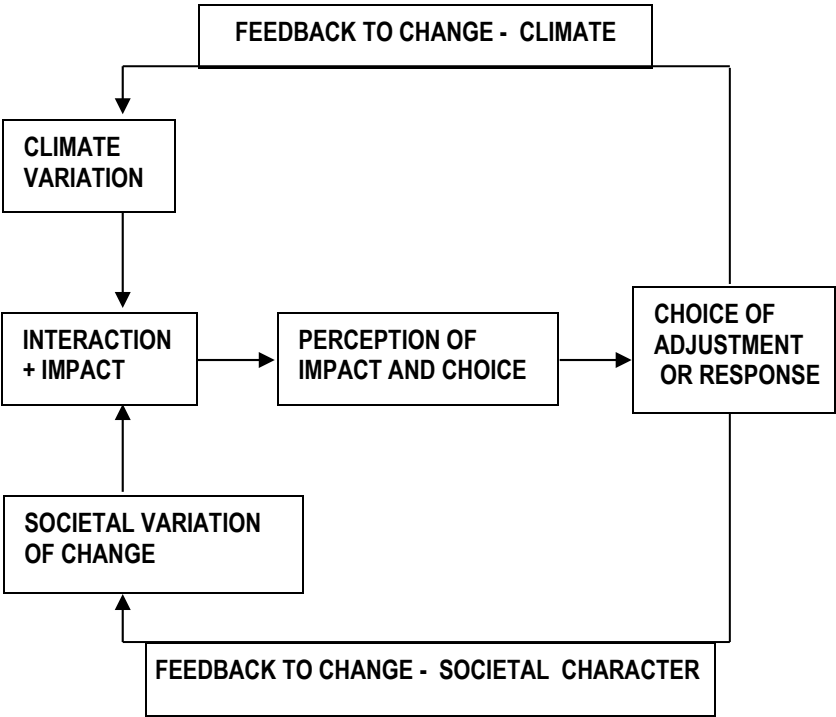


Fig. 5

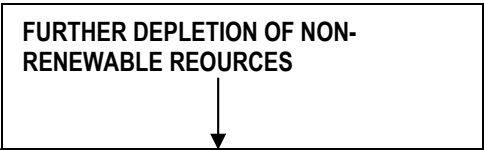
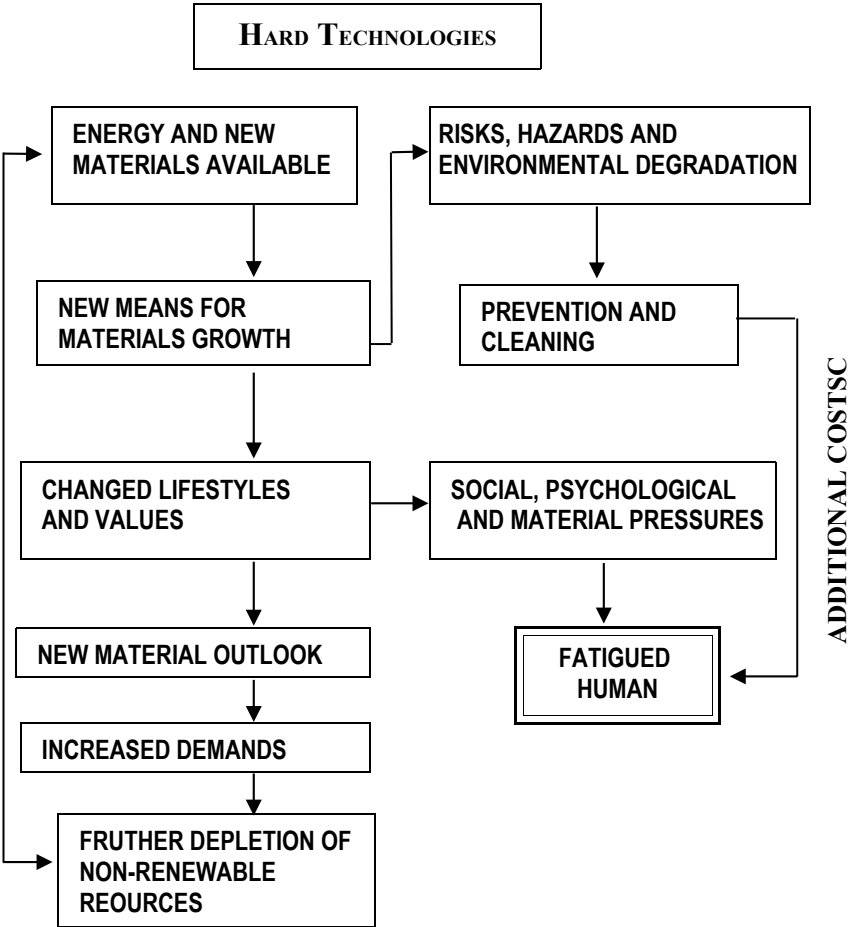


Fig. 6

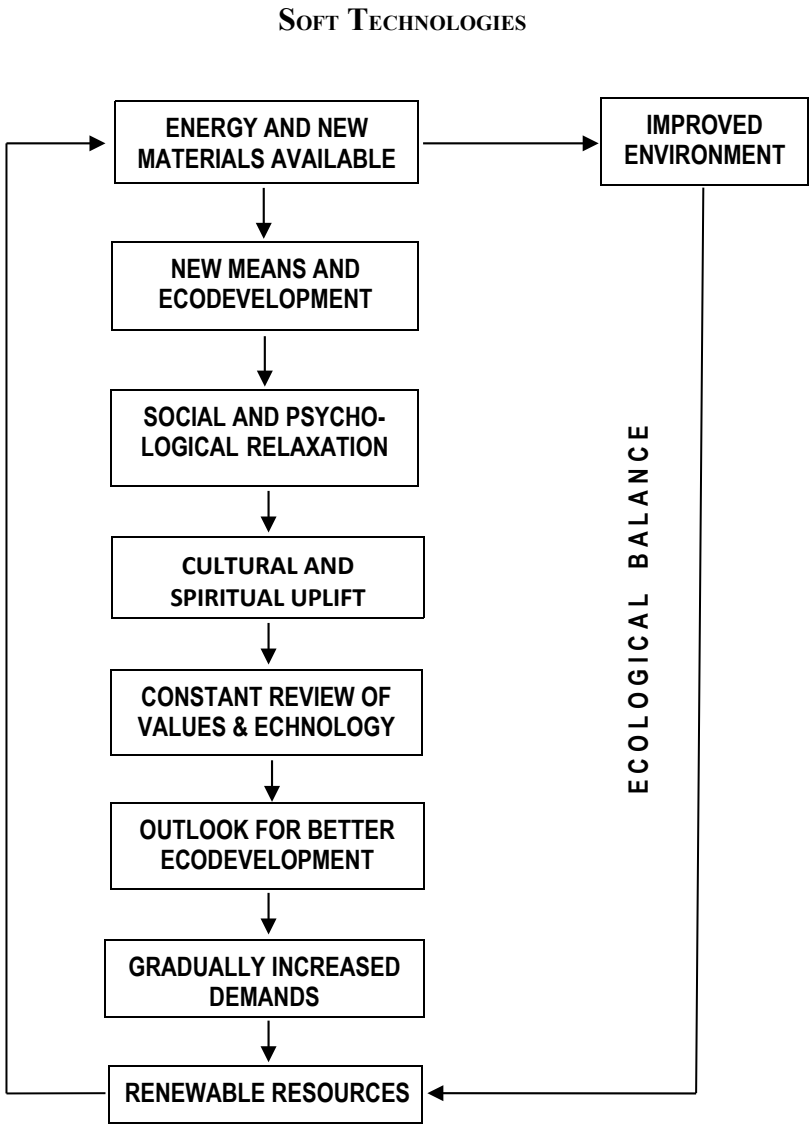
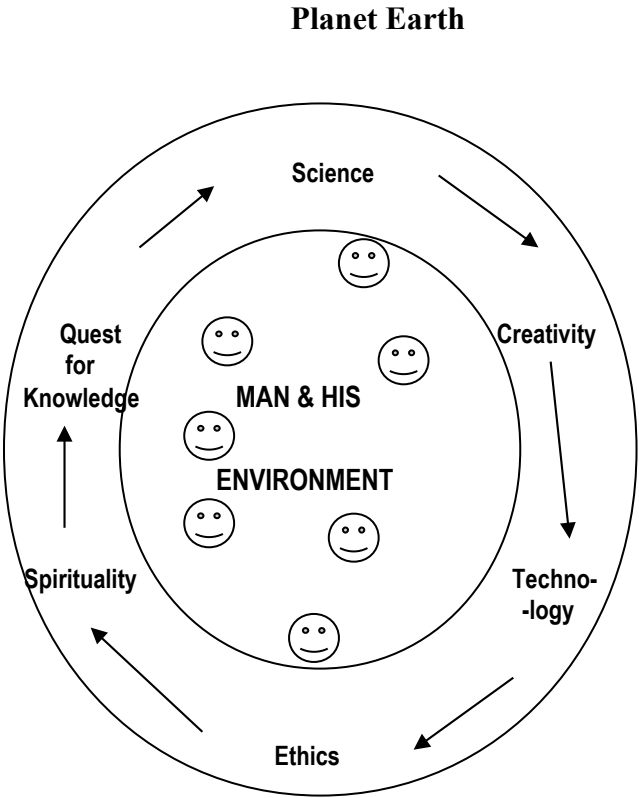


Fig. 7



“Scientific Materialism” needs to yield to “Scientific Idealism”, NOW.

Gandhi's Criticism of Industrialization and Modernity; An Environmental Perspective

*Nishikant Kolge
Sreekumar N.*

Introduction

Gandhi viewed life as a whole. He did not divide life into different watertight compartments like political, religious, economics and so on. What he had said about politics must be largely applicable in religion, economics and many other fields of human life as well. Therefore, Gandhi has been attracting scholars from various fields and when concerns for environment acquired a kind of movement in 1960s, many scholars and activists of this field also looked at Gandhi for inspiration. Thus, the name of Gandhi and his relevance in environmental movements are not new for the scholars and students who have been working in this field. The way he lived his personal life itself is a great example as well as matter of study for many environmentalists. And the way he interacted in different domains of human life opens several other possibilities to claim him as an environmentalist with a difference. Environmental philosophers including Arne Naess, founding father of Deep Ecology, constantly acknowledged their debt to Gandhi on many occasions and many environmental activists like Sunderlal Bahuguna, Baba Amte and Medha Patkar own debt to Gandhi for borrowing his techniques. Apart from all these, many scholars have worked to establish and re-establish Gandhi as an environmentalist. This

paper is also a part of this long series which reassert and reclaim Gandhi as an environmentalist with a difference by examining his criticism of industrialization and modernity which are today understood as one of the major causes for many problems related to environment.

This paper argues that, Gandhi had a very realistic and optimistic conception of industrialization and contrary to the common perception; he was even prepared to accept industrialization with some reservations. Gandhi knew that Industrialization and modernity are going to stay. He said “No one is opposed to machinery. Or opposition is to its misuse, or its excessive use.”¹ Hence he wanted people to judge them by their consequences to different aspects of human life including the environment. As mentioned, his acceptance of industrialization was with some reservations and he often vigorously criticized it, which reflect deep concerns for the environment. He vigorously fought against the evils of modern civilization. But at the same time he appreciated many modern virtues like equality and freedom.

But one should also see that Gandhi’s criticism of industrialization and modernity was not pre-dominantly form an environmentalist perspective. He profusely takes insights from many 18th and 19th century Western thinkers like, Tolstoy, Thoreau and Ruskin, in order to develop his position. They too have criticized industrialization and some of the basic assumptions of modern society. But their oppositions were not necessarily confined to the perspective of an environmentalist. Instead, many of them raised strong concerns which were rooted in their ethical, moral, religious and spiritual positions. For Gandhi too, the concerns of religion/ spirituality and even politics were not alien. But this paper will explore his criticism of industrialization, and modernity from the perspective of an environmentalist.

Gandhi's Criticism of Industrialization

As we know Industrialization, urbanization and westernization are not essentially connected with modernity. Modernity brings reason, universality, order, autonomy, equality, freedom and many other meta-narratives. But Gandhi used modern civilization, western civilization and some time British civilization as synonyms and for him all these words stand for industrialization and urbanization and they are associated with the modern virtues of rationality, equality and universality. They are applicable to the various institutions of modern life as well. Gandhi criticizes industrialization and urbanization because, as he says, he believes that, “the distinguishing characteristic of modern civilization is an indefinite multiplication of wants,”² As Ramchandra Guha observes, to satisfy these wants, one had to forage far and wide for raw materials and commodities.”³ and it is totally against and altogether contradictory to his idea of civilization. For him “Civilization in the real sense of the term consists not in the multiplication, but in the deliberate and voluntary reduction of wants.”⁴ In *Hind Swaraj* he writes: “Observing all this, our ancestors dissuaded us from luxuries and pleasures. We have managed with the same kind of plough as existed thousands of year ago. We have retained the same kind of cottages that we had in former times and our indigenous education remains the same as before.”⁵

He appreciates this alternative way to living because he could have visualized that this modern industrial civilization which “wholeheartedly detest the mad desire to destroy distance and time, to increase animal appetites, and go the ends of the earth in search of their satisfaction”⁶ will lead to reckless consumption and exploitation of natural resources. He further observes: The earth, the air, the land and the water, are not an inheritance from our forefathers, but a loan from our children.

So we have to hand over to them at least as it was handed over to us.”

Gandhi is critical about the typical way man relates himself to the world and the environment in the modern age. Nature is here treated as something different from man; to which man eternally turn to satisfy his needs and wants. He is worried about the animal instincts in man which know no limits to their appetite. The *Hind Swaraj* for Gandhi is thus an attempt to see beauty in voluntary simplicity, (voluntary) poverty and slowness.⁷

Growing reliance of human beings on machines was another feature of industrialization, which Gandhi found objectionable. As we have seen, he was not against industrialization as such. He had objections to the way the new industries and technologies were incorporated into the society. He had an idea of peaceful co-existence, where industrialization went hand in hand with the village handicrafts and human labour. He adds: “I do visualize electricity, ship-building, ironworks, machine-making, and the like existing side by side with village handicrafts. But the order of dependence will be reversed.”⁸

He finds that the village handicrafts and labour are the most direct responses to genuine human needs and wants. But he was ready to accept the use of machinery wherever it is inevitable, and opposed an overdependence on it. From an environmental perspective, he observes that this dependence on machinery had destroyed man’s inseparable relationship with nature. According to him, such a natural relationship is found in manual labour, where there are no machines coming between them. He says that, “to forget how to dig the earth and tend the soil is to forget ourselves.”⁹

Moreover, he feared that this overdependence on machinery may destroy the stable and long-established agrarian village communities which is environment friendly and which for him constituted the core of the nation's strength, not just material, but ethical and spiritual. Mechanization which does not disturb the environment-which does not interfere man's direct intimate relationship with the rest of nature-was acceptable to him. He says: "...we have to concentrate on the village being self-contained, manufacturing mainly for use. Provided this character of the village industry is maintained, there would be no objection to villagers using even the modern machines and tools that they can make and can afford to use."¹⁰

For the same reason he was against industrialization of agriculture. He was also equally aware of the dangers of using chemical fertilizers for increased productivity. He warns that, trading in soil fertility for the sake of quick returns would prove to be a disastrous, and is a short-sighted policy.

Gandhi's Criticism of Modernity

As it is mentioned above, Gandhi accepted many virtues of modernity like freedom, equality, justice etc. But he strongly objects the modern notion of rationality, particularly instrumental rationality. He accepted its importance in human life but he vigorously opposes the modern attribution of omnipotence to it. For him, though rationalists are admirable beings, rationalism is a hideous monster when it claims for itself omnipotence.¹¹ He questions the modern belief that rationality provides the only material we need to determine truth. He holds that it may sweep away alternative modes of coping up with the world and makes hardly any room for ethics and morality. He believes that this rejection of alternative thinking and attribution of omnipotence to rationality may

reduce wisdom to knowledge and the latter to a form of power only useful as an instrument of control over nature and other men.¹² On the other hand for Gandhi, the primary concern of human being is not how to “take charge of the world” but how to live with nature and take control of ourselves.

Gandhi has reservations in accepting modern anthropocentric idea of man for similar reasons, which places him as the highest being on earth if not as the centre of the universe. As Bhiku Parekh observes, Gandhi’s favorite metaphor is that “the cosmos was not a pyramid of which the so-called nature or material world was the basis and man the apex, but a series of ever-widening circles.”¹³ He believed that such a hierarchical arrangement would legitimize and encourage man’s exploitation of the rest of the world and nature. He has shown respect for every living creature and was against killing of animal even in the name religious rituals. He announces that any religion which stressed on such practices diminished God’s dignity and called such act as a sin. He adds that he is quite convinced that sacrifice of dumb animals to appease a deity cannot have any religious or other merit about it. It is a sinful act.¹⁴

Gandhi was complete custodian of non violence. In his Ashram the killing of any minute creature, even poisonous one was completely forbidden. His view on this issue enlightens us with a profound insight in environmental ethics. He said: “I do believe that all God’s creatures have the right to live as much as we have. Instead of prescribing the killing of the so-called injurious fellow- creatures of ours as a duty, if men of knowledge had devoted their gift to discovering ways of dealing with them otherwise than by killing them, we would be living in a world befitting our status as men—animals endowed with reason and the power of choosing between good and evil,

right and wrong, violence and non-violence, truth and untruth.”
 15

Conclusion

His commitment to *ahimsa*, or non violence was complete, but not idealistic. As explained above, he was never a dogmatic opponent of modernization and even industrialization, but was more concerned with the judicious incorporation of such new phenomenon into human life, without disturbing the natural and innate relationship men have with nature and environment. He visualised the seat of all human values and ethics - which for him is responsible for all human progress and development - in such an unbreakable relationship. He was so uncompromising on this as he even goes to the extent of condemning the use of modern drugs, as it involved violence against animals in the research process.¹⁶

Gandhi's criticism of modernity presupposes a very strong and uncompromising ethical point of view. At the core of this ethical commitment is the principle of *ahimsa* or non-violence and for him the gist of this principle of non-violence is contained in the Upanishadic manthra, *tena tyktena bhunjita, magritha kasya sidhanam*, which asserts the importance of the act of renunciation, before we consume anything. Gandhi too talks about a control. But not about controlling nature, but ourselves, by keeping a watch on our eternally multiplying wants. The above mentioned *Upanishadic mantra* insists us to restrain from such a multiplication of wants and their pursuance and it makes an act of renunciation the very rule of life or *dharma*.

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Environment and Spirituality

Tanmaya

The environment is the aggregate of surrounding things, conditions, or influences, especially as affecting the existence or development of some one or some thing. Spirituality is the quality of fact of being spiritual. Spirit is the principle of conscious life; the vital principle in man, animating the body or mediating between body and mind. The spirit, we can say, is the vertical dimension of oneness in life experiences and the environment is the horizontal manifestation of the “any.” The verticalization of the horizontal world of environment with a higher value impregnation from the vantage point of one’s own Self or spirit within can make one’s own environment more harmonious and beautiful to live peacefully.

We happen to exist in this environment like an intra-uterine foetus lies in the womb of mother. All creations are getting nourished from the five elementals in nature such as earth, water, fire, air, and space. When we live in this world, we occupy a space. Because of a narrow vision about our environment we have technologically and “scientifically” misused our natural resources not only out of need, but also out of greed. From many parts of the world we started hearing about the damage made by pollution from the early 1970s.

From an unknown past, different varieties of living and non-living things manifested in this world, existed for a particular period of time, and then dissolved back into the five elements. What is true about this world is its changefulness.

All manifestations also carry along with them a correlating counterpart like the two sides of a coin. Male has its counterpart in the female. At the level of energy there are the dual functions of expansion and contraction in the pulsation of the heart. The human experience also carries its own duality of happiness and sorrow. In this changing world with contradictions, we are destined to identify with a changing form and a changeless name. But this temporary, existential identity also has a vertical, non-changing substratum as its basis. This eternal permanent existence is knowledge through and through, which is to be understood through deep pondering. The enquirer has to use the belief aspect of knowing as in the case of religion and our rational questioning capacity like a modern scientist. One has to probe the one and the many at the same time by a dialectical way of higher reasoning. The contradiction of one and many is to be transcended inclusively and the paradox is to be resolved in one's own heart in this life itself.

Although the experience of this existence is beyond any separation, when we try to probe and know the subtle realms of it, we unknowingly make a division of the knower and the known in the usual way of knowing. This relativistic knowledge was communicated through the word symbols as material science to others. There is another way approaching this one knowledge basis without making a break, by correcting this duality in our knowledge with the help of intuition. This corrective way of taking one to the level of higher wisdom is the secret in the spiritual literatures of humanity. This science of wisdom is called secret only because it is very difficult to know and understand. Contemplation is needed to identify with this corrective force within us which is non-dual knowledge.

Dualistic knowledge as well as non-dual knowledge has a common, neutral source in our consciousness. The dual

knowledge helps us to understand the specific facets of truth with certitude. This has brought different specialties in the arena of modern science with its application as technology and its innovations for the last three hundred years. The use or misuse of technology that affects our environment through pollution or over use of natural resources are to be tackled at the individual level by an overall value emanating from the integrated vision of the absolute truth.

Belief in the “oneness” or “sameness” of reality is to be contemplated. This oneness or sameness can be seen to be the basis for its variegated manifestations. A dialectical approach to the paradoxes in life is the secret methodology proper to this value realm. Knowledge and its discourse are thus transcended through reflexive investigation of the inner reaches of inner space. The spiritual person helps others to get clarity about the secrets behind life and our environment. More than knowing, an identification with the light within is to be practiced so that our mind can start merging in the luminosity of peace and silence. Knowledge has its own source which is referred to as “light” in the scriptural texts. The light within is to be continuously contemplated as a neutral witness in one’s life in order to overcome the sufferings inherent in the dual experiences of life.

This core light of ours also carries the unchanging laws that operate in this universe. A spectrum of values from food to freedom is to be identified in a vertical, ladder-like order from the omega to the alpha. A hierarchy of values is to be discerned with clarity of vision through intense study of the problems we are facing like global warming. The Self or the highest Value in life is to be identified in the Core of one’s own consciousness. The Kingdom of Heaven or God is to be realized in the heart itself. From the neutral Self that knows no second, this Value

unfolds into the whole of the experiencing world of the knower and known. The duality of knower and known is to be transcended by an intuitive understanding with the help of belief. There are unchanging laws that operate in consciousness. They pervade the manifestations of consciousness which we take to be our inner “world” and outer “cosmos.” However, at no time is the purity of consciousness affected by the apparent changefulness it silently witnesses.

A potent factor which is not different from it is the cause for the changes happening in True Self. The possibility of all errors in one’s life has its source in this power which is like the shade of a lighted lamp. This power carries a dark and a light aspect. The pure Self is like a mirror reflecting the images on it and at the same time no residue of any image is left behind. Thus, the knower of the Self will become the knower of all. One has to find permanent peace within by identifying all without a second in one’s own self. Fear will go from the mind when one can identify with an absolute value without an “other.” The concept of “other” makes one afraid of a “second.” A spiritually perfect person will behave as an absolutist in his or her outlook without seeing the relativistic world around as the “other.”

We can see three realms in absolute knowledge: existence, subsistence or knowledge, and value or the purpose in life. This understanding can provide an overall norm for living the truth in total. These three realms of experiencing, knowing, and enjoying are lived usually in a local environment or a relative world of limited existence in the transactions of everyday life. A value addition through a verticalized process of punitive understanding gives a more integrated vision of environment. It is in our day-to-day life that we are to work out

our spiritual progress. The resulting unitive experience will be of oneness without a second.

Belief in the one basic truth will lead the experience of the sameness of all manifestations as a wonder and mystery of life. With this integrated vision in mind, we can probe the ordinary realm of our immediate environment with our intellect which carries the power for dialectical reasoning. Out of all creation, only human beings carry this unique feature of dialectical reasoning in them. Thus, an integrated vision of life and environment includes an absolute realm of contemplating the “one” through belief and a relative realm for intellectual probing with linear thinking to see cause-effect relations. The meeting point of these two dimensions is the neutral source of everyday cyclical experiences in the wakeful, dream and sleep.

Silence and compassion are the respective applications of the wisdom of one and many in life. We can be compassionate in our everyday actions by contemplating and identifying ourself as the silence-filled ocean of immortal bliss. The more we silently contemplate, the more clarity comes to us to help us deal with the environmental problems facing us.

The variety of life forms such as plants, animals, and micro organisms are dependent on each other in various ways. They are continuously changing with changing external factors and internal conditions. The loss of biodiversity will impact all life forms and in particular, human beings. Each person needs the wisdom to conserve biodiversity in his/her environment for the survival of the living world.

Climate Change

Arindam Ghosh

Introduction

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from natural factors, such as changes in the sun's intensity, natural processes within the climate system (e.g. changes in ocean circulation), anthropogenic activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.)

The Earth's climate has changed many times during the planet's history, with events ranging from ice ages to long periods of warmth. Historically, natural factors such as volcanic eruptions, changes in the Earth's orbit, and the amount of energy released from the Sun have affected the Earth's climate. Beginning late in the 18th century, human activities associated with the Industrial Revolution have also changed the composition of the atmosphere and they are influencing the Earth's climate.

Climate Change or Global Warming?

The term climate change is often used interchangeably with the term global warming, but according to the National Academy of Sciences, "the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are [other] changes in addition to rising temperatures."

Global Warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities.

Earth has warmed by about 1°F over the past 100 years. The Earth could be getting warmer on its own, but many of the world's leading climate scientists think that anthropogenic activities are helping to make the Earth warmer.

Weather and Climate

Weather includes daily changes in precipitation, barometric pressure, temperature, and wind conditions in a given location. Weather describes whatever is happening outdoors in a given place at a given time. The weather can change within a very short time. For example, it may rain for an hour and then become sunny and clear.

Climate describes the total of all weather occurring over a period of years in a given place. This includes average weather conditions, regular weather sequences (like winter, spring, summer, monsoon), and special weather events (like tornadoes and floods). Climate tells us what it's usually like in

the place where we live. Mumbai is known as having a mild climate, Kolkata a humid climate, Srinagar a snowy climate, and Shillong a rainy climate.

Green House Effect

The greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere (water vapor, carbon dioxide, nitrous oxide, and methane, CFC, for example) trap energy from the sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 15°C colder. Because of how they warm our world, these gases are referred to as greenhouse gases.

Most greenhouses look like a small glass house. Greenhouses are used to grow plants, especially in the winter. Greenhouses work by trapping heat from the sun. The glass panels of the greenhouse let in light but keep heat from escaping. This causes the greenhouse to heat up, and keeps the plants warm enough to live in the winter. The Earth's atmosphere is all around us. It is the air that we breathe. Greenhouse gases in the atmosphere behave much like the glass panes in a greenhouse. Sunlight enters the Earth's atmosphere, passing through the blanket of greenhouse gases. As it reaches the Earth's surface, land, water, and biosphere absorb the sunlight's energy. Once absorbed, this energy is sent back into the atmosphere. Some of the energy passes back into space, but much of it remains trapped in the atmosphere by the greenhouse gases, causing our world to heat up.

The greenhouse effect is important. Without the greenhouse effect, the Earth would not be warm enough for humans to live. But if the greenhouse effect becomes stronger,

it could make the Earth warmer than usual. Even a little extra warming may cause problems for humans, plants, and animals.

Climate System

- Atmosphere : The atmosphere covers the Earth. It is a thin layer of mixed gases which make up the air we breathe
- Oceans : Oceans cover about 70 percent of Earth's surface.

[The atmosphere and ocean constantly exchange energy and matter. For example, water evaporates from the oceans into the atmosphere. This moisture then falls back to the Earth as precipitation – rain, snow, sleet, and even the morning dew on the grass]

- Land : Land covers 27 percent of Earth's surface, and land topography influences weather patterns. For example, the weather in areas covered by mountains can be completely different than the weather in areas where the land is mostly flat.
- Ice: Ice is the world's largest supply of freshwater. It covers the remaining 3 percent of Earth's surface including most of Antarctica and Greenland. Because ice is highly reflective and because of its insulating properties, ice plays an important role in regulating climate.
- Biosphere: The biosphere is that part of Earth's atmosphere, land, oceans that supports any living plant, animal, or organism. It is the place where plants and animals, including humans, live. Large quantities of carbon dioxide are exchanged between the land-based

biosphere and the atmosphere as plants take in carbon dioxide and give off oxygen, and animals inhale oxygen and exhale carbon dioxide

History of Climate Change

- Earth's climate has been changing constantly over its 5-billion-year history. Sometimes, the climate has warmed so that the oceans have risen and covered much of the Earth. Each of the changes may seem extreme, but they usually occurred slowly over many thousands of years.
- Recent Climate History : The Earth has warmed about 1°F in the last 100 years. The eight warmest years on record (since 1850) have all occurred since 1998, with the warmest year being 2005. Periods of increased heat from the sun may have helped make the Earth warmer. But many of the world's leading climatologists think that the greenhouse gases people produce are making the Earth warmer, too.

Climate Forecast

Special computer programmes indicate that the Earth may continue to get warmer. Together, the melting glaciers, rising seas, and computer models provide some good clues. They tell us that the Earth's temperature will probably continue to rise as long as we continue increasing the amount of greenhouse gases in the atmosphere.

Melting Glaciers: a glacier is a large sheet of ice that moves very, very slowly. Many glaciers in the world are now melting. For example, glaciers are melting in the Himalayas.

Some scientists think the glaciers are melting partly because the Earth is getting warmer.

Rising Sea Level: Over the last 100 years, the level of the sea has risen about 6-8 inches worldwide. When the sea level rises, the tide goes farther up the beach. Scientists think the sea has risen partly because of melting glaciers and sea ice. When some glaciers melt, they release water into the sea and make it higher than it was before. Scientists also think that warmer temperatures in the sea make it rise even more. Heat makes water expand. When the ocean expands, it takes up more space.

Can We Change Climate

It may seem hard to believe that people can actually change the Earth's climate. But scientists think that the anthropogenically generated greenhouse gases emitted into the air are making our planet warmer.

- Once, all climate changes occurred naturally. However, during the Industrial Revolution, we began altering our climate and environment through agricultural and industrial practices. It started more than 200 years ago and changed the way humans live. Before the Industrial Revolution, human activity released very few gases into the atmosphere, but now through population growth, fossil fuel burning, and deforestation, *we are affecting the mixture of gases in the atmosphere*. Since the Industrial Revolution, the need for energy to run machines has steadily increased.
- *Whenever we* Watch TV · Use the Air Conditioner · Turn on a Light · Use a Hair Dryer · Ride in a Car · Play a Video Game · Listen to a Stereo · Wash or Dry Clothes in washing machines · Use a mechanized Dish

Washer · Microwave ovens ... *we are helping to send greenhouse gas into the air, because to perform many of these functions, we need to use electricity which comes from power plants which run on fossil fuels such as coal and oil , and generates greenhouse gases when burning them.*

- Among the other major anthropogenic sources, the municipal solid waste (MSW) that we send to landfills produces a greenhouse gas called methane. Methane is also produced by the animals we raise.

Climate Change and Environment

What Might Happen?

Some changes brought about by climate change will be good. For very cool climate, warmer temperatures might be welcome. Days and nights could be more comfortable and people in the area may be able to grow different and better crops than they could before. But it is also true that changes in some places will not be very good at all. . If temperatures rise above normal levels for a few days, it's no big deal – the Earth will stay more or less the same. But if temperatures continue to rise over a longer period of time, then the Earth may experience some problems.

Average global temperature has increased by almost 1°F over the past century; scientists expect the average global temperature to increase an additional 2 to 6°F over the next one hundred years. This may not sound like much, but it could change the Earth's climate as never before. At the peak of the last ice age (18,000 years ago), the temperature was only 7°F colder than it is today, and glaciers covered much of North America!

Even a small increase in temperature over a long time can change the climate. When the climate changes, there may be big changes in the parameters of life that people depend on such as:

Human Health

Climate change may affect people's health both directly and indirectly. For example, heat stress and other heat related health problems are caused directly by very warm temperatures and high humidity. Untreated, heat stress can be a very serious medical problem. Indirectly, ecological disturbances, air pollution, changes in food and water supplies, and coastal flooding are all examples of possible impacts that might affect human health. Some people and places are likely to be affected more than others. *Generally, poor people and poor countries are less likely to have the money and resources they need to cope with preventing and treating health problems. Very young children and the elderly adults will run the highest risks.*

Ecological Systems

Climate change may alter the world's habitats and ecosystems – all living beings are included in and rely on these places. Many of these places depend on a delicate balance of rainfall, temperature, and soil type. A rapid change in climate could upset this balance and seriously endanger many living beings. Most past climate changes occurred slowly, allowing plants and animals to adapt to the new environment or move somewhere else. However, if future climate changes occur rapidly, plants and animals may not be able to react quickly enough to survive. The ocean's ecosystems also could be affected for the same reasons.

Sea Level Rise

Global warming may make the sea level become higher. Sea level may rise from several centimeters to as much as 1 metre during the next century. This will affect both natural systems and manmade structures along coastlines. Coastal flooding could cause saltwater to flow into areas where salt is harmful, threatening plants and animals in those areas. Oceanfront property would be affected by flooding, and beach erosion could leave structures even more vulnerable to storm waves. Whether we move back from the water or build barricades in the face of a rising sea, it could entail huge costs to adapt to such change. Coastal flooding also may reduce the quality of drinking water in coastal areas.

Crops and Food Supply

Global warming may make the Earth warmer in cold places. People living in these places may have a chance to grow crops in new areas. But climate change also might bring droughts to other places where we grow crops. In some parts of the world, people may not have enough to eat because they cannot grow the food that they need.

What can be done

All out awareness development through :

- **Reading (Self awareness)**
- **Talking to Family and Friends (community awareness)**
- **Saving Electricity**
- **Biking , Using Public Transports such as Bus, and Walking**
- **Planting Trees**

- **Recycling** : Bottles, plastic bags, cans and newspapers. When we recycle, we send less MSW to the landfill and we help save natural resources, like trees, oil, and elements such as aluminium.
- **Buying Energy Efficient (= Cool !!) Merchandise:** One of the ways to reduce the amount of greenhouse gases that we put into the air is to buy products that don't use as much energy. Some products – like certain cars and stereos, electric lamps etc. – are made specially to save energy.
- **Using Solar Energy** : Solar energy can be used for homes, buildings, water, and to make electricity.
- **Using Environment Friendly Automobiles:** Cars are an important part of life for most people. But cars also cause pollution and release a lot of greenhouse gases into the air. Fortunately, there are some cars that are better for the environment. These cars can travel longer on a smaller amount of gasoline. They don't pollute as much, either. Using these kinds of cars can help reduce the amount of greenhouse gases in the air.
- **ENERGY STAR®**
Many items such as, computers, TVs, stereos, and VCRs, have special labels on them. The label says "Energy" and has a picture of a star. Products with the ENERGY STAR® label are made to save energy. Buying products with ENERGY STAR® labels will help protect the environment

Further Activities

- **New materials development:** Materials which help combat climate change include silicon which is the

prime material for solar cells. Also there are materials such as advanced zeolites which help capture carbon dioxide. NEERI is working on new materials development. NEERI is also working on the assessment of Greenhouse gas emission and impact such as from MSW landfills and domestic and industrial activities in India.

- There has been international collaboration also through which the enhanced carbon dioxide capture is envisaged. India is party in one such experimental activity. Termed “Lohafex” (*Loha* in Hindi and *Fe* in Latin mean iron) the experiment is an Indo-German experiment in which a part of the South Atlantic (east of southern Argentina) ocean will be seeded with iron sulphate which will enhance growth of planktons in the ocean water , which in turn will help absorb carbon dioxide and release oxygen through the well known photosynthesis route.

Conclusion

Climate Change issues have, presently, become the foremost challenges endangering the survival of the earth. Although geological and anthropogenic activities have been identified as the chief contributors to the phenomenon, the latter calls for and is amenable to control and reduction. A concerted global action plan is needed to effectively combat the problem. Awareness development and focussed development planning are the needs of the hour.

The Blind Carrying the Lame: Nuclear Power Programme and Opposition in Southernmost India

S. P. Udayakumar

The Indian state has embarked upon a very ambitious nuclear power generation plan to gain what they variously call ‘energy security’ and ‘energy independence.’ The Department of Atomic Energy (DAE) has set a target to produce 20,000 MW power from nuclear power plants by the year 2020 and to reach the ultimate goal of generating 40,000 MW nuclear power soon after. As part of the massive expansion plan, the Indian state is setting up more nuclear power plants all over the country and seeking funds, fuel and futuristic technology from all possible sources. Koodankulam, a coastal village on the Gulf of Mannar near the southernmost tip of India, is one such nuclear site where the Nuclear Power Corporation of India Limited (NPCIL), a subsidiary of the DAE, is setting up two 1,000 MW light water reactors with Russian technology and loan.¹ The department has proposed to set up six more nuclear reactors at Koodankulam. Although there are some people who are enthusiastic about the jobs, other economic opportunities and the overall development of the region that the Koodankulam project may bring about, many people are very concerned about the dangers the nuclear power plants may pose to the local environment, the livelihood of the local people and their health and safety.

Although anti-nuclear sentiments and activities were not hitherto totally unknown in the southernmost tip of India,² and the area woke up to the nuclear reality in 1988 when the

Koodankulam project was first proposed, the conflict between the Indian state and the anti-nuclear movements has been rather dormant. There have been intermittent encounters between them with mixed results. A study of this conflict assumes great importance in the light of the contemporary fusion of issues such as energy, development and environment; the present-day articulations on human security and human development; the current trends of the globalizing world reposing greater faith in violence in the form of terrorism and militarism; and the popular struggles across the world to create, preserve and nurture the democratic spaces in the wake of various assaults. The task here is to see if and what we can learn from the Koodankulam struggle. Locating myself at the interstices between the Indian state and the local civil society, I try to look at the conflict both as a student of social sciences and as an anti-Koodankulam and anti-nuclear activist.³ Attempting to understand the conflict parties' assumptions, perceptions and values, and the overall dynamics of the conflict, I seek to probe the nature and scope of anti-nuclear movements in India today by bringing in some of my own personal activist experiences and discern the possible lessons the anti-nuclear movements in other parts of India could derive from this case.

Background to the Conflict

The southern districts in Tamil Nadu have been plagued by communal disturbances and caste clashes for many years. For instance, Kanyakumari district, the southernmost tip of India, witnessed violent communal clashes in the early 1980s. There were attacks and counter-attacks, reprisals and retaliatory actions between Christians in the coastal villages (*Mukuvar* caste) and the inland Hindus (especially *Nadar* caste). The Venugopal Commission that inquired into the 1982 communal riots in Kanyakumari summed up the situation succinctly:

It is the socio-economic problem arising out of deprivation, unemployment, hunger, squalor, lack of proper housing facilities and civic amenities, operating against the background of anger and discontent with an increasing population and overcrowding towns and villages, which is the main reason behind these clashes in Kanyakumari district. With the rising socio and political consciousness, everybody expects that the more the better. The economy and infrastructures are not keeping pace quantitatively and qualitatively with the increasing demands. More hands are grasping at the limited opportunities available in Kanyakumari district. ...The level of spread of violence and frustration will keep increasing unless the phase and pattern of development are able to meet the growing expectations of rising numbers. Generating full employment and containing the growing regional and sub-regional disparity, hold the key to solve the problem and pave the way for communal harmony and peace in the District on a permanent basis.⁴

The Ratnavel Pandian Commission that was set up some two decades later to investigate the growing incidence of communal disturbances and caste clashes in the southern districts of Tamil Nadu also came up with similar conclusions. It concluded that the southern districts in Tamil Nadu should have more development which in turn would create more employment and economic opportunities for the young people, thereby weaning them away from anti-social behavior. The authorities have used this pro-development reasoning to implement the Koodankulam nuclear power plant, Sethusamudram canal project, Colachel commercial harbor, Nanguneri high-tech park (a Special Economic Zone), and many other smaller projects in the southern tip of India.

The Rajiv Gandhi government in New Delhi signed the Koodankulam nuclear power project deal with Mikhail Gorbachev on November 20, 1988, barely two years after the nightmarish Chernobyl accident that took place on April 26, 1986. Due largely to a handful of social activist groups such as *Samathuva Samudaya Iyakkam* (Movement for Equitable Society), public opinion was mobilized against the nuclear power plant and Rajiv Gandhi was forced to put off the foundation laying ceremony that had been planned for December 19, 1988. Between 1989 and 1991, the situation changed rapidly as the Soviet Union collapsed, Gorbachev lost power and Rajiv Gandhi (who had been out of power) was assassinated. Consequently, the Koodankulam project was shelved until March 1997 when Prime Minister Deve Gowda and Russian president Boris Yeltsin signed a supplementary deal to the 1988 agreement. The anti-Koodankulam campaign was also revived slowly with talks and seminars on the issue organized by several groups such as the National Alliance of People's Movements (NAPM), and the nuclear weapons issue was also included in the anti-nuclear agenda of the local social movements ever since the May 1998 nuclear tests (Pokhran II) of the Vajpayee government. What had started off as NIMBYism (Not In My Backyard) became a more comprehensive and principled movement. But still Koodankulam continued to be the rallying point against nuclear plants as it provided immediacy and a sense of urgency and focus. The *Anumin Nilaya Ethirpu Iyakkam* (Nuclear Power Project Opposition Movement) was created on November 14, 1999 at Nagercoil and a sporadic and small-scale mobilization continued. When Prime Minister A. B. Vajpayee signed the final agreement on the Koodankulam Nuclear Power Project on November 6, 2001, a broad umbrella organization called the People's Movement Against Nuclear Power (PMANP) was

founded at Madurai on November 10, 2001⁵ to spearhead the struggle against the Koodankulam nuclear power plant.

The state elites largely ignore the facts that mega “development” projects such as the Koodankulam nuclear power plant would hurt the ecological balance of the sub-region, give rise to environmental and health hazards, and undermine the rights to life and livelihood of the farming and the fishing communities alike. For the elites, development means economic growth reflected in enhanced statistical aggregates and not the cumulative pursuit of happiness of individual citizens and communities. In their short-sighted scheme of providing larger economic good for the largest number of people, sociological and environmental consequences matter little. Most importantly, the mega “development” projects with huge budgets and overlays have been quite appealing for the state elites as these projects provide substantial economic incentives in the forms of contracts, commissions, and kickbacks.

For many of the poverty-stricken villagers, however, mega “development” projects look appealing as they could increase the value of their land, create jobs for their children, generate more economic opportunities, bring more visibility, attention and resources to their communities, and enhance the overall development of their area. As far as the Koodankulam project is concerned, the mostly illiterate and semi-literate rural people in southernmost India, are largely unaware of the consequences of nuclear power plant accidents or an attack or a nuclear war. When the patriarchal state thrusts “development” projects down their throats in a high-handed manner with little public participation or democratic dialogue, the relatively privileged top layer of the rural societies plays along (and seeks to make the best out of the situation), and others passively

acquiesce due largely to the we-cannot-fight-the-government or why-should-I-stick-my-neck-out and other such apolitical attitudes that are prevalent in the contemporary Indian political culture today.

There are also fissiparous tendencies in the civil society of this complex peninsular tip sub-region. Although many local farmers (mostly *Nadar* caste) in and around Koodankulam are enthusiastic about the development-enhancing potentials of the nuclear power plant, nuclear fears run very high among the coastal fishing communities (*Mukuvar* caste). They are afraid of plant interference in fishing, disposal of the hot and radioactive coolant water into the sea, overall impacts on fish and marketing, and even eventual evacuation from their native villages. Similarly, many people in southern Kerala do not seem to be mindful of the fact that Koodankulam is quite close to them and the state boundaries could not possibly insulate them from any nuclear catastrophe on the other side of the border. Muslims, another significant section of the civil society in southernmost India, also tend to keep away from sensitive issues such as the Koodankulam power plant. Either this largely business-oriented community thinks that their predominant business interests may be jeopardized by social and environmental activism or they are afraid that such activist initiatives could be wrongly interpreted as disguised Islamist politics or even acts of terrorism by the authorities. The student community and the non-student youth of Tamil Nadu and Kerala are held back by the celluloid world, caste and religious associations, and partisan party politics. The self-centered urban middle classes are so busy climbing up the economic ladder that they fail to see that the bottom of the ladder is on fire.

Only the coastal communities are more informed about and care for the environmental impacts of many of the “development” projects of the Indian state. The state of Tamil Nadu has a 1,000-km-long coastline comprising 442 fishing villages which is 17.4 percent of India’s coastline. The Tamil Nadu coastline is divided into four zones: the 350-km-long Chola zone extending from Chennai to Thanjavur district; the 270-km-long Palk Bay from parts of Thanjavur to Ramanathapuram; the 320-km-long Gulf of Mannar between Ramanathapuram and portions of Kanyakumari district; and the 60-km-long western zone comprising the rest of Kanyakumari district. Both the southern zones are adversely affected by the sea sand-mining operations and will bear the brunt of the Koodankulam and the Sethusamudram projects. Though the coastal communities’ contribution to the economic vibrancy, and nutritious food intake of the local people is quite significant, other sections of the civil society often overlook this and perceive the coastal communities’ concerns as narrow and parochial.

In spite of all these intricacies and complexities, the Koodankulam conflict is very much there on the socioeconomic-political radar of the southern tip of India. However, the Indian state elites, like the proverbial cat that closes its eyes and assumes that the whole world is dark, tend to conceal the conflict. Incredible as it may be, the state abhors any opposition to a “development” project as anti-national and even unpatriotic. The state ignores or intimidates the unorganized and self-motivated dissenters, tends to violate even the democratic rights of the dissenters and seeks to neutralize the situation in its favor. The local civil society in the southern tip of India, on the other hand, is rather preoccupied with its internal dynamics and is confused about the conflict, like a dog chasing its own tail. The conditions are not yet ripe for the

Koodankulam conflict to reach a climax as the cat is in the 'dark' and the dog is going in a circle.

At this point, it is also pertinent to consider the characteristics of social movements in India in general. Gail Omvedt posits that most social movements in India today draw upon the 19th century ideologies such as Gandhism of elite nationalism and the Dalit-Bahujan ideology of anti-caste movements. Marxism, on the other hand, is stuck in left nationalism (with an outmoded dependency theory approach) and has little to offer the masses who desire sustainable development. So it is neo-Gandhism, in alliance with the dependency theory of Marxism, which is providing themes for most oppositional movements today. Given this situation, Omvedt claims that there is a need for a new social vision—an all-encompassing ideology to inspire and lead new social movements.⁶ In reality there is a call for such new social movements in India. The rural and agricultural India is in “deep and continuing distress” with rising unemployment, falling gross food grains output, loss of purchasing power because of the state’s reduced spending on rural development, falling per capita food grains absorption (which is now one of the lowest in the world at around 154 kg for India as a whole, lower still in the villages of India) and declining per capita caloric intake. Due to rising costs of production but falling global commodity prices due to trade liberalization, farmers have descended into deep debts, lost assets including land, and more than 9,000 farmers have committed suicide across the country since 1998. It is indeed true that “rural India is crying out for work and food.”⁷ In the midst of this struggle for survival, cries for human security, better health, environmental safety, and sustainable development are quite weak. So it is no wonder why anti-nuclear or peace movements are not pervasive or powerful in contemporary India.

Scholars have already pointed out the difficulties involved in taking on nuclearism because of the fact that the nuclear technology is shrouded in secrecy and sustained by state control. Robert Jungk established in the late 1970s that the arrival of nuclear fission opened up new dimensions of terror and the quest for 'total immunity' from the risks of nuclear power necessitated surveillance, prohibitions and constraints in the society. Jungk concluded that a nuclear state would inevitably tend towards totalitarianism.⁸ Writing about the Indian nuclear program almost two decades later, Itty Abraham asserted that the atomic program was presented by the Indian scientific and political elite as the postcolonial state's project of modernity. The Indian nuclear program became shrouded in secrecy "since it had been admitted, or rather could not credibly be denied; that the atomic energy program would aid India's defense."⁹ Praful Bidwai and Achin Vanaik posit that "the nuclear obsession of the ruling elites in a handful of states has proved thoroughly addictive and almost irresistible to change" but it has recently begun to weaken or loosen. They contend further that there are no easy solutions to force the states to move away from a pathological and misguided reliance on nuclearism in their search for security. Combining the moral concerns and the commitment to universal objectives such as nuclear disarmament, defense of human rights and social justice, we need to have strong Southern input into the global struggle for nuclear disarmament. Such a movement, according to Bidwai and Vanaik, "must be truly internationalist in outlook, concerns, reach and representation." In this struggle, denuclearization and democratization become inseparable processes.¹⁰

Most research and writing on states and anti-nuclear movements look at various state actions that contribute to the

emergence and development of anti-nuclear movements, or state structures that influence movement strategies and policy outcomes.¹¹ However, the interactive perspective adopted in the book *States and Anti-Nuclear Movements* focuses on the interactions between the state and the anti-nuclear movements rather than exclusively on state structures, political elites, national policies or resource constraints and so forth. This interactive approach “pin-points outcomes as they are realised within and around different conflict arenas” and helps us trace “the actual impact of an anti-nuclear movement on the formulation, decision-making and implementation phases of policy-making.” This interactive comparative focus helps to determine which specific policy outcomes can be attributed to the anti-nuclear movement and which ones are the results of national policy, elite support, or the open state structures themselves. The interactive outcomes can be studied from the political economy perspective also which sees them as attributable to factors such as energy resources endowment, techno-industrial structures, and military interests in nuclear energy etc. From such an analysis, we can understand whether or not the movement-state interactions have made any discernible impact.¹²

The study of encounters between states and anti-nuclear movements in *States and Anti-Nuclear Movements* formulates a few hypotheses with regards to the impacts the encounter dynamics could have on the movement and policy. The more protracted a conflict or the greater the socialization of the conflict with greater number of encounters and arenas, the more likely it is for a movement to achieve some policy modifications and some of its goals. With respect to impacts on the movement, the state elites play a crucial role. If they adopt a tolerant and flexible conflict-handling style, the less likely it is for a movement to resort to confrontational or violent politics.

On the other hand, if the state elites are closed to debate with a relatively small number of direct encounters and arenas allowing for the participation of the movement, it is more likely that the state elites would respond with the use of force and may cause a movement to demobilize and/or withdraw from the streets.¹³ The case-studies in *States and Anti-Nuclear Movements* probe the question “whether and to what extent the particular, national anti-nuclear movements actually posed a challenge to the polity during the ongoing conflict, and whether any changes in the polity resulted from their activities.”¹⁴ Although the anti-nuclear movement in southernmost India is still in the nascent stages and the Indian state elites simply do not even acknowledge the anti-nuclear sentiments of the local civil society or recognize the fledgling oppositional movement, it can be illuminating to test the present case with the hypotheses that we have listed above. Moreover, this case study also seeks to identify the agents involved in the present conflict and see if the above interactive approach could help us delineate the interaction dynamics of the early stages of the conflict, probe the future scope and nature of their potential encounters and the arenas of their contestations, and finally discern the preconditions for the movement-state interactions to influence the policy outcomes.

The State Elites and Conflict Concealment

The state elites who comprise both structural and dynamic elements of the state also include the “nuclear experts.” The Indian nukedom, that claims to be enhancing the country’s scientific and technological prowess and contributing to national security and energy independence, has always had an air of supremacy and inviolability. This Gaborian thinking holds that science means “the application of man’s reasoning power to ways for achieving his aims” and divides humans into “cyclic” and “acyclic” men, or “common” men and “dedicated

world-improvers.” According to Dennis Gabor, the British physicist who won the Nobel Peace Prize in 1971, “the common man may be less used to balancing complicated rational arguments against one another than the highly educated man.” On the contrary, “[s]cience sprung first from the urge of exceptionally gifted men to exercise their mental powers.” Gabor contends that “a stable but progressive society can exist only if the ”cyclic” type is common, and the other is rare.” In this society, “*True* science will provide congenial work for uncommon men and women as far as thought can reach.” However, there is one predicament for “the social inventor” in this process and that is the need for “the engineering of human consent.”¹⁵

Encountering difficulties in “the engineering of human consent” because of “social activists,” an Indian technocrat probes “the contrarian views of social activists and technologists,” to conclude that “social activists are among the most significant impediments to rational development.” He tabulates these “contrarian views” as below:

The Adversarial Relationship between Social Activists and Technologists

Social Activists	Engineers and Administrators
Insist on zero-cost solutions	There is no free lunch
Single issue activity	Should consider all ramifications
Not responsible for resultant problems	Responsible for all consequences
No hesitation to break the Law	Constrained to act within the law
Offer impractical solutions	Must make their designs work
Opposed to innovation	Experiment with technology
Seek to avoid poverty	Try to generate wealth
Have high communication skills	No communication skills

Talking of ecologists, this writer argues, “It is even debatable whether their methods will bring prosperity to the

people whose cause they claim to espouse – they are more likely to perpetuate their present dismal poverty.”¹⁶ The worldview of these Gaborian scientists and technocrats is obvious. There are two forces in the world. They are on the “right” side with privileged access to the scientific “Truth” through colonial education, the military-industrial-academic complex, and political patronage; the innate knowledge and wisdom and, most importantly, the divinely ordained duty of guiding the rest of the society to a scientific salvation. These modern messiahs as much as their cohorts from the military, political, bureaucratic, and economic constituencies with pronounced self-interests in continuing the science and technology programs are quite important actors in the ongoing neo-colonial scheme and they appropriate the larger nation-building task to themselves for obvious selfish goals and gains. They are blind (or deliberately choose to turn a blind eye) to social costs, environmental consequences, future liabilities, and other such externalities of their modern development scheme.

Although independent India’s Atomic Energy Commission (AEC) was set up in August 1948 in the new Department of Scientific Research, it was only on August 3, 1954 that the fully-fledged Department of Atomic Energy (DAE) was created under the direct control of the Prime Minister through a Presidential Order. The Atomic Energy Commission (AEC) was absorbed by the DAE by a Government Resolution of March 1, 1958. Just three months after the DAE was established, Prime Minister Jawaharlal Nehru unequivocally declared in a conference on ‘Development of Nuclear Power for Peaceful Purposes’: “We want to utilise atomic energy for generating electricity because electricity is most essential for the development of the nation.” In 1950 India was producing a meager 1,800 MW power but now a generating capacity of 127,000 MW has been installed.¹⁷

Almost all of this is thermal and hydropower, with the share of nuclear power an insignificant 2,770 MW, hardly 2.5 percent of the total energy output. The DAE failed to achieve their target of producing 10,000 MW of power by the year 2000 and the new plan is to produce 20,000 MW power by 2020. Although the DAE keeps promising the nation big things such as fast breeder reactors using thorium as fuel, and constructing advanced heavy water reactors (AHWRs) and so forth, the fact of the matter is most of the 14 units (two at Tarapur in western Maharashtra state, four at Rawatbhatta in western Rajasthan state, two at Kalpakkam in Tamil Nadu, two at Narora in northern Uttar Pradesh, two at Kakrapar in western Gujarat and two at Kaiga in southern Karnataka) are beset with technical problems and are operating at well below full capacity.

The safety of the DAE's nuclear installations is supposed to be overseen by the Atomic Energy Regulatory Board (AERB) set up in November 1983. However, it is not really independent of the DAE as the AERB reports to the AEC whose head is also the head of the DAE. When A. Gopalakrishnan, the AERB Chairman from 1993 to 1996, submitted the Safety Issues Report that ordered several procedures and corrective actions in Indian nuclear installations, "the BARC [Bhabha Atomic Research Centre] management refused outright to comply with [them]."¹⁸ In fact, in April 2000, R. Chidambaram, then secretary of DAE, simply took away the authority of the AERB to oversee the safety of a large number of critical nuclear installations meant for the weapons program in the BARC. An Internal Safety Committee set up by the BARC director became responsible for ensuring the safety of the public and the workers from dangers that could emanate from these facilities. Thus there is a strong basis to be concerned about the safety of the DAE reactors. What makes the Koodankulam project's Russian-made VVER-1000 (*Vodo-*

Vodyannoy Energeticheskoy Reactor; water-cooled and water-moderated) reactors even more disconcerting is the fact that neither the DAE nor the AERB have had any experience with them. According to technical experts, there are grave and serious unresolved technical and safety questions with the VVER reactors such as the embrittlement of the reactor pressure vessel (RPV), failure of control rods to insert properly during an emergency, and steam-generator problems, etc.

However, the DAE does not see the need to inform the public anything about the Koodankulam project. The DAE's secretive, opaque, exclusivist, and extra-Constitutional functioning has had legal sanction also. Section 3 of the Atomic Energy Act 1962 (the "Act") enables the Central Government "to declare as 'restricted information' any information not so far published or otherwise made public" and "to declare as 'prohibited area' any area or premises" where "production, treatment, use, application or disposal of atomic energy or of any prescribed substance" is carried out. Leaping much further, section 18 (restriction on disclosure of information) restrains nuclear information sharing even more stringently. To make matters worse, the Supreme Court ruled in January 2004 that the Central Government had every right to maintain secrecy about nuclear installations and deny public information about them in the interest of national security, which was considered a paramount goal. Although the Indian Constitution guarantees access to information vide Article 19(1)(A), these are, according to the court, subject to reasonable restrictions in the interest of national security. Rejecting a petition by the People's Union of Civil Liberties (PUCL) and the Bombay Sarvodaya Mandal for making public a government report on safety of nuclear installations, submitted by the AERB to the Delhi government in November 1995, the Court ruled that the petitioners were "not entitled" to obtain the document since it

has been declared “secret” by the Union Government under Section 18 of the Act.

It is important to note that the petitioners did not ask for any information about India’s nuclear arsenal or storage sites, and they merely expressed a genuine concern that there were not enough safety precautions in nuclear power stations in the country and stated that any accident could have a disastrous effect on human beings, animals, and the environment and ecology of surrounding areas. The Atomic Energy Act allows arbitrary suppression of all information, an act dubbed by senior legal personalities in the country as patently unconstitutional. The DAE is easily one of India’s most secretive departments and has much to hide: uranium mining hazards in Jadugoda, excessive irradiation of power-plant workers, waste mismanagement, numbers regarding explosive yields, and so forth.

Without any transparency, accountability, parliamentary oversight or popular scrutiny, and with unlimited funding, a ‘sacred cow’ status, an innocuous ‘science and technology’ label, and the ‘national security’ jingoism, the DAE is an undemocratic department. By making it possible for the DAE fraternity to keep several “incidents” and “accidents” under wraps and to persist with the authoritarian tendencies and practices, the Atomic Energy Act clearly undermines India’s democratic heritage. There is an added danger now that the DAE is looking into ways of making amendments in the Act in order to have private participation in the future nuclear power programs. Talking to reporters after inaugurating the Reverse Osmosis Plant and participating in the “Bhoomipooja” for the construction of turbine building and other civil structures at Koodankulam on August 1, 2002, the chairman and managing director (CMD) of the Nuclear Power Corporation of India

Limited (NPCIL) V. K. Chaturvedi said that NPCIL's proposal in this regard was under the consideration of the Central Government. An amendment to the Atomic Energy Act is said to be under consideration at various levels of the government. Once the amendment is passed in the Parliament, rich power barons could invest in the nuclear power program and reap high dividends while the Indian state would subsidize nuclear research, enrichment of fuels, disposal of nuclear wastes, and decommissioning of plants with public funds.

In the wake of this privatization move, it is important to consider the track record of the NPCIL and the overall Indian nuclear establishment. The NPCIL was incorporated in 1987 and it presented a maiden dividend cheque of Rs. 50.44 crores to the Prime Minister on December 1, 1999. According to NPCIL's five years' balance sheet (1994-95 to 1998-99), Rs. 92,425.78 millions (almost Rs. 9,243 crores) had been used up by the corporation. If we include all the expenses that the country has incurred on behalf of the Indian nukedom from 1948 till 1994, the total cost for installing the current power generating capacity of the Indian nuclear establishment would be quite mind-boggling. And it is certainly not an exaggeration to claim that the civilian nuclear program in India has been money guzzling and inefficient.

The Koodankulam Nuclear Power Project has neither conducted any legally-mandated public hearings nor has it shared the Environmental Impact Assessment (EIA) or Environmental Impact Statement (EIS) with the public. On February 28, 2002, the Conservation of Nature Trust of Nagercoil organized a one-day seminar on "Health Hazards of Radiation" at Nagercoil and one of the invitees was S. K. Agrawal, the director of the Koodankulam Nuclear Power Project. We talked to him about the possibility of the

Koodankulam reactors adding more radiation to the region that is beset with a high amount of background radiation caused by the indiscriminate sea sand-mining of the Indian Rare Earths Limited and other private operators such as V.V. Minerals for thorium, bauxite, ilmenite, garnet and other such rare minerals. We also highlighted the fact that the sand-mining region between Chavara in Kerala and Thoothukudi in Tamil Nadu had been suffering from a very high incidence of cancer. In response, Agrawal casually pulled out a piece of paper from his pocket, drew an X-Y axes graph on it and identified the current level of radiation close to the X-axis without identifying what the axes signified. Redrawing on the same line once again, Agrawal reassured us that the level of radiation would be the same even after the Koodankulam plants started working. Later in the day, Dr. R. Ramesh of Doctors for Safer Environment (DOSE) and I confronted Agrawal on the stage asking why they were not sharing the Environmental Impact Assessment (EIA) that is said to have been done in 1988 (for a project that is going to go critical in 2007), the Koodankulam site evaluation study and the safety analysis report with the public. After much ducking, dodging, and dilly-dallying, Agrawal undertook publicly and on record that he would share the EIA and the site evaluation report with us and that he would let a few of us see the safety analysis report in their Mumbai office. On February 29, 2002 a few of us were shown around the Koodankulam project site by S.K. Agrawal and when I asked him about the reports that he had undertaken to share with us, he said he was going to Mumbai the next day and would give the reports as soon as he came back. Despite repeated reminders by Dr. R.S. Lal Mohan, another member of our group, Koodankulam authorities have not shared any of these reports with us or anyone else.

The Koodankulam project claims to have obtained (a backdoor) clearance from the Ministry of Environment and Forests in Delhi to set up two 1000 MW nuclear reactors. But the nuclear establishment keeps on adding more reactors to be set up in Koodankulam. The decision-making process is unfortunately not a transparent one. Such conduct on the part of the DAE is not limited only to Koodankulam. On July 27, 2001 a public hearing was held at the Kanchipuram District Collector's office to let the public decide if they wanted the Prototype Fast Breeder Reactor (PFBR) at Kalpakkam (near Chennai). Except the first speaker, who also later turned against the proposed project, everybody opposed the project vociferously. But the central government sanctioned Rs. 3,600 crores for the same project and Prime Minister Manmohan Singh himself inaugurated the construction of the PFBR plants on October 23, 2004. In other words, the public hearing was treated as a perfunctory part of the process. It is pertinent to note that the 100x100 meter foundation pit of this PFBR plant was inundated by the tsunami of December 26, 2004, and *Kumudam*, a reputed Tamil weekly, reported in its February 14, 2005 issue that some 150 construction workers from northern India were killed in the pit. While the Kalpakkam project director claimed that no one died in the tsunami, the magazine quotes reports of the dead bodies being secretly cremated and demands the truth from the DAE.

It is also equally disconcerting that no political party or politician in India would take the DAE to task about its commissions and omissions. Almost all the political parties in India have similar understanding of 'development' and 'national security' and hold the same belief that the DAE is an agency for the development and security of the country. Hence they hesitate to challenge the status quo. I met a few Members of Parliament (MP) in October 2004 and in March 2005 in New

Delhi to lobby against the Koodankulam project. When I called on a prominent Congress MP and former cabinet minister from Tamil Nadu, he was on his morning workout. After listening to me frostily, he said that humans die either in their sixes (*aaru* in Tamil) or by the hundreds (*nooru* in Tamil) and hinted that the possible dangerous scenarios I was referring to should not be taken seriously. Impervious to the contradiction between his insensate statement on the insignificance of human longevity and his rigorous workout, he was sure that the scientists would take care of the safety of the plants and that was what we should ask for. Another Marxist MP from Tamil Nadu declared characteristically that if one were to ask him whether the youth of the country should starve without employment or die after working for ten days, he would prefer the latter option. He lectured me about radiation from TV sets, cell phones and computers, and when I pointed out the difference between these types of radiation and the ionizing radiation from nuclear plants, the irate MP butted in saying he knew all about it. In my interactions with some thirty MPs from Tamil Nadu and Kerala, I was quite surprised to find out that most of them seemed to know very little about the DAE, the weaponization program, or the nuclear power issue. Several MPs pointed out the need to consult with their party high command before they could take a stand on the nuclear issue; and only two MPs were keen on raising a question in the parliament and asked me to provide them with more information.

So the overall approach of the state elites is that if they ignore the conflict, it will simply cease to exist. The facts that the New Delhi government and the DAE do not share any information about the Koodankulam project with anyone make the local people suspect that it could also be a weapons production and storage facility. After all, Koodankulam is far away from Pakistan and China, and tucked away in a narrow

strait across the powerless island nation of Sri Lanka. When the Hindu right-wing Bharatiya Janata Party (BJP)-led government in Delhi and the Muslim League government in Islamabad carried out nuclear tests, Pokhran-II and Chagai, on May 11, 13 and 28, 1998, their nuclear adventurism, political rhetoric, and military postures threatened to push the people of the Subcontinent back to square one --the communal hatred and violence of the 1930s and 1940s—and to force to start all over again with an additional nuclear danger this time. Strangely enough, the futuristic security plan pushed us all back into the insecure past. In India, the BJP-led government set off the nuclear fireworks with very little strategic thinking or long-term socioeconomic-political forethought and compromised the country's longstanding reputation for emphasizing normative considerations in international affairs. India's rich nonviolence, peacemaking and peacekeeping heritage, adherence to Panchsheela principles, leadership in the Non-Aligned Movement, principled stand on specific issues such as the signing of the Comprehensive Test Ban Treaty (CTBT) and Non-Proliferation Treaty (NPT), and the general resistance to the Western understanding of technologies and development were all abandoned overnight. Seeking admission into the notorious nuclear club and pinning the country's pride on killing capabilities, the then-Indian rulers betrayed their underdeveloped self-image and undeveloped political credulity. As far as the Koodankulam power plant issue is concerned, the state elites have successfully concealed the dangers involved in the project and presented it as a source of employment, security, peace, and development.

The Civil Society and Conflict Confusion

Whether we should establish 'democracy' at the superficial level, or bring about 'social change' at the fundamental level is only the secondary issue for any civil society. What is

primary is the people's responsibility to challenge things and change them. After all, it is the people who participate in the state policies and take part in the gross social injustice.¹⁹ Describing the events in his country as 'cultural revolution,' Vaclav Havel said, "what is most important about this revolution is what the students began with. It is its humanitarian dimension."²⁰ Although India is holding together and moving forward (albeit extremely slowly for some 400 million poor people), the mind-boggling pluralistic nature of Indian society, absence of class-based mobilization or any coherent social vision, lack of positive and charismatic political leadership, and the virtual impossibility of moving this huge 'nation' of more than one billion people (living in 27 cities with a population of one million and above, more than 4,000 towns and some 594,000 villages) to any single political cause are serious impediments to mass mobilization. In the absence of any revolutionary agenda, overt class conflicts have become more acute within the ruling classes between the major segments of industrial and agricultural capital. The oppression of the 'lower castes' has become more intensified. However, "increased mass awareness of civil and democratic rights has led to an opening up of new political spaces in which political movements and parties would be well placed to raise the demands of the backward castes, scheduled castes, *dalits*, *adivasis* and other oppressed sections of society. It is the long-term consequences of this development that will constitute the backbone of future politics in India."²¹

While the Vishwa Hindu Parishad (VHP) workers distributed the radioactive Pokhran-soil as the *prasad* of their nuclear nationalism, the Indian middle class reveled in new-found scientific glory without realizing that this was a copy-cat technology shamelessly lifted from the White Master who had exploded the inhuman atomic bombs almost sixty years ago. While many may still be indifferent to the facts that the nuclear

confrontation produces a perilous arms race, causes an unbearable burden on the national coffers, alarms other neighboring countries, and creates a very messy situation for the entire Subcontinent, most Indians seem to be clear about their priorities. In a survey conducted by *The Hindu* newspaper during September-October 1998, the people of India identified 'population control' (40.51 percent) and 'poverty elimination' (31.29 percent) as the most preferred national goals. Only 20.59 percent of the sample population considered "national security" as the number one national goal.²² But this has not resulted in any kind of spontaneous outbursts of protests or dissension against nuclearism, due mainly to the prevailing indifferent political culture that is marked by remarkable selfishness and submissiveness, poverty, illiteracy, lack of immediacy about the Indo-Pak confrontation in southern India, "nuclear cleansing" of the Indian state by presenting a positive picture about it and so on.

'India' or 'Indians' cannot be reduced to essences as some empiricists and idealists would do, but it is pertinent to point out the centrality of religions in ordering and interpreting life in the Subcontinent. Although misconstrued manifestations of religious enthusiasm are commonplace (which, by the way, render making any essentialist claims ludicrous), the daily transactions of life in India are definitely influenced by religions and the values they preach. Even Jawaharlal Nehru with his secular and modern bent of mind, who called communalism the "greatest enemy of the country," proclaimed to the Parliament once: "only a return to moral and spiritual values could control nuclear energy and save mankind."²³ The "moral and spiritual values" are being replaced by amoral and material values of the globalization era with 'financial security,' 'energy security,' 'national security,' and other such security arrangements for the elites. A highly populated country

like India does have an increasing need for energy, but that energy has to be economical, sustainable and environment-friendly because of the over- and dense-population. We need to spend less (of our national resources) on energy because we have other pressing needs such as health, education, housing, transportation and so forth. We cannot afford the “use and discord” strategy as in nuclear power projects for obvious reasons—among them limited land availability, and future generation’s needs. Our energy projects have to be environmentally friendly because even a small incident can harm, hurt, or kill a huge number of people. But unfortunately, the apolitical trends and tendencies in the Indian civil society are not conducive to influencing the thinking or the functioning of the Indian government or the DAE.

In fact, many of the local *Panchayat* leaders in the Koodankulam area work as subcontractors on the nuclear power project. Most commoners were taken in by the false promises of the DAE that 10,000 jobs would be created by the Koodankulam project and that the locals would gain most. The people of the area also thought that by giving up their land at the low price of Rs. 800-1,200 per acre, versus the typical asking rate of Rs. 75,000 per acre, they would also guarantee their children jobs in the project.²⁴ The southernmost tip of India has been rife with distrust and animosity between the farming *Nadars* and fishing *Mukuvars*. The peasant leaders tend to think that the nuclear power project is a threat mainly to the coastal areas and fishing communities and hence are not overly worried about it. They took greater interest in the Koodankulam project only when their agricultural interests came to be threatened. For instance, the news that the project would draw water from the Pechipparai dam in Kanyakumari district spurred them into swift action such as street protests and a court case against such a move. The fishing communities

are quite aware of the fact that their rights to life and livelihood will be severely hampered when the nuclear project becomes operational. However, these uneducated, marginalized, and economically disempowered people who are torn by internal divisions and dominated by the Catholic Church are not politically proactive. When they participated in a struggle against sea-sand mining operations at Perumanal village a few years ago, the State unleashed brutal violence and pressed serious charges against many men and women. True to the old adage, “once bitten twice shy,” this “Perumanal incident” still holds sway in the local people’s political psyche and thwarts them from engaging in any direct action. Their inability to do anything meaningful about the indiscriminate sea-sand mining operations and the lack of external sympathy or help with the nuclear power project situation have only compounded their sense of resignation. The devastating tsunami of December 2004 has sealed their fate even more irrevocably.

The student community that has the potential to play an active role in any social movement is also largely apathetic today because of the ever increasing demands for more and more specialized skills and the prove-your-worth logic of the globalized market. Increasing costs of education, heavy competition for educational and employment opportunities, and the peer pressure to do well in life along the “our way of life” American model entices the student community and keeps them occupied. The Private Voluntary Organizations (PVOs) tend to play safe by not engaging in anti-government activities in order not to jeopardize their chances of getting government grants and loans or attract the wrath of the government in the form of scrutiny of their funds and activities. Many NGOs such as the M.S. Swaminathan Foundation in Chennai that manage to project a highly credible image mainly because of their huge funding and elite patronage provide the much-needed ground

support to the Koodankulam project by undertaking support projects such as setting up a 'green belt' around the Koodankulam plant at a huge cost. It has also been a trend in the NGO circles in India to pick a fight with soft targets rather than hard ones such as the powerful government departments like the DAE. For instance, at the World Social Forum in Mumbai in January 2004, scores of NGOs from various corners of the country were demonstrating against Pepsi Cola, Coca Cola, World Bank and the World Trade Organization (WTO). Picking on such soft targets, these NGOs maintain their activist profile, secure sufficient funding and avoid unnecessary confrontation with the state authorities.

The leaders of various religions also steer clear of any confrontation with the government as they do not want the government to scrutinize their divine transactions and spiritual escapades. Some of the anti-Koodankulam activists' repeated request to a Hindu (*Nadar*) religious sect leader to support their campaign invariably brought disingenuous nods and not-to-be-honored campaign dates as the response. When the activists approached the Thoothukudi Bishop for his support, he said that he would like to invite the Koodankulam authorities also, listen to both sides of the story and then decide if he could extend his and his parish priests' support. The activists appreciated the fairness of the deal, accepted it without any preconditions and agreed to meet the Koodankulam officials anytime anywhere. However, the agreed meeting dates were always cancelled or postponed and the meeting never took place. Later news reports indicated that the same Bishop was working closely with the Koodankulam project officials on a few projects and functions. The Koodankulam authorities offer free computers to coastal villages, take some villagers on a trip to the Kalpakkam nuclear power station and other nuclear(ized) installations to show how clean and green these power projects

are, and do a public relations stunt at the cost of public money and with media support.

There is hardly any debate in the media about the DAE and its acts of commission and omission. The Sun TV, the most popular channel in Tamil Nadu, conducted a rather long interview with me on the Koodankulam conflict and the larger nuclear power issue in May 2001 for their primetime breakfast show, *Vanakkam Tamilagam* (Greetings Tamil Nadu). When the interview was not telecast for some time, I called the station to inquire about it and came to know that the Managing Director of Sun TV, who was the son of Murasoli Maran, a senior cabinet minister in the BJP-led government in Delhi, and grandson of the DMK leader M. Karunanidhi, had to approve the interview for telecasting. When the 2001 state election results went against the ruling DMK government, the interview was hurriedly telecast the same day without any of the usual pre-show announcements. Similarly, when I tried to take out an advertisement for founding the 'Green Party of India' at Nagercoil in October 2001 that, I thought, could provide the much-needed ideological rigor and vision and spearhead the struggle against the Koodankulam project and the larger nuclear issues, the leading Tamil newspapers refused to accept my ad saying that it was against the government. I managed to get the ad in only by exploiting their business rivalry.

When the activists talk to men, women, children, and the elderly in farming and fishing villages, it is often hard for them to explain the complicated scientific concepts such as nuclear fission, spent fuel, and radioactivity etc. Equally hard is to describe the inexplicable events that happened in distant and strange-sounding places like Hiroshima, Nagasaki, Chernobyl and Three Mile Island. Similarly, informing the rural people about the unfamiliar policymaking and decision-making

processes and the different players in the game is also quite cumbersome. Over the years, the activists have developed a knack and the language to get their message across by dwelling on safety concerns, health issues, environmental impacts and so forth. Although these deprived people do not quite grasp the scientific, economic, and political sides of the issue, they are certainly aware of the health hazards in varying degrees. They are worried about the possibility of losing their livelihood; they fear for their children's safety; they are concerned about the prospects of being (forcefully) relocated from their ancestral homes and villages; and they are simply scared about what is in store for them. Most women often lament, "What do we, illiterate women, know about anything?" And they would earnestly appeal, "You educated people should do something about this menace." The activists' exhorting them to use their political power, organize themselves and engage in nonviolent activism mostly induces chuckles, sighs, silence and sometimes tough questions. The fishermen are easy to talk to as they are relatively better informed about the ways of the government and the impacts of the nuclear and other 'development' projects, especially on the sea. Many of them agree that there is a close connection between nuclear power and bomb programs and that the Koodankulam project is a highly dangerous one for them and for the entire region. But they are quite confused about what and how to do anything about the conflict.

The State and Anti-Nuclear Opposition Encounter

When all is said and done, nuclearism is an ideology, a mindset, a worldview dominated by an amalgamation of fears and insecurities, bigotry and prejudices, and misplaced conceptions of the self and misperceived notions of the Other. Nuclearism attempts to look innocuous by encompassing notions such as nationalism (national security, national pride, military virility etc.), scientism (advanced science and

technology), and developmentalism (energy security). When this paranoid mindset reigns supreme without any ethical and moral considerations, the resultant socioeconomic-political values and interests are quite hypocritical and deceitful. For instance, the nuclear establishments around the world insist on differentiating between civilian and military nuclear programs but quite strangely, the civilian programs of Iran somehow become unacceptable to the nuclear powers. The Indian nuclear establishment has always held their “atom for peace” flag aloft. But now it has switched from the cheap and clean power promises to greater national security and energy security assertions to ensure continued funding, power and prominence.

Reacting to the US-India nuclear deal signed in July 2005 which requires opening up the Indian civilian nuclear facilities for international inspection, A. N. Prasad, former director of the Bhabha Atomic Research Centre (BARC) told *The Hindu* that segregation of civilian and military facilities in the nuclear field in India is “impossible.” Pointing out and problematizing the stockpiling logic/bias of the agreement, Prasad said the Indian deterrent is maintained by “incremental efforts” from existing “civilian” nuclear facilities around the country and not just the two research reactors at BARC, Dhruva and Cirus. According to Prasad, “We produce what we need for the military programme at any given time and leave the rest for civilian use.” Agreeing to IAEA safeguards has the country’s fast breeder program at stake and the eventual third stage of utilizing India’s huge reserves of thorium that will allow energy security “for the next 300 years.” Prasad fears: “Allowing IAEA inspectors and signing the Additional Protocol means throwing open not just your reactors but the entire chain, the whole fuel cycle. This is the crux of the whole issue.” Prasad argues that the fast breeder program “is sacred for us in the long-run. Once we get into thorium, no one can

touch us. If we do it and succeed, we will be on top of the world. But to reach there, we need full freedom to do our research. Nobody should be breathing down our necks.”²⁵

As a result of this thinking, Indians and Pakistanis were about to be on top of the world on a mushroom cloud in May 2002. All the defense bodies were put on alert in India and it was announced that an integrated battlefield shelter had been developed to provide protection from nuclear as well as biological and chemical agents and to ensure retaliatory attacks. On May 25, an Indian minister said that India would use nuclear weapons if Pakistan used them. On May 31, 2002, the Pakistani ambassador to the United Nations held out the nuclear threat. He said that they would use nuclear weapons even if India stuck to conventional weapons. As our “leaders” were playing so thoughtlessly with the lives and futures of some 1.6 billion people, many Americans, Australians, Germans, French, British, and UN workers were leaving India and Pakistan in a hurry. On May 28, the American intelligence agencies announced that some 12 million Indians and Pakistanis would be killed and up to 7 million could be injured in a nuclear war between the two countries. These were just immediate casualties. And the subsequent casualties could not even be assessed. The “ordinary” Indians and Pakistanis were reading the newspapers every morning to see what their fate was going to be that day.

Capitalizing on the general and nuclear illiteracy that prevail in the country, and hiding behind the notions of national security, energy security and economic development, the Indian nuclear establishment manages to create an impression that theirs is a progress-oriented program and that there is no opposition to their doings. The Indian nuclear establishment does have a method to its madness. It keeps its cards close to its

chest and keeps the people of India in the dark about its intentions and activities. No one outside the top leadership of the nukedom and the government is ever informed of anything directly. In March 1999 there was a leak of heavy water at Kalpakkam but the AERB dismissed the incident by saying that “the release to the environment is maintained well within the limits specified by the AERB.” Another leak that affected workers at the Kalpakkam Reprocessing Plant in January 2003 was met with complete silence, but after persistent media reports and pressure from eminent scientists and public figures, the DAE acknowledged the accident six months after the event. Some of the installations at Kalpakkam are outside the reach of even the AERB or any other authority because they carry a strategic tag.²⁶ Similarly, Tamil daily *Dinakaran* reported on January 20, 2005 that there was widespread fear of radiation leak at Kalpakkam and that foreign experts would arrive on January 24, 2005 to fix the problem, but the DAE authorities maintained that there was no radiation leak whatsoever.

Another characteristic of the Indian nuclear establishment's functioning is to explain things away without ever assuming any responsibility. When people expressed concerns about the impacts of tsunami on the Koodankulam power plant, the project director S. K. Agrawal claimed in a press meet (as reported by *Dinakaran* on January 14, 2005) that they had already studied the possible impacts of a tsunami on the plant, and that the tsunami waves in that area were estimated at 5.44 meters above Mean Sea Level (MSL) and hence the minimum grade level of the site had been designed as 7.5 meters MSL. Similarly, the DAE chief Anil Kakodkar and the chairman of NPCIL, S. K. Jain allayed the fears of natural calamities affecting the Koodankulam reactors by saying that “the reactors at Koodankulam, safeguarded by strong dykes, were situated at an appreciably elevated site.”²⁷ Yet another

feature of the Indian nukedom's functioning is to leak information by bits and pieces and never revealing the complete plan to the outside world in a straight-forward manner. A good example for this sneaky behavior is the way the number of power plants in Koodankulam complex is increased incrementally and the way the information is shared with the local people.

The DAE's "temples of science and technology" (to use Russian President Putin's words) provide the middle class scientists and engineers stable job, steady income, and comfortable living. But what 400 million poor people of India get out of these nuclear power projects is a big question. Most of them are not even aware that the hardnosed blind elites are taking them for a ride. And they remain tongue-tied. As the blind have their eyes fixed on the power, prominence, professional careerism, and profit that the nuclear idiocy fetches them, the politically lame are tied down by poverty, illiteracy, political centralization, and social oppressions. With their own truth-claims summarily rejected and their dignity trampled, the "ordinary citizens" are denied the basic necessities of life, meaningful education, appropriate technology, sustainable development, and access to the corridors of power. Having been deprived of these entitlements, and denied the inalienable right to envision their own futures, the "ordinary citizens" are rendered lame. The national development journey then becomes the hardnosed blind leading the tongue-tied lame to a singular nuclear(ized) salvation. The informed sections of the civil society in the southern tip of India do challenge in vain the state elites' understanding of development and doubt the nuclear scientists' unmitigated truth-claims, copy-cat science and technology, aversion to TAP (transparency, accountability, and people's participation) and

their undemocratic scheme of taking us all to a Western-type 'Brave New World.'

When the interactive approach that focuses on the interactions between the state and the anti-nuclear movements is employed to study the Koodankulam conflict, we find out that little is achieved within and around different conflict arenas. Because of the Indian nukedom's culture of secretiveness, evasiveness, sneakiness and the totalitarian tendencies, it is quite hard to pin them down and they are also closed to debate. Although the state elites have not been too tolerant or flexible in their conflict-handling style and have employed intimidation tactics like the police firing in May 1989, they tread very carefully and avoid provoking the local people into action by indulging in any high-handed behaviors or actions. On the other hand, the anti-nuclear movement has been rather non-confrontational and nonviolent. It has neither achieved any significant mobilization of the civil society nor posed any challenge to the polity during the ongoing conflict. Consequently, the encounters have been rather indirect and remote. Because of the weak encounter dynamics, the actual impact of the anti-nuclear movement on decision-making and policy-making is also quite negligible. The movement has not achieved any of its goals. It is pertinent to note that the anti-Koodankulam movement attained strong momentum when the Pechiparai dam water that is so valuable for the majority and powerful farming (*Nadar*) communities was at stake. But the movement went into dormancy when only the minority fishing (*Mukuvar*) communities' interests were threatened by the Koodankulam project. With the majority *Nadar* community's leaders beating a retreat and the marginalized *Mukuvar* community failing to develop a strong leadership, the movement has now become more of a sophisticated intellectual campaign.

While the scope of anti-nuclear movements is not very different from other social movements, their nature is vastly different as the anti-nuclear movements take on the sensitive national security and development issues and confront the top echelons of the state elites with big money and bigger powers. The conflict parties here are not exactly individuals or institutions but different understanding and prioritization of security and development and hence the conflict could actually be turned into a healthy and constructive dialogue process for the betterment of the society. Unfortunately, the practice of democracy and governance in the contemporary world has a very long way to go before we attain such maturity and fairness. As a result, the anti-nuclear movements are not necessarily seeking resolution of the conflict; in fact, the power differential between the state elites and the movements is so high that the elites do not even bother about the movements. The anti-nuclear movements, if sincere to their principles and values, cannot attempt any meaningful conflict transformation efforts also because the basic beliefs and convictions are so starkly different that they could not possibly see eye to eye with the state elites. So 'conflict persistence' is more of an appropriate idea here. Delineating the basic foundational principles such as ecological wisdom, social justice, grassroots democracy, nonviolence and so on, the anti-nuclear movements must persist with the conflict and keep telling their side of the story strongly and stubbornly. There are inherent dangers of harassment and hardships, intimidation and even extermination in some stray cases, but then this is a fight for principles and the future of the Earth and the humanity. The anti-nuclear activists embrace the dangers and risks but they do not become the sources of the same. Success in a socioeconomic-political conflict may not be defined as achieving what the activists and movements actually wanted. Problematising the issue at hand

and embarking on the journey of critical thinking and dissenting is half the success. Success is a relative concept here and even ‘failure’ is a kind of success as the anti-nuclear movements conscientize a considerable number of citizens. Since there can only be a beginning but no clear end for this principled journey, the anti-nuclear movements had better persist with the struggle as long as they can and as much as they can.

A recent book, *Prisoners of the Nuclear Dream*,²⁸ sums up the current predicament in the southern tip of India succinctly. The authors, Ramana and Reddy, rightly point out that the battle between the weapon-supporters and weapon-opponents (by extension, nuclearists and anti-nuclearists in general) is a battle for the soul of India and the final choice that “ordinary citizens” face is one “between education and catastrophe.” So the anti-nuclear movements should do three things: educate, educate, and educate a bit more. The basic operating principle of this education should not be ‘Us vs. Them’ but ‘Us vs. Then,’ all of us facing the common future. This education should focus on seeing the sea as humanity’s food basket, the atmosphere as our collective external lung, and the future a hope of sustainable joy.

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Midland Laterite Hill Degradation in Kannur District, Kerala

P. Muraleedharan

Midland laterite hills are beautiful natural gifts, giving a curvaceous shape to the entire landscape, with plenty of vegetations and a rich array of animals. The laterite hills are the most imposing but extremely threatened topographical floristic and faunistic feature of northern Kerala. Major part of Kannur district comes under midland region with numerous hills and dales. Vast stretches of laterite capped hillocks are the characteristic feature of Kannur district.

The midland lateral hills in the northern part of the state are slowly vanishing as the soil is enormously being scrapped off to meet the demand of land developers and contractors. Trucks and Tipper Lorries, carrying hundreds of loads of soil shuttling up and down the main roads across the region is a common sight in these days. Large number of excavators are being engaged every day for the demolition work. It is estimated that more than 1000 truck loads of earth from demolished hills are being transported everyday in this district.

Midland hills have become the attractive source of big business involving builders, land developers and contractors who purchase private midland laterite hills and coastal wet land plots at cheaper rates. The hills are then demolished and laterite soil is transported to fill water lands and paddy fields.

It has been estimated that more than 50 percent of the hillocks in various panchayats and municipal towns had been subjected to heavy excavations and removal of earth; among them 10 to 15 percent had suffered ultimate eradication. Nearly half a dozen laterite hillocks near Thalassery are in the process of demolition. A major portion of a hill near Iritty town has been completely demolished. Demolition also took place at Chuzhali and Chiravakku near Thaliparamba. Hill degradation is also taking place in Srikandapuram. The Achilamvayal hillock degradation at Vellur near Payyanur had been studied in detailed by a society in a Kannur district (SEEK). Hillock at Madayipara is also facing a threat.

People are often unaware of the importance of the midland laterite hills that are being demolished due to the growing commercialization of land, expanding urbanization and booming construction industry. The geological and ecological importance of these laterite hills are to be highlighted and conveyed to the local people with appropriate propaganda and orientation. Media has a significant role in educating the masses on the ecological and environmental impacts of this activity. The demolition often goes unnoticed and unopposed because of the popular perception that these hills are waste lands and absolutely useless in the new scenario of development.

The uncontrolled deterioration of the laterite hills cause irreparable damage to the ecosystem, bio diversity and nature's water conservation strategies. Degradation of hills resulting in loss of vegetation, destruction of the animal fauna, land deterioration, ground water loss, dust pollution, change in wind pattern and its influence in traditional faiths, rituals and culture of localities are to be studied in detail.

Ecosystem and bio-diversity depletion

Rocky surfaces, grass lands and green patches of laterite hills are rich and diverse habitats accommodating vast varieties of flora and fauna. The age old biological activities have transformed these areas into bio-rich realms which are the nature's gifts. Degradation of midland laterite hills brings about simultaneous collapse of atleast three ecosystems including hillocks, valleys and wet lands. The sacred groves which are unique to these laterite hills are the naturally existent floral centers supporting various groups of butterflies, birds and other animals, of which some are endemic to these habitats.

The floral diversity is astounding with different species of shrubs, herbs, trees and creepers growing at the surfaces and in the slopes of the hills. Midland hills are characteristic with hundreds of varieties of grasses, some of which are medicinally important. Candhium, Figs, Alstonia, Indian Coral tree, Indian Iron wood, Semicarpus, Neem, Pterocarpus etc. are invariably present in midland hills. Holorrhena, Terminalia, Ixora spp. Vinea, Gnetum, Calycopteris, Vitis and Lianas represent some of the highly important and rare plants having commercial and economic importance.

Bio-diversity of midland laterite hills varies greatly. Studies of Madayipara alone has documented 38 species of grass, 280 species of other plants, 92 species of butterflies and 68 species of birds (Jaffer, 1998). The scope of fodder for cattle and green manure is abundant.

Faunistic diversity of the midland laterite hills is amazing. Butterflies which are the bio-indicators of nature are abundantly present in these hills. As they cannot be seen in polluted lands, their presence indicates the virginity and

versatility of these hills. The water bodies found during rainy season support different species of fishes and amphibians. Out of 80 species of amphibians reported from Kerala 13 survive in midland laterite hills. Skipper frogs, Rufescent frogs, Common tree frogs, Malabar flying frogs and several varieties of toads are peculiar inhabitants of the laterite hills. Out of 100 species of snakes reported from Kerala 20 species inhabit the laterite hills. Other reptiles include Pond Terrapin, Mugger crocodiles, Mabuya, Calotes and Lizards.

Out of 480 species of birds reported from Kerala, about 50% of species have been recorded in midland hills. It is interesting to note that the Desert Wheater was first located in Kerala in Madayippara hills of this District. Many migratory birds select water bodies in the laterite hills as their favourite breeding grounds. The Skylarks, Lapwings and Stone Crews which are intimately associated with the laterite hill habitats are on the verge of extinction as they are unable to withstand the changing situations.

Out of 110 species of mammals of 15 orders reported from Kerala, 90 are terrestrial and one-third among them inhabit the midland laterite hills. Bonet monkeys, Jackals, Indian fox, Smooth coated otters, Toddy cat, Small Indian civet, Mongoose, Jungle cat, Wild boar, Pangolins, Hares, Shrews, Squirrels, Mole rats, Porcupines, Flying fox etc are some of the mammals facing the threat.

All these animals face severe threat due to their loss of habitat by the deterioration of the midland laterite hills. With regard to the fauna it should be taken into account that depletion of different groups of organisms should not be treated separately as different groups associate in diverse ways forming intricate chain or web in utilizing the biological resources and

in energy transfer. This chain relationship and energy dynamics will be irreparably affected when a particular group is disappearing and the ultimate sufferers will be we ourselves. The disappearance of plants and animals endemic to this peculiar habitats ultimately leads to severe damage in genetic diversity and gene pool.

Midland Laterite Hills and Water Conservation

The rough peripheral surface of the rock leads to numerous ditches and channels which are interconnected. Towards the bottom these channels are replaced by numerous globules of clay. Limestone, sand and clay form the inner layer beneath the hard upper surface. This peculiar structural frame work contribute to the water retaining capacity of the laterite rocks. The rain water is stored in the vacuities of laterite hills which form the underground reservoir of water.

This shows that the thick top layer itself is a good aquifer and the seasonal rain percolates deep into the plateau through the laterite and recharges the never-depleting water table of the plateau. Ground water is found to be depleting at a faster rate in Thalasseri, Thaliparamba , Kannur taluks as per the water table data of the Ground Water Department. Thus in a district where water problem is very acute, degradation of water repositories like laterite hills will be highly suicidal.

Conclusion

The authorities are helpless in checking the demolition of hillocks because there is no effective law to check the razing of hills owned by private parties. They are also having no complete data of degradation.

Environmental organizations and NGOs should seriously take up the issue by creating awareness on the

ecological role of the laterite hills. Proper orientation and education should be given to the local people. Today, there are only some discontinuous protests here and there which can bring about no results. Massive and coordinated agitation in the form of protest rallies, *dharna* involving the youth are the need of the hour. Agitation should be strong enough to make the authorities to frame sufficient regulations and to take stringent action against those who violate these regulations.

The interrelationship between the exploitation and degradation of environment and natural resources and development and poverty is particularly relevant in the present context. Sustainable development is the only alternative to conserve nature and natural resources to enable the forthcoming generations to live here safely and successfully. The degradation of all natural resources should be discussed with this approach in mind.

**Discovering Gandhian Thought:
Perspectives of Women in Grassroots
Environmental Struggles from Kerala**

Anitha S.

Background

The State of Kerala located in the south-western tip of India is demarcated by natural features that contribute to a unique tropical environment. The Arabian sea bounds the State in the west and the Western Ghats (at an elevation of 900- 2450 m) lies on the eastern side. The State with a land area of 38,863sq.km and population density of 819/sq.km can be geographically divided into 3 regions- the coast, the midlands and the highlands with unique natural, cultural and historical features. The State with 44 rivers and more than 150 wetlands was blessed with adequate freshwater for all human purposes including diverse livelihoods. The average rainfall of 3000 mm and humidity of 70-90% contributed to a lush environment with tropical forests covering more than 26% of the land area conducive for the growth of spices and other special vegetation.

The west sloping terrain with the high Western Ghat mountain occupying half the land area, the biologically rich rainforest ecosystems, high rainfall and an agricultural system most suited to the humid tropical climate are the living backdrop of the people of Kerala. The innate knowledge that various communities in Kerala with primary relationships and dependence on natural resources about the fragility and

vulnerability of ecosystems has been jeopardised since a century in the name of development and progress. In the face of the present ecological crisis and environmental disasters that Kerala is facing now, it is no wonder that people have responded spontaneously and strongly against the destruction of vital life –support systems. As early as the 1960s people have been raising questions on the very ethics of the model of development especially basic facts about for whom development and at what cost. They have started questioning not only the viability of and sustainability of the western model of large scale development but also its suitability to our culture. The social, ecological and generational justice which was being undermined by such indiscriminate ecological destruction and impoverisation of communities dependant on natural resources for sustenance was also questioned. In all these struggles, public dialogues and debates women have taken prominent role perhaps much more than in other spheres of conflicts.

The Context

The basis of this paper is the year long study that was done along with women involved in grassroots environmental movements in Kerala and also individual women who have been for many years raising basic and ethical questions regarding development and civilisation. The grassroots movements in Kerala connected to environment have undergone a drastic shift in approaches, strategies and attitudes. The latter has witnessed changes from trying to maintain a so-called romantic version of an utopian world to raising basic questions about development and science. The most striking shift that has happened is the presence of women in the struggles that are linked to and which exemplify the real ground reality where resources are depleted or taken away from the actual beneficiary in the name of progress. In fact many of these struggles question not only the inequality and unfairness

of the process but are also representatives of the politics of sustenance and survival. It is here that the voices of women involved in the struggles discover the basic ethics of Gandhiji's often quoted aphorism –“ the world has enough for everyone's needs but not enough for everyone's greed”. The most important aspect of the movements in which women are involved that echo Gandhiji's philosophy is in Passive resistance strategies that clearly contextualise “ refusing to do a thing that is repugnant to my conscience and use soul force (*Hind Swaraj*, p.69). This also transcends the ideology of *Swaraj* and forces the observer to place it in the larger context of the ethics of living and life that Gandhiji always searched for. (Ramachandra Guha, 2007).

Women's voices : The most significant Gandhian element in the struggles

1. Dialogue:

The voices of women in the 20 struggles from various parts of Kerala which have been documented along with the 20 women who have been raising their voices and concerns about the present development paradigm bring to light the most significant of Gandhian approaches- the power of dialogue. We have seen the power of dialogue in all the writings of Gandhi- the need to harmonise dialogue with action has been his forte always. In *Hind Swaraj* one of the first documents written by Gandhi the concepts evolve through close dialogue between the editor and reader. In these times when no one listens to anyone, the need to use dialogue as an effective means of communication has been felt by women. This is especially poignant in the case of Kerala where the much lauded People's Campaign for Decentralised Planning with a concern for Gender Equity along with Social Justice included the Women's Component Plan. The WCP fell short of expectations and the

task to secure the interests of women remained a politically unsupported activity. The presence and absence of gender concerns along with the rights-based approach that emerges has been silencing women even in *Grama Sabhas* and other political foras. It is in this situation that women who have taken up highly localised causes like sand-mining, dam displacement, pesticide overkill and land alienation have raised their voices and concerns to dialogue with the society, the planners and developers and so on.

2. Civilization:

The women who have come to the forefront of the struggles do so because the present path to development with its inbuilt patriarchal approaches most often denies women's access to resources, income and employment. The women who have got out of the victim mode say that the crisis is now related to impoverishment, food insecurity, financial and monetary disarray, environmental degradation and denial of access to life-sustaining resources which are related to the "Distinguishing characteristics of modern civilisation (which) is an indefinite multiplicity of wants" (Gandhi, *Young India*, 1927). The women in Plachimada Coco-Cola struggle, the Athirapally dam displacement issue and the Vellikulangara quarrying problem have raised concerns that reflect on the definition of "civilisation as the mode of conduct that points out to man the path of duty" (*Hind Swaraj* (HS), p. 53). But we also come across individual women who go beyond in search of their defined identity as 'Queens of the household' (HS, p. 33) and identify the "point where women begin to affect the political deliberations of the nation" (*Young India*, 1921).

3. Morality, Chastity and Good conduct:

The women in struggles that have been documented have brought to focus the most common allegation –their lack

of morality. The word civilization in Gujarati means “good conduct” (HS, p. 53). To achieve good conduct there has to be a strict moral code. The women in Vellikulangara, Muriyad, Athirapally, Kainur and Neyyatinkara have redefined morality, chastity, good conduct in terms that go beyond the physical being, beyond fidelity and domestic/conjugal terms. It is here that they unknowingly and inadvertently adhere to Gandhi for whom “chastity is one of the greatest disciplines without which the mind cannot attain requisite firmness” (HS, p. 73). The women are also questioning morality as being part of “civilisation that seeks to increase bodily comforts and fails miserably in doing so”.

4. True Home Rule and Swaraj:

It is *Swaraj* when we learn to rule ourselves. Do not consider this *Swaraj* to be a dream. It is in the palm of our hands.

Is this not what the 80 year old grandmother who sat in the Satyagraha hut for 3 years asking for a review of the Vamanapuram Dam project in Thiruvananthapuram district asked the planners and developers? She could forcefully stop all those who passed by whether the local MLA, the Minister or any other VIP on the way to the tourist destination Ponmudi and point out that *Swaraj* is in the palm of the people’s hand and not with a handful of politicians. The downstream *panchayats* who are adversely affected by damming the Chalakudy river in Thrissur came together and passed a resolution against the dam inspite of all the projected supposedly beneficial outputs. The eight *panchayats* surrounding the famed Muriyad lake struggle in Thrissur district got together shedding their political differences to protect the lake that was being reclaimed for mining by the land mafia. The women and community in Eriyamkudi in Thrissur

district who led a significant fight for the right to plant paddy and retain the water cycle in the wetlands were able to get the Collector to ban the land developers and real estate lobby and rejuvenate agriculture in the area. This processes have happened along with the ongoing debate on digression from decentralisation and its essential pre-requisites like participation and transparency along with community participation in major decision making processes. The *Adivasi* women in local self governments in Wynad, Attapady and Idukki districts in Kerala say ‘Politics is not just for power per se but for the power to preserve culture, value systems, autonomy and survival security’. Is this not what Gandhi meant by “learning to rule ourselves”?

5. Passive resistance:

Passive resistance is “the method of securing rights by personal suffering. When I refuse to do something that is repugnant to my conscience, I use soul force “(*HS*, p. 69)

The women in various struggles that have been documented have realised the strength and innovativeness inherent in soul force. The myriad ways in which the State and the executing machinery tries to suppress and oppress the passive resistance strategies and make it a law and order situation is shocking. The local Sub Inspector of Police who refused to give police protection to a lone woman who was being abused by the sand-miners by saying that “police protection cannot be given to an old hag” was shocked when she reacted that the “strength of my faith in what I am doing will protect me”. This is true in the case of the women who blockaded the road through which 20 lorries of untreated waste from Trivandrum city was being taken to the waste treatment plant in their village – there was no argument, no negotiation , no conflict- only resistance. The *Adivasi* women in Attapady

who physically obstructed the bull-dozers in diversion of Bhavani river project were jailed for several days. The women in Alapad in Kollam district who stopped the India Rare Earths Company from mining sand from their coastal homes were also jailed as law-breakers. The women discovered Gandhi in this strategy and reiterate that passive resistance is the strongest weapon that cannot be suppressed –“passive resistance is an all-sided sword- it blesses him who uses it and him against whom it is used. It never rusts and does not exhaust. The sword of passive resistance does not require a scabbard” (*HS*, p. 71-72).

6. Fear and Fearlessness:

Strength lies in the absence of fear (*HS*, p. 38)

Those who defy death are free from fear

Passive resistance cannot proceed a step without fearlessness (*HS*, p. 72)

The words of the lone women fighter for the rights of the river to flow at Neyyatinkara where the sand miners are indiscriminately mining reflect the above statements of Gandhi ‘I am not afraid. Let them abuse, throw stones, come and pull my house down. I am not afraid of death’

The women who are lobbying against the huge rock and stone quarrying company in Vellikulangara in Thrissur in spite of witnessing the ‘accidental’ death of two young resisters by a lorry brave the threats and say

‘We are not afraid. How can we be silent when the blasting has cracked the walls of our homes and also the school where our children go?’

Fearlessness certainly is the hallmark of a true passive resistance movement.

The above said are some of the main areas in which the environmental struggles and women have found Gandhi in their own strategies and approaches. Even now they do not refer to him or use him as a model, but there is definitely a strong undercurrent of Gandhian thought here. As Gandhi wrote (*Harijan*, 1935) “we do not know we are burning these lights at the expense of the poor “ the young Kada girl who travelled all the way to Trivandrum to meet the Chief Minsiter remarked on seeing the neon lights and hoardings shining all night through –‘Is it for this that you are damming the Chalakudy river? Why should we pay the price for this opulence ?’

Gandhi’s famous comment “ the blood of the villages is the cement on which the edifices of the cities is built” (*Harijan*, 1946) is echoed in the response of women in Vilappilsala and Kainur where the waste of a city and waste from a pig farm destroyed life in the small villages –Why should we take your waste? Why are our waters and health being sacrificed so that you can be neat and clean?’

The analysis of macro processes of economic development, the prescriptive positions and effective solutions for rural reconstruction and ethics for living that Gandhi put forth in all his writings and dialogues form the basis of many women-led reconstruction and rejuvenation processes happening in the State. The most striking among this are the organic farmers group called the Jaiva Karshaka Samiti led by a women and the Eco-san initiative combining sanitation, health and restoration of health in coastal villages along with the Zero-Waste and Organic bazaar program in Thiruvananthapuram city.

The stories and narratives that emerge from the *adivasi* women in governance, *adivasi* women in struggle for basic land

and resource rights reveal the real questions that modern human civilisation needs to ask itself and to which Gandhi offered a talisman. At a time when survival rights are under siege by corporate regimes, delving deeper into the mindsets of the women who are silently but strongly in true citizenship movements holding close the talisman of seeing the face of the poorest before planning an action would give the human race the path to a more secure democratic, egalitarian world.

Afterword

The women in the environmental grassroots movements of Kerala have been thrown into the face of struggle and opposition and have taken it not by choice or compulsion but because there is no choice at all. But all of them have found immense meaning and fulfilment in the self-sacrifices, the corrections, regulations, abnegations and learning that the chosen path demands of them. They admit that this exposure and the need to go beyond their secluded private lives with a Do or Die attitude has opened a vast and challenging world hitherto unknown to them. With little or no precedence of activism or ideological positioning most of these women have stumbled, struggled, fallen and stood up with a courage, honesty and steadfastness that their conviction and commitment granted them. The pitfalls associated with fighting the invisible enemy within and outside has empowered them to evolve their own strategies and action plans. It is here that we see the hidden shadow of Gandhian thought and action that seems to be a directing force and strength too. The most poignant linkages that remain as we near the end of this sojourn from one end of Kerala to the other is about the moral courage, the capacity to dialogue and the chancing upon their own infinite reserves of fearlessness that women have rediscovered and rejuvenated in their lives and in the lives of those around them. The new social transformation that this has initiated in Kerala which surpasses

all existing political, social, communal and religious alliances is the only path to *Swaraj* as Gandhi envisioned a century ago. The women here have not read Gandhian thought or do not refer to him in any way, but they 'perennially return to Mahatma Gandhi while at the same time going beyond him' (Ramachandra Guha, 2007).

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**Genetically-Engineered Agriculture and
the Re-invention of Nature
- A Recipe for Ecological Disaster!**

D. Jeevan Kumar

Agricultural biotechnology is an emerging area of biological research. It has some major, well-recognized areas of specialization. Transgenic technology is the most sophisticated one, which is attracting wide public attention for a variety of reasons.

In recent decades, scientists have immersed themselves in research involving manipulation of biological material. They claim to have made dramatic advances in our understanding of how biological organisms function at the molecular level, as well as in our abilities to analyze, understand and manipulate DNA molecules, which are the biological materials from which the genes of all organisms are made. It may be noted here that there is no substance so important as DNA, because it carries in its structure the hereditary information that determines the structure of proteins, instructions that define the cells, direct the cells to grow, divide and socialize in an organism, and therefore accounts for all the life forms on earth.

This technological breakthrough made by scientists enables them to shuffle the genes across the boundaries of species, genera and other biological groups. The Human Genome Project, which made enormous investments to develop

technologies for working with human genes, has accelerated the process, and the same technologies are found applicable to all other organisms, including plants. This discipline called *genomics* has contributed to powerful new approaches in agriculture and medicine, and has helped to promote the biotechnology industry.

Genetic engineering is a significant departure from conventional breeding. Genetic engineering transfers genes horizontally between unrelated species that would never interbreed in Nature. Viruses and other pieces of parasitic genetic material called *plasmids* and *transposons* can transfer genes horizontally. Parts of the most infectious natural agents are combined to make artificial vectors (carriers of genes), which are designed to overcome species barriers. Genes are spliced into these vectors.

In order to boost the expression of the foreign genes to well above the normal level, genes with strong genetic signals are typically introduced. These genes are called promoters or enhancers, and are most often from viruses. 'Marker genes' are introduced along with the genes of interest so that those cells that have successfully integrated the foreign genes into their genome can be selected. The most commonly used marker genes are antibiotic-resistant genes, which enable the cells to be selected with antibiotics.

Transgenic crop biotechnology has already entered farmers' fields in many countries like the USA, Argentina, China, Canada, Australia, Mexico, Spain and South Africa. Crops like cotton, soyabean, corn, wheat, tomato, potato and rapeseed are the leading ones. Globally, the coverage of biotech crops is observed to be rapidly increasing. What was about 1.7 m ha in 1996 is now stated to have crossed 50 m ha.

Ecological Hazards of Genetically-Engineered Agriculture

Genetically-engineered agriculture introduces a variety of dangers to the environment and biodiversity. They are as follows:

1. A most commonly introduced class of gene products from the soil bacterium, *bacillus thuringiensis*, targeted at insect pests, has been shown to be harmful to pollinators and other beneficial species such as bees. These harmful effects can even go up the food chain. Purified Bt-toxins, similar to that found in some lines of transgenic Bt-crops are not degraded by soil microbes, and are still able to kill soil insects. The build-up of Bt-toxins in the environment will also accelerate the evolution of Bt-resistance among pests, rendering the toxin ineffective as an organic pesticide. Already eight species of insects have developed resistance to Bt-toxins, either in the field or in the laboratory, including diamond-back moth, Indian meal moth, tobacco budworm, Colorado potato beetle and two species of mosquitoes. Genetically-engineered Bt-crops continually express the Bt. Toxin throughout its growing season. Long-term exposure to Bt. Toxins promotes development of resistance in insect populations.
2. Hazards arise from transgenic plants engineered to be resistant to broad-spectrum herbicides. Most transgenic plants are engineered to be resistant to broad-spectrum herbicides such as glyphosphate, whose toxicity and danger to human health are well-documented. Broad-spectrum herbicides have a major impact on

biodiversity as they kill all other plants indiscriminately, which in turn destroys the insects, birds and other animals that depend on the plants for food and shelter. They also harm organisms and micro-organisms in the soil that are involved in nutrient recycling, and which are crucial for maintaining species diversity, productivity of eco-systems, and thus the stability of eco-systems. Herbicide-resistant transgenic plants may lead to increased use of herbicides, as these transgenic plants are already turning up as volunteer plants after the harvest and have to be controlled by additional sprays of other herbicides. Weeds and other species will very quickly evolve to be glyphosphate-resistant, even without cross-pollination.

3. Once released, genes cannot be recalled, and have the potential to multiply and recombine out of control. Transgenes and marker genes have spread to wild relatives by cross-pollination, thereby creating potential super-weeds. A recent report suggests that transgenes may be up to 30 times more likely to escape than the plant's own genes.
4. Transgenes and marker genes may also spread by horizontal gene transfer. Secondary horizontal transfer of transgenes and antibiotic-resistant marker genes from genetically-engineered crop plants into soil bacteria and fungi have been documented in the laboratory. Plants engineered with genes from viruses to resist virus attacks have actually showed increased propensity to generate new, often super-infectious viruses by

horizontal gene transfer and recombination with infecting viruses. A genetic parasite was found to have jumped into many unrelated species of higher plants.

5. Genetically-engineered crops may spread antibiotic-resistant marker genes to pathogenic bacteria in the environment, and may also contribute to generating new viral pathogens.
6. Genetic engineering of agriculture will also lead to the practice of mono-culturing. The goal of the biotech revolution is to create superior varieties that can be planted as monocultures in agricultural regions all over the world. The switch to a handful of “the best” patented transgenic seeds will further erode the genetic pool, as farmers abandon the growing of traditional varieties in favour of transgenic products. Jeremy Rifkin refers to a *Catch-22* situation that lies at the heart of this new technology:

On the one hand, the success of the biotech revolution is wholly dependent on access to a rich reservoir of genes to create new characteristics and properties in crops and animals grown for food, fibre and energy, and products used for pharmaceutical and medical purposes. Genes containing novel and useful traits that can be manipulated, transformed and inserted into organisms destined for the commercial market come either from the wild, from landraces (traditional crops) and domesticated animal breeds, and from human

beings. Notwithstanding its awesome potential to transform Nature into commercially marketable commodities, the biotech industry still remains utterly dependent upon Nature's seed stock – germplasm - for its raw resources. At present, it is impossible to create a 'useful' gene in the laboratory. In this sense, biotechnology remains an extractive industry. It can mine genetic material, but cannot create it, de novo. On the other hand, the very practice of biotechnology – gene splicing, tissue culture, clonal propagation and mono-culturing – is likely to result in increased genetic uniformity, a narrowing of the gene pool, and loss of the very genetic diversity that is so essential to guaranteeing the success of the biotech industry in the future.

7. Transgenic crops pose an even more direct threat to the world's remaining centres of crop diversity. These centres are the regions that contain both wild relatives and landraces and are the reservoirs for providing new genetic material for purposes of breeding. There is growing concern that the large-scale introduction of transgenic crops could contaminate the world's remaining centres of crop diversity. Gene flow from transgenic plants to landraces is inevitable in the wake of ambitious plans by the biotech industry to aggressively market their new "super seeds" in every agricultural region of the world. It will probably be impossible to shield the few remaining centres of crop diversity from the increasing encroachment of transgenic crops.

8. Genetically-engineered agriculture poses other problems for developing countries. As Prof. M.D. Nanjundaswamy points out, genetic engineering of crops focuses on yield and not on the by-products. After the fibre has been removed, cottonseeds are used to extract oil for cooking and protein for making stock feed. "All these will be casualties, the first being fodder availability. And when you have toxin-producing plants, fodder availability will be nil, since you cannot feed it to animals. Most cattle will have to be consigned to the slaughter houses for lack of fodder," he says. Moreover, the dependence on genetically-engineered plants will lead to the destruction of local varieties. "Already the so-called Green Revolution has destroyed soil fertility, killed friendly pests and reduced yields, which should make us stop and wonder whether we really need such technologically developed plants. They are unnatural. They are made by crossing not the same species, but different species. We have to think of what kind of consequences this will have and the damage it might cause of which we shall not know for generations to come."

Genetic engineering has serious ecological risks, according to Vandana Shiva. This is the reason Article 19.3 of the Convention on Biological Diversity called for a Biosafety Protocol. This is also the reason why several countries in Europe have banned all genetically-engineered crops, and the UK has responded to the call of citizens by imposing a moratorium on release of genetically-engineered crops. Most recently, the International Federation of Organic Agriculture Movements (IFOAM), the world's largest body for organic agriculture, called for a ban on genetic engineering in agriculture, because it poses hazards without being necessary for the development of agriculture.

Vandana Shiva also points to the inadequacies of present bio-safety regulations in this country. The clearance of Monsanto, the multinational agribusiness company's trials with toxic plants, *without* the democratic consent of concerned governments, from State to local level, and democratic participation of the public in bio-safety decisions, reveals the loopholes and inadequacies in the present bio-safety regime, *from both the democratic perspective and the ecological perspective*. The bio-safety regulation regime needs to undergo dramatic changes by increasing public participation in decisions related to genetic engineering. The clearance for trials of genetically engineered crops needs to be given, not just by the Union Government, but also by all levels of government, from the State to the local level. Further, before any clearance is granted for trials of a particular genetically engineered crop, the application for trials should be notified to the public as part of the citizen's right to know. Public hearings need to be organized in the specific villages and districts and States where the trials and introductions are planned. The scientific framework of the ecological impact of genetically engineered crops on bio-safety, ecosystem health and public health also needs to be upgraded for dealing with the impact of field trials under diverse ecological contexts existing in India. If the government fails to fulfill these ecological and democratic criteria for field trials of genetically engineered crops, we will have further evidence that the promotion of genetic engineering by corporations like Monsanto are based on dictatorial, distorted and coercive methods. In such context, genetic engineering in agriculture must necessarily be anti-Nature and anti-democratic.

The commercial enclosure of the world's seeds – once the common inheritance of all humankind – in less than one century, while hardly given more than a passing notice in the media, is nonetheless one of the more important developments

of modern times, writes Jeremy Rifkin. Just a century ago, hundreds of millions of farmers, scattered across the planet, controlled their own seed stocks, trading them freely among neighbours and friends. Today, much of the seed stock has been bought up, engineered and patented by global companies and kept in the form of intellectual property. Farmers wishing to plant for future harvests are increasingly dependent on access to these same companies, to whom they have to pay a fee for use of what was a commonly-held good a short time ago. For their part, the chemical and pharmaceutical companies have little desire to champion the interests of small peasants and independent farmers around the world who still grow traditional landraces, passing on their heirloom crops from one generation to another. The independent farmer, growing traditional varieties, is seen less as a curator of potentially valuable resources and more as a potential buyer of the new patented seeds. The biotech corporations seek his patronage and make every effort to sell him their brand of seeds. By focusing on short-term market priorities, the biotech industry threatens to destroy the very genetic heirlooms that might one day be worth their weight in gold as a new line of defence against a new resistant disease or super bug.

The re-seeding of the planet with a laboratory-conceived *Second Genesis* is likely to enjoy some enviable short-term market successes, only to ultimately fail at the hands of an unpredictable and non-compliant Nature, concludes Rifkin. While the genetic technologies we have invented to re-colonize the biology of the planet are formidable, our utter lack of knowledge of the intricate working of the biosphere we are experimenting on, poses an even more formidable constraint. The introduction of new genetic engineering tools and the opening up of global commerce, allows an emerging “life industry” to “reinvent” Nature and manage it on a worldwide scale. The new colonization, however, is without a compass.

There is no predictive ecology to help guide this journey and likely never will, as Nature is far too alive, complex and variable to ever be predictably modeled by scientists. We may, in the end, find ourselves face-to-face with an ecological disaster of our own making!

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GM Technology and Sustainable Agriculture Future: Some Reflections Based on Bt Cotton Experience in Maharashtra and Gujarat

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Introduction

World agriculture is passing through a distinct phase of transformation, called the second Green Revolution or Gene Revolution, in which modern biotechnology enable the production of genetically modified (GM) crops/ foods that are claimed to help resolve the pressing problems of food security, malnutrition and abject poverty in different parts of the world. This phase of transformation driven by the GM technology becomes more critical and detrimental in so far as sustainable future of world agriculture is concerned. Because, there are growing apprehensions the world over that the GM technology as it unveils may have harmful consequences on sustainable livelihoods in view of the potential threats to food security and subsequent environmental and health challenges. Serious concerns about the positive impacts of GM technology also stem from the negative externalities caused by the Green Revolution in various parts of the world.

An optimistic view about the first Green Revolution (GR) is that it was a strategic intervention involving technology, scientific knowledge and package of practices in many regions and was instrumental in achieving self-sufficiency in the production of foodgrains and sustaining it for

several decades amidst growing population pressure on land, water and other scarce natural resources. Notably, in the first decades of the GR, risks to human health and to the environment have been minimal due to somewhat careful use of pesticides, fertilizers, and water. Consequently, the GR had little problem in achieving a desirable level of public acceptance that was necessary for the technology to have a significant impact on agriculture growth with necessary linkages. Viewed in that perspective, the GR had been a success in terms of broader coverage of crops and regions and progress in development and diffusion of state of the art technologies, farm mechanization, accelerated investments in rural infrastructure development, spread of Research and Development (R&D) and extension activities, creation and maintenance of governance institutions and centres of excellence in many regions of the world. Thus, the GR created a social space for its own functioning in its own might with tremendous public-sector funding for R&D, extension and smoother diffusion of the agricultural technology to the farmers at reasonable levels of costs.

However, especially since the late 1980s, there has been growing realisation that the world agriculture is heading towards a crisis or an unsustainable growth path. Several decades of GR experience across countries suggest that it had resulted in tremendous strains on the natural resources and unequal distribution of the welfare gains in the society. First and foremost, the beneficial outcomes of GR have mostly favoured the rich and resourceful regions and sections of the society. The Green Revolution also left a number of human health problems unsolved, and, of course, has exacerbated the socioeconomic and environmental problems in very many cases. The spread of GR was rapid and almost 100 percent where irrigation was available and it was a casualty where

irrigation was unavailable. Further, for a significant part, small and marginal farmers with less and poor resource endowments received few benefits and in some cases became more deprived and poorer, as incentive systems and institutional structures have been less appreciative and supportive of the cause of their economic wellbeing.

The massive investments for development of irrigation infrastructures have in fact generated more negative externalities in terms of: a) sub-optimal or non-performance of canal irrigation systems; b) over development of groundwater sector leading to depletion of groundwater resources; c) waterlogging and soil salinity; d) inter and intra generational inequities in water distribution, etc to mention a few. The Green Revolution has exacerbated these problems as the need (or greed?) for irrigated lands was so high that high-yielding varieties (HYVs) could succeed. The GR has also turned detrimental in its effects as it boosted an intensive agriculture regime in terms of use of chemical fertilisers and pesticides leading to contamination of water bodies and soils as well as human and animal health related issues. An unfortunate consequence of overuse of pesticides in particular areas is that crop pests have developed resistance to the pesticide chemicals, rendering the chemicals ineffective.

It was in this historical context that the GM technology has received scattered attention particularly in countries, such as the US, Canada, Latin America (Argentina, Colombia, Mexico) and some countries in Europe. Most of these countries started growing GM crops on a commercial basis since 1996. The GM revolution as it progress, resembles the Green Revolution in the following ways: (1) It employs new science and technology to create crop seeds that can significantly outperform the types of seeds that preceded it; (2) the impact of

the new seed technologies can be critically important for sustaining world agriculture; and (3) for a variety of reasons, these technologies have not yet reached the parts of the world where they could be most beneficial. However, GM revolution may appear to be different from GR in the following ways: (1) The science and technology required to create GM crops/ seeds are far more complicated than the science and technology as being used in the Green Revolution era; (2) GM seeds are seemingly created largely through private enterprises rather than through public-sector efforts; and (3) the political climate in which agricultural science can influence the world by introducing innovations has changed dramatically since the Green Revolution. In this regard, some of the greatest challenges facing the GM revolution are that:

- a) Whether it would offer to be a panacea for the ills of world agriculture and how can agricultural production rise to meet the ever growing demand in a framework of equitable, environmentally, socially, and economically sustainable development?
- b) What will be the prospects for the Gene Revolution, taking cue from the successes and failures of Green revolution?
- c) How the GM technology would ensure the sustainable future of global agriculture amidst the growing challenges of conserving biodiversity and inter and intra-generational distribution of natural resources?
- d) What sorts of regulatory regimes and institutional intermediations are there to make a firm grounding of the GM technology, its scaling up in diverse resource endowed regions and there by creating sustainable

impacts on socio-economic and hydro-ecological environments?

The present paper is set against this perspective and it makes a modest attempt at examining some of the potential challenges emerging from the unscrupulous expansion of GM technology and their implications for sustainable agriculture. In doing so, the paper draws useful insights from the empirical analysis of the dynamics of Bt cotton adoption in the dominant cotton growing states of Maharashtra and Gujarat in India. The analysis contained in the paper is based on farm household data gathered from the five districts of Vidarbha region in Maharashtra (Wardha, Amaravati, Akola, Yavatmal and Buldhana) and five leading cotton-growing districts in Gujarat (Ahmedabad, Bhavnagar, Rajkot, Vadodara and Surendranagar). The information gathered pertained to 200 farm households in each state and was confined to the kharif season of 2007-08. However, historic data pertaining to Bt cotton adoption trends have also been gathered following recall method in which, farmers have been asked to provide information for the past 4-5 years experience with Bt cotton.

Rest of the paper is presented in four sections. Accordingly, Section I provides a brief overview about the trends in development of GM crops in the world, followed by a detailed assessment of Bt cotton scenario in the world and India. Section II provides an empirical analysis on some of the important aspects of Bt cotton adoption among the farmers in Maharashtra and Gujarat. Section III examines few of the major challenges confronting the sustainable development of world agriculture in the face of the technological transformation as brought about by GM technology. Section IV concludes the paper by highlighting some of the important challenges posed by the GM technology in general and Bt cotton in particular

and their potential implications for sustainable agriculture development.

I. Growth of GM Crops: The global scenario

On a global scale, the GM cropped area was estimated at 100 million ha which accounts for about 5 per cent of the global cropped area during 2006. During 2007, the area further increased to 116 million ha. Among the countries, the US continue to dominate biotech agriculture with close to 50 per cent of the GM cropped area, followed by Argentina (16.5%), Brazil (13%) and Canada (6%). India and China are placed next in the global GM crop map with relative shares of 5.3% and 3.3% respectively. As evident from the Table, the share of other countries in GM cropped area has been below 2.5 per cent and this group is dominated by the European countries. The lukewarm response among the European countries towards adoption of GM crops is widely known because of the health, environmental concerns and the presence of big US multinational firms. Among the various GM crops, four, *viz.*, soyabean, cotton, maize and canola together account for 30 per cent of the GM cropped area. Compared to India, China shows a more diversified crop adoption scenario as it also grows crops other than cotton and tomato as reportedly grown in India.

I.1. Expansion of GM Cotton or Bt Cotton

Among the various GM crops that gained commercial acceptance, cotton is important for both the developed and developing countries as: a) a cash crop supplementing the livelihoods of millions of farmers, including small and marginal; and b) as a strategic raw-material for the textile industry.

Though cotton is grown in about 100 countries, almost 73 per cent of the world cotton area (35 million ha) and 80 per cent of production (43 million MT) is contributed by six countries, viz., US, China, India, Pakistan, Brazil & Uzbekistan (FAO, 2006). Nevertheless, differences exist across countries in terms of the basic crop/ commodity performance indicators, such as area, production, productivity, trade, etc for a host of reasons that are quite known. Following the introduction of the GM crops, the Monsanto Company developed the Bt cotton (*Bacillus Thuringiensis* cotton) and there has been significant rise in Bt cotton area, especially the US, China, India, Australia, Argentina, and South Africa. The area under Bt cotton has increased from 0.03 million ha in 2002-03 to 6.2 million ha in 2007-08, accounting for 66 per cent of global cotton area. The wide scale switch over to Bt cotton in these countries may be seen as an outcome of farmer expectations that the technology would make the new cotton varieties insect-resistant and herbicide-tolerant, and thereby help increase production and productivity as compared to the conventional and the hybrid non-Bt cotton varieties.

Among the major cotton producing countries, India's status is distinct as the country occupies the prime position in terms of share of cotton area in the world (26%), but lags far behind in terms of production (16%) with lowest productivity (520 kg/ha) in the world (Table 1). The major reasons indicted for India's low-productivity of cotton, inter alia, include: (a) major share of cotton is grown under rainfed conditions with lack of source of assured water supply; (b) predominance of smaller and marginal holdings; (c) inadequate transfer of production technology; (d) inadequate availability of quality inputs, including seeds, fertilizer, pesticides, etc; and (e) inadequate financial resources.

Table 1: Trends in area, production and productivity of cotton in the world, 1995-2006

Country	Area (% of million ha)		Production (% of million MT)		Productivity (Kg/ha)	
	1995	2006	1995	2006	1995	2006
India	25.48	25.44	12.36	15.47	486	520
China	15.29	14.47	26.83	26.46	1759	2252
USA	18.27	15.97	17.48	17.9	959	1380
Pakistan	8.45	8.87	10.14	10.28	1202	1427
Brazil	3.36	3.61	2.57	4.14	767	1412
Uzbekistan	4.21	4.21	6.71	5.73	1599	1677
Sub total (%)	75	73	76	80	1129	1445
World (Mha/ MT)	35	35	36	43	1003	1231

Source: Estimated from FAO: www.fao.org/agristat

I.2. Expansion of Bt cotton in India: an overview

India's cotton sector directly supports about 5 million farmers spread across 9 states and it occupies a pivotal position in the domestic economy as a strategic industrial raw material for the textile industry. With a cultivated area of around 9 million ha, India ranks first in world cotton area and is the third largest cotton producer after US and China. Even though India ranks first in cotton area, its productivity is one of the lowest in the world. Almost 65 per cent cotton cultivation is rain dependent. Continued presence of cotton in the Indian subcontinent spread over a crop cycle of 8-10 months makes it home for pest, diseases and other biotic stress agents to survive, multiply and cause frequent epidemics (APCoAB, 2006).

In India, the Genetic Engineering Approval Committee (GEAC) of the Ministry of Environment & Forest (MoEF) has made a formal approval for commercial release of Bt cotton in 2002. It was supposed to have major impacts on the cotton sector in the country in terms of effective control of bollworms

and thereby leading to rise in production and productivity of cotton.

It may be observed that following the introduction of Bt cotton, there has been tremendous expansion in area under Bt cotton in the country from 44,500 hectare in 2002-03 to about 6 million hectare in 2007-08. By 2007, there were as many as over 100 Bt cotton varieties and 109 non-Bt hybrids available in the markets in India, a vast majority of which have been widely adopted by the farmers in Maharashtra and Gujarat in particular. It may also be observed that following the release of Bt cotton, there has been a tremendous increase in cotton production in all the states and often the increasing output levels have compensated for the decline in area in some states. For instance, though the states, viz., Andhra, Haryana, Rajasthan, Madhya Pradesh, Karnataka and Tamilnadu have experienced decline in area under cotton, the technology impact has been significant in terms of compensating for the decline in area (Tables 2 and 3).

Table 2: Trends in cotton area in major states in India, 1996-97 to 2006-07

Year	Area under cotton (Lakh ha)				
	Gujarat	Maharashtra	Andhra	Punjab	All India
1996-97	15.24 (16.7)	30.85 (33.7)	10.07 (11.0)	7.42 (8.1)	91.66
1999-00	15.39	32.54	10.39	4.75	87.31
2001-02	16.87	29.80	10.02	6.00	87.30
2003-04	16.47	27.66	8.37	4.52	76.30
2005-06	19.06	28.75	10.33	5.57	86.77
2006-07	23.9 (26.0)	31.24 (34.1)	9.62 (10.5)	5.88 (6.4)	91.58
(%) change	56.82	1.26	-4.47	-20.75	-0.09

Note: Figures in parentheses indicate respective shares in total area.

Source: Compiled from Cotton Corporation of India.

Though cotton is grown in nine states, four states, viz., Maharashtra, Gujarat, Andhra Pradesh and Punjab together accounted for 77 per cent of cotton grown area and 76 per cent of cotton production during 2006-07 (Tables 2 & 3). As evident from the Tables, trends in area and production of cotton indicate contrasting scenarios of growth, as there has been significant increase in cotton production over time while area under cotton tended to stagnate at the national level.

Notably, the rise in production and productivity has been contributed by a perceptible shift from desi/ conventional cotton varieties to hybrids and from hybrid varieties to Bt cotton varieties in these states. While authentic data on the extent of area under Bt cotton across the states is yet to be confirmed, available sources indicate that the area planted with Bt cotton currently account for almost 39 per cent of the gross cotton area in the country. Among the states, adoption rate is reported at as high as 70 per cent in Andhra Pradesh, followed by Maharashtra (57%) and Gujarat (40%).

An exceptional trend in area expansion can be observed only for Gujarat, where area has increased by more than 56 per cent during the last decade against significant decline in Punjab (21%) and Andhra (5%) and marginal rise in Maharashtra (1.26%). Gujarat's share in the country's cotton area increased from 17 to 26 per cent during the decade, while that of Maharashtra increased only marginally from 31 to 34 per cent. It is also important to note that the area under cotton remained the same during the two terminal years with significant decline during 2003-04.

Trends in cotton production as shown in Table 3 show that all the four states experienced growth in output, with Maharashtra recording almost three times rise in output. Apparently, much of the rise in cotton output could be

decomposed as the ‘technology induced yield effect’ rather than ‘area effect’, as the period also coincided with the popularization of ‘Bt cotton’. It may be argued that the introduction of Bt technology enables India to come out of the ‘age old muddle’ of ‘low yield trap’.

Table 3: Trends in production of cotton in major states in India, 1996-97 to 2006-07

Year	Production (in Lakh bales of 170 kgs)				
	Gujarat	Maharashtra	Andhra	Punjab	All India
1996-97	16.00 (9.0)	34.25 (19.3)	33.00 (18.5)	26.50 (14.9)	177.90
1999-00	7.85	27.50	38.00	22.50	156.00
2001-02	9.25	32.50	34.25	26.75	158.00
2003-04	10.35	50.00	31.00	27.40	179.00
2005-06	20.00	89.00	35.00	33.00	241.00
2006-07	26.00 (9.3)	101.00 (36.0)	52.00 (18.6)	35.00 (12.5)	280.00
(%) change	62.5	194.89	57.58	32.08	57.39

Note: Figures in parentheses indicate respective shares in total area.

Source: Compiled from Cotton Corporation of India.

For instance, cotton productivity has almost doubled from 330 kg/ha (1996-97) to 520 kg/ha (2006-07) with the highest levels of productivity reported from Gujarat (718 kg/ha), Punjab (752 kg/ha), and Andhra (619 kg/ha), while Maharashtra reported productivity levels (280 kg/ha) much lower than the national level.

However, it is widely realized that the Bt technology poses serious issues and challenges that need thorough empirical scrutiny especially in the Indian context. There emerge certain questions that: (a) whether Bt technology is a

panacea to the problems faced by the Indian cotton farmers over the past several decades?; (b) what are the important tenets of the technology as propagated by its proponents and as realised by the farmers?; (c) Do the technology has desirable traits of being sustainable in terms of its beneficial outcomes - socio-economic and environmental - and effects to its users?; and (d) Does the technology have a firm grounding in terms of creating an enabling institutional and policy and regulatory environments to make sustainable impacts on the production structure, and value addition in the supply chain?

Obviously, some of these issues need a careful scrutiny through empirical analysis based on farm level data from cotton growing regions in the country which are diverse and heterogeneous in terms of farmer characteristics, agro-ecological factors and other resource endowments. It may also be noted that Bt cotton is an externally imposed technological outcome and its better performance in a given environment presupposes a host of factors that are beyond the control of majority of the resource-poor farmers in the country. Cotton farmers also encounter regular crop failures caused by recurring droughts, severe pest menace and rising costs of critical inputs resulting in huge losses in crop and income. Given this, the optimum yield levels as propagated by the technology is highly ambiguous and if at all is achieved; it makes the farmers to follow an input and cost-intensive farm management regime amidst growing uncertainties in output prices.

II. Experiences of adoption of Bt cotton in Maharashtra and Gujarat:

Ever since its commercial release, there has been a surge in the empirical literature examining various aspects of performance of Bt technology in various countries. Broadly, there have been three broad streams of empirical studies on the

impact of Bt cotton, which may be classified as: (a) economic; (b) social; and (c) environmental.

A critical review of the empirical literature on the impacts of Bt cotton across the major cotton producing countries, including India shows that the technology offers a mixed bag of opportunities along with serious apprehensions about its sustainable developmental outcomes. While the overall positive impact of the technology seems to be highly debated in the Indian context, China shows some positive outcomes. Further, countries such as Argentina and South Africa report dubious outcomes as adoption of Bt cotton is highly restricted in terms of monopoly provision of seeds and imposition of fees for technology transfer.

Studies in the Indian context have shown varying performance of Bt cotton in comparison to non-Bt cotton, including hybrids and traditional *desi* cotton varieties. By and large, studies indicate that the technology, if at all has been effective in providing higher yields, it was at a huge cost of input use (both fertilizers and insecticides) for control of major pests and diseases. Evidences also show that Bt cotton may be effective only with respect to certain of the bollworms while it does not control sucking pests and certain types of bollworms classified as *Spodoptera*. In fact, almost all the studies in the Indian context come to a consensus that the legal and administrative challenges emerging from development of GM crops cannot be addressed by the existing administrative and legislative capabilities (see also Joseph, 2007).

Hence, it is important to make an assessment of the farmer's experiences and perceptions about the performance of Bt cotton in India. In order to do this, we have undertaken a survey of 200 cotton farmers in Maharashtra and Gujarat covering the entire crop season of kharif 2007-08.

The cotton growing regions in the two states show clear distinctions in terms of the socio-economic profile and resource endowment status of the cotton growers. For instance, the average cotton area held by a farmer in the Vidarbha region in Maharashtra has been 2.7 ha compared to 5.08 ha in Gujarat. Bt cotton farmers in Gujarat have greater access to irrigation facilities (73%) compared to those in Maharashtra (49%). More importantly, access to irrigation facilities varied considerably across the districts in Maharashtra. For instance, Buldhana has the highest share of cotton grown under irrigation (76%) compared to Wardha (56%), Akola (51%), Amaravati (32%) and the lowest in Yavatmal (19%). Further, Bt cotton farmers in Gujarat show a greater dependence on cotton as 75 per cent of their household income comes from cotton compared to only 41 per cent in Maharashtra (ranging from 34 to 56% across districts).

Ever since the introduction of Bt cotton, the farmers have shown greater interest to grow Bt cotton in both the states. A clear distinction can be drawn here as regards the farmer preferences to Bt varieties. The percentage of sample farmers who were growing Bt cotton was about 54 per cent in Gujarat compared to Maharashtra (hardly 2%) during 2003-04. However, the scenario changed suddenly and by 2007-08, the adoption rate has reached 90 per cent in Gujarat and 74 per cent in Maharashtra. The scenario of Bt adoption in Gujarat becomes furthermore interesting as almost 59 per cent of the Bt cotton area is planted with unapproved or illegal seeds. Whereas, the Bt adoption situation in Maharashtra appears to be somewhat straightforward and the regulatory systems have better control over the seed market compared to Gujarat.

II.1. Bt cotton: Expectations and realisations

An important aspect needing careful scrutiny in the performance analysis of Bt cotton is the multiplicity or

proliferation of Bt and non-Bt varieties in the field. The seed market is highly dynamic in that newer varieties are introduced into the market year after year. In view of this multiplicity of varieties, it becomes rather complex to understand the yield and related secondary attributes of the varieties, thus making it difficult to arrive at a realistic measure of performance of Bt cotton. As majority of the seed sellers/ dealers are not 'well informed' in terms of the key attributes of the varieties, they are also unable to educate the farmers. On the other, farmers in the absence of adequate information about the varieties and their attributes relating to yield, resistance to the pests, and other biotic and abiotic stresses, tend to grow as many varieties as their tiny plots could accommodate. In view of these complexities, though Bt cotton would show up a significantly higher yield over non-Bt at the aggregate level (when all the plots are combined), there would be significant yield difference between varieties. In fact, a vast majority of the empirical analysis on the impact of Bt cotton at least in the Indian context ignores this important aspect while reporting the yield performance of Bt vs non-Bt cotton varieties.

We had asked a specific question regarding the yield performance of Bt and non-Bt varieties which we tried to capture in terms of expected yield and realised yield. As the survey was done in three phases, we could gather variety-specific information regarding the expected yield in the first round of the survey which was later compared by collecting the realised yield during the third round of the survey. Interestingly, in both the states, farmers have reported wider differences between the expected and realised yield outcomes. As evident from Table 4, the average expected yield reported in Maharashtra was 4.43 quintals per acre while the farmers were able to realise only 2.69 quintals per acre. Thus, there was a clear shortage of 39 per cent between the expected and realised yield of Bt cotton in Maharashtra.

Table 4: Differences in expected and realized yield of Bt and Non-Bt cotton varieties in Maharashtra and Gujarat

Bt/ Non-Bt	Descriptives	Expected yield (Qtl/ acre)	Realized yield (Qtl/ acre)	Difference between two (%)
1. Maharashtra				
Bt cotton varieties* (n = 48)	Mean	4.43	2.69	-39.28
	STDEV	1.98	1.67	27.64
	CV (%)	44.71	62.08	--
Non-Bt varieties* (n=25)	Mean	3.85	2.26	-41.30
	STDEV	1.75	1.83	36.92
	CV (%)	45.58	80.90	--
2. Gujarat				
Bt cotton varieties* (n = 56)	Mean	12.25	8.37	-31.7
	STDEV	5.12	4.69	-8.5
	CV (%)	41.80	56.02	--
Non-Bt varieties* (n=38)	Mean	6.73	10.87	61.6
	STDEV	6.92	10.89	57.4
	CV (%)	7.03	11.47	--

Note: The analysis was based on the number of Bt and non-Bt cotton varieties (n) as being grown by the farmers during 2007-08.

Similarly, in Gujarat, the farmer expectations regarding yield of Bt cotton varieties was 12.25 quintals per acre while they received 32 per cent less of the expected yield, ie., 8.37 quintals per acre. The performance of Non-Bt varieties has been much better in Gujarat where the farmers could realise more than what they expected.

In order to understand whether the farmers are influenced by the seed markets/ seed dealers in their varietal preferences, we have tried to look at the different sources of seed purchase resorted to by the farmers. The results indicate interesting contrast between Gujarat and Maharashtra.

Consultation with local farmers (and observations in nearby fields) has been the most important source for Gujarat farmers who apparently used more of unapproved seeds. In contrast, they rely heavily on dealers' advice for the approved varieties. Local learning (from neighbouring farmers and observing the variety in other fields) is most important for Maharashtra farmers, although seed dealers also play an important role. Advertisements and demonstration plots hold comparatively little sway although their influence is much more in Maharashtra than in Gujarat. It would seem that dealers' direct advice is the primary channel for companies to influence seed choices.

II.2. Bt Technology and pesticide treadmill

Arguably, most of the GM crops have been engineered to check or resist pests and diseases. In the case of Bt cotton seeds, there takes place production of high doses of BT toxin. Similarly, planting of non-Bt (refugia) crops either on borders or in several rows of Bt cotton fields is recommended so as to control the Bt toxin resistant insects. Moreover, proponents of Bt technology claim that Bt hybrids have inbuilt resistance to bollworms. It has been further claimed that the toxin produced in Bt hybrid plant is effective against all the three species of bollworms, viz., spotted bollworms, American bollworms (*Helicoverpa spp.*) and pink bollworm (*Pectinophora gossypiella*).

But, it has been proven beyond doubt that cotton is affected by more than 160 pests. This raises the resurgence of secondary pests as well as newly introduced pests and diseases (due to spraying of mixtures of insecticides). In the process, farmers end up spraying the same quantity of insecticides as they have been using before the introduction of Bt cotton. In

the literature, this phenomenon has been rightly identified as the 'pesticide treadmill'. It has been reported that in Andhra Pradesh, the number of attacks by number of 'sucking pests', such as aphids, thrips, jassids, etc has risen since the introduction of Bt cotton in 2002. Tobacco leaf streak virus, tobacco caterpillars etc have emerged as new diseases and pests of Bt cotton in the state. Of late, the emergence of new pest, called mealy bug (*Phenacoccus* spp.) has been widely reported from the Punjab, Gujarat and Maharashtra, which is a distinct case of secondary pest resurgence. According to the Punjab State Agriculture Department, over 2000 acres of cotton were destroyed by the mealy bug during the kharif 2007.

While a vast empirical literature suggests that there has been considerable reduction in the number of sprays against bollworms (Pray et al., 2001; Edge et al., 2001; Qaim and Janvry, 2005; Naik et al., 2005; Bennet et al., 2006), some recent studies negate this argument by indicating that Bt varieties require more insecticide sprays compared to non-Bt varieties (Narayanamoorthy and Kalamkar, 2006; Mahendradev et al., 2007; Lalitha and Ramawami, 2007). More importantly, it emerges from the above studies that since the farmers are more concerned about protecting the crop against all odds of attacks by pests and all other whether induced disease occurrences, they tend to spray more pesticides leading to a sizeable increase in their farming expenses.

Given this, we have examined the pesticide use practices of Bt cotton farmers in Maharashtra and Gujarat. It has been reported that in Maharashtra, the farmers have undertaken more number of sprays for Bt cotton (5 sprays/ha) as against close to 4 sprays per ha for non-Bt cotton. Similarly, in Gujarat, the average sprays for Bt cotton was close to 8 sprays per ha compared to 5-6 sprays per ha for non-Bt cotton.

Based on the number of sprayings undertaken for the Bt cotton plots in Gujarat, it was observed that about 57 per cent of the Bt cotton plots were sprayed 6-10 times and about 14 per cent of the Bt cotton plots were sprayed more than 10 times. Thus, it emerges from the analysis that adoption of Bt cotton did not have a positive impact on farmers' pesticide use behaviour. In turn, farmers in both the states report an increase in the number of pesticide sprays due to their adoption of Bt cotton.

The opinions of cotton farmers about the use of insecticides bring out an interesting point. Most farmers believe that the technology has lowered the use of insecticides for bollworm control. But, in turn, there has been a significant rise in insecticide use for other pests, like sucking pests, Mealybug, and other diseases as a result of adoption of Bt cotton (Lalitha and Viswanathan, 2009).

III. Bt Technology and sustainable agriculture: potential challenges

In this section, we try to contemplate some of the critical challenges confronting the sustainable development of cotton sector in India especially in the context of emergence and wide-scale adoption of Bt technology by a major segment of the small and marginal cotton farmers. Broadly, these challenges encompass an array of operational level issues and constraints affecting the feasibility of the technology, profitability of the crop and the sustainability of the Bt cotton production. For analytical brevity, these issues and challenges may be broadly categorized into two, viz., a) institutional and regulatory regimes; and b) farm level structural and operational impediments. In what follows, we briefly discuss on each of these issues.

III.1. Institutional and regulatory regimes

In the first instance, it may be noted that the Bt technology has been introduced in India as a panacea for the ills of low productivity which has been haunting the country since past several decades. While the technology has achieved certain amount of success in making a dent on the low productivity syndrome, there are serious concerns about the efficiency and consistency in the performance of the technology in diverse agro-ecological and hydrological environments. In fact, the proponents of the technology have made several claims about its performance, which mainly include: a) resistance to bollworms and the resultant decline in insecticide sprays and thereby a significant reduction in cost of cotton production; and b) a positive impact on yield arising from effective control of insecticides. Having said that, the question remains to be further clarified 'whether Bt cotton contributes directly to enhancing yield irrespective of varietal diversity and the complexities arising from insect attacks'.

However, as emerge from the foregoing analysis as well as the voluminous empirical literature within and outside India, the Bt technology has had only limited success in realising the claims. Apparently, the Bt technology, which is otherwise considered as the second green revolution (GM revolution), has been introduced in India without adequate thought on creating a conducive institutional and regulatory environment for legitimising the technology adoption on a wider scale. In other words, the technology has been externally imposed (by the corporate seed combine, like the Mahyco-Monsanto) without a strong institutional or legal backing from the regulatory regimes at the national level. This is in sharp contrast to the historic context when the Green Revolution was launched in India during early 1960s. Notably, Green revolution had made tremendous strides in Indian agriculture as it was backed up by a strong network of R&D as well as regulatory institutions and

governance structures. The GM technology, including Bt cotton has been introduced in India in a vacuum created by the virtual absence of such institutional and regulatory systems to facilitate the technology adoption and its scaling up with proper R&D and extension facilitations. Even after almost seven years of its introduction, the national as well as the respective state governments have not taken any serious attempts to understand the rationale behind the development and spread of the technology, its potential and scope for scaling up in the Indian context and legitimize it based on proper investigations on the ground level performance of the Bt technology.

A serious challenge posed by the apparently haphazard scenario of Bt technology as exist today is that the agriculture R & D institutions as created in the GR era virtually remain non-functional or redundant in terms of facilitating the adoption of technologies and best management practices (BMPs) for achieving the desirable outcomes of the GM technology in the India. This observation needs to be substantiated with the empirical reality that prevails in most of the states where Bt cotton has made a tremendous breakthrough at least in terms of farmer adoption. The fact is that Bt cotton farmers are left themselves to decide their destiny by the State and agriculture R&D institutions (like the State Agriculture Universities, Agriculture Departments and other specialized institutions) especially in matters of decision-making as regards choice of seeds, insecticides, and adoption of other disease control measures. In most cases, farmers are left at the mercy of the seed companies or pesticide companies or the local seed and pesticide sellers to seek extension and information support as regards the varietal attributes and crucial management practices to be followed at the farm level.

This points to the imperfections in the existing institutional environments encompassing R&D interventions and extension services as well as apparently exploitative inputs (Bt cotton seed and insecticide) and output markets at the fag end of the cotton production system. The imperfections in the seed and insecticides markets breed in total anarchy in the production system as the farmers are unable to get proper advice and timely guidance for choosing a seed or Bt variety based on prior understanding about its primary and secondary attributes given the agro-climatic and other resource endowments. Further, the anarchy in the production system is aggravated when the farmers do not find any extension services forthcoming at times when they are faced with problems of increasing infestations by pests like mealy bug, sucking pests and other unknown diseases affecting Bt cotton.

On the question of access to extension facilities, it may be further observed that the farmers in Maharashtra were mostly expressing their lack of access to better extension services especially when new pests like mealy bug or diseases like reddening of leaves occur. The farmers widely feel that they are really in problems on such occasions to get a trained extension agent to help them resolve their Bt cotton pest related problems. Ultimately, in most cases, their search for access to extension desperately takes them to the footsteps of the pesticide dealers who further complicate the matter by prescribing insecticides, which are new in the market, but may be quite obsolete to serve the purpose.

At the national level, public awareness about the potential benefits of the Bt technology as well as the probable risks involved in the use of GM crops including cotton is rather low. Though commercial release of a Bt variety needs prior approval and authentication by the Genetic Engineering

Approval Committee (GEAC), often the approvals are not based on scientific investigations based on larger trials laid out in diverse agro-ecological and hydrological settings of the cotton growing regions in the country. Moreover, there has not been greater appreciation of the fact that the commercial release of Bt varieties is to be preceded by proper dissemination of information about the varieties to the farmers.

A yet another challenge faced by the Bt cotton farmers especially in Maharashtra has been that despite a significant switch over to Bt varieties, cotton prices were stagnant in the state for most part of the decade beginning 1997-98. Farmers are never equipped to improve their skills to upgrade the quality of raw-cotton so that they could strive for a better price for the produce. In fact, this is going to be a major challenge affecting the sustainability of Bt cotton in India. Though it may seem quite untenable, a major chunk of the farmer suicides as reported from one of the study districts, *ie.*, Yavatmal, may have some corollary with the mental state of affairs that the Bt cotton farmers have been underway in terms of: a) lack of access to the institutional support, R&D and extension services; b) heavy dependence on the seed and insecticide dealers; and c) the unattractive cotton prices over the entire decade of Bt adoption. Thus, it is important to streamline policies for institutional restructuring so as to make the input and output markets more responsive to the dynamic changes in the production sector as brought out by the introduction of Bt cotton.

It may also be observed that the country has not yet evolved a fool proof legal or regulatory framework to monitor the spread of legally approved Bt cotton varieties on the one side as well as the wide-scale use of illegal or unapproved Bt varieties on the other side. For instance, an overwhelming

majority of cotton farmers in Gujarat still use unapproved Bt varieties, which have been sourced from the same retail outlets who also sell approved Bt varieties. This underlies the dilemma that the State faces in matters of legitimizing the Bt technology through exercising the regulatory power for devising proper monitoring mechanisms. Since a vast majority of the farmers have been planting these varieties ever since the official release of Bt varieties, any legal or regulatory measure to be adopted by the state government for banning such illegal Bt varieties would have serious repercussions on the political future of the government.

In India, both public sector institutions (universities, autonomous research bodies, Central Institute of Cotton Research, etc) as well as private sector agencies [Maharashtra Hybrids Seed Company- Mahyco, Monsanto; M/s Proagro PGS (India) Ltd, etc] are engaged in developing cotton varieties with high levels of resistance. However, it is pertinent to note that these agencies are primarily focusing on developing plants that are resistant to biotic stresses, i.e., resistant to pests and insects, and not to abiotic stresses, ie., making plants more adaptable or tolerant to adverse climatic conditions, such as drought. This is an important challenge in the country where a major chunk of Bt cotton is grown under rainfed or drought conditions, like Maharashtra. More importantly, with the emergence and spread of Bt varieties, the rich genetic diversity is being replaced by the new varieties. For instance, in Maharashtra, the emergence of Bt varieties has significantly replaced the traditional (*desi*) cotton varieties and currently almost the entire cotton growing area in the traditional cotton growing districts are distributed between Bt cotton and hybrid cotton varieties. Of late, the Central Institute of Cotton Research (CICR) based at Nagpur has been trying to develop insect resistant and high yielding *desi* cotton varieties as an alternative to the Bt cotton. However,

it has been reported that the GEAC has been successful in getting Government accord in directing the CICR to discontinue with the R & D experimentations in this regard.

III.2. Structural issues and operational impediments

The structural as well as operational impediments affecting the upscaling of Bt technology in India is certainly unrelated to the resource endowments of the small and marginal farmers, as the technology is scale-neutral. In fact, there are no significant differences between small and larger farmers in terms of adoption of Bt technology. Thus, the issues are more related to the structure and functioning of the input and output markets which exert greater influence on the non-viability of Bt cotton production system in India.

As stated above, the input markets comprising the seed, pesticide and fertiliser sectors are highly imperfect in terms of creating dilemmas among the farmers in matters right from the choice of Bt cotton varieties to the choice of proper insecticides and fertiliser use. As newer and newer Bt varieties are introduced into the market year after year, farmers hardly get sufficient time to make a careful scrutiny about the varieties and build up their knowledge base based on experience. The proliferation of varieties makes the scenario further complex as majority of these varieties do not seem to be unique in terms of farm level performance and other varietal attributes as already observed. Thus, there are limited chances for the farmers to strengthen or enrich their experience with Bt cotton based on either environmental or social learning.

Since the performance (of what ever magnitude) of Bt varieties is certainly specific to the single year of adoption, farmers become highly dependent on the seed market to replace seeds every year. The market dependence is further

strengthened by the propaganda that the Bt seeds used in the first year cannot be saved for the second year, as the seeds won't be as effective as that in the first year. To make the matters further worse, newer varieties are introduced into the market which persuades the farmers to try the new seeds/varieties every year, thus adversely affecting their economic status. Thus, with the entry of Bt cotton, the practice of the use of 'farm saved seeds' come to permanent halt.

III.3. Imperfections in input and output markets

With the emergence of Bt cotton in particular, the local input markets became highly integrated with the seed, pesticide as well as fertiliser companies. A survey conducted among 80 seed dealers in the Vidarbha region as part of the study revealed that almost 95 per cent of the seed dealers are also sellers of insecticides and fertilisers. As a result, the farmers are mostly compelled to buy the seed, insecticides and fertilisers from the same shop. This enables the local seed-pesticide-fertiliser sellers to strengthen their hold over the farmers, which always puts the farmers at a disadvantage. Though sales of seeds are not on credit, the sales of insecticides and fertilisers are on credit and very often, the interest rates charged by the seed/pesticide sellers are exorbitant.

Coming to the complexities in the output market, it is important to note that the development of Bt technology did not have any considerable impact on revamping the otherwise ineffective and imperfect cotton marketing systems. Though the existing system of marketing of raw-cotton also allows for differential pricing of the product based on quality of the lint, in reality, farmers do not get higher prices for better grades of cotton sold by them. Hence, the farmers are compelled to sell cotton as ungraded and there are no proper systems or legal or institutional mechanisms to distinguish between cotton outputs

produced from Bt planted plots and non-Bt or conventional cotton planted plots. Even the existing lower prices of such ungraded cotton are further discounted in the pretext of poor quality of cotton (containing seed, wastes, particles of leaf and cotton stem) as sold by the farmers. This is an important challenge which has greater implications for the viability of Bt technology and sustainability of Bt production system.

IV. Conclusion: The way forward

To conclude, it may be observed that there is no clear way forward to sustain the initial dynamism cast by the introduction of Bt technology in India. A bright future for Indian agriculture with the presence of GM technology in general and Bt technology in particular, would essentially call for many reforms, development strategies and institutional and policy interventions covering a wide spectrum of activities ranging from restructuring the input markets to the output markets. Though it is true to believe that Bt cotton contributes to yield increases, the most important objective of the technology was to lower the use of insecticides. The study reveals that Bt technology has been a total failure on that score and the impact of the technology has been less evident. While the effect of Bt technology becomes somewhat clear in reducing (but not eliminating) bollworm attack, it proves to be highly ineffective in terms of control of sucking pests, including the latest emergence of mealy bugs as widely reported from almost all the cotton growing regions in the country.

The paper highlights the importance of evolving new institutions and regulatory systems for proper grounding and spread of the Bt technology in India. Areas of immediate concern includes *inter alia*:

- a) Development or strengthening of existing R&D systems in the cotton sector to make the technology work efficiently for the benefit of about 4-5 million cotton farmers in the country;
- b) Regulation of input markets with proper legislations and administrative systems;
- c) Developing financial support systems, like crop insurance against crop loss caused by germination failure (seed companies to be implicated for this), pest infestations, drought or floods;
- d) Creating efficient extension systems by revamping the state level agriculture extension services to facilitate better adoption of Bt technology among the farmers with proper skill formation through imparting training on farm level benefits arising from the practice of IPM and IRM; and
- e) Creating efficient marketing system for Bt cotton by which output quality is improved through grading with higher premiums paid for better quality output.

To sum up, it may be observed that India has to evolve carefully devised strategies and action plans to learn from the experiences of other countries with respect to the performance of GM technology in general and Bt technology in particular. These strategies and action plans presuppose creation of new institutional or regulatory regimes or reinventing the existing ones so as to make a sustainable impact of the technology on the livelihoods of millions of cotton farmers as well as the century old cotton production sector in India.

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**Natural Resource Management -
Creating Leadership for Confidence Building
Amongst Farmers in Vidarbha District Especially
in the Light of Suicides Taking Place Amongst
Them**

Soham Pandya

Introduction

Maharashtra state is a developed state of western India in many ways. The most eastern side of Maharashtra is known as Vidarbha and it consists of 11 districts. Vidarbha is located between 21°46' North latitude (in Amaravati) to 18°43' North latitude (of Gadchiroli) and 80°53' east longitudes (of Gadchiroli) to 75°57' east longitude (of Buldhana).

The 11 districts of Vidarbha are Gondia, Bhandara, Gadchiroli, Nagpur, Chandrapur, Wardha, Amarawati, Yeotmal, Akola, Washim, Buldhana (please see above map). It has good track record in agriculture as well as horticulture.

Climate and Rainfall

All districts of Vidarbha face extreme variations in temperature with very hot summers (47.8 degree Celsius) and very cold winters (4.5 Degree Celsius). Vidarbha region receives rainfall from south westerly monsoons mainly in the months of June, July, August and September. Maximum rainfall is reported in Bhandara and Gondia districts (about

1300 to 1500 mm). July and August are the months during which the maximum continuous rainfall is reported.

Agriculture and Crops

The main crops in the western Vidarbha are as follows

Irrigated: Wheat, Gram, Vegetables; **Non-Irrigated:** Cotton (second largest area of agriculture land is covered with this crop in these days), Jawar, Toor or Arhar, Moong, Groundnut, Soybean (Maximum area of the region is covered with this crop in these days), Gram, Sunflower; **Major Cash Crops:** Cotton, Orange, Groundnut, Soybean, Chilli, Banana; **Major Plantations:** Orange, Banana.

In eastern district of Vidarbha major crops are mostly **Non-Irrigated:** Paddy and Toor or Arhar.

The Issue

Farmers of six districts of Vidarbha are committing suicide due to combined effect of debts and crop failure. In the last three decades farmers are relying predominantly on external inputs in the form of # Tilling the land with tractor, # Seeds, # Fertilizer, # Insecticides and pesticides. In earlier days there was a delicate financial balance in the income and expenditure of the crop economics. Crop failures were reported even in earlier days but it used to be compensated from the earnings in other years which use to be good or excellent from the farmers point of view.

However in recent times the input cost of the agriculture has increased dramatically (many times as high as 1,000% more) but the cost of agriculture produce has increased almost negligibly (except in the case of some selected cash crops). This situation has tilted the economic balance against the farmer. **A cash crop of yester years has lost its battle to a**

cheaper imported cotton bales. Dependency of farmer on external energy intensive costly agriculture inputs has its own economical and ecological backlash. Similarly dependency of farmer only on one crop has its own negative impact. It is opined by the experts that dependency of farmer should rest on more than one crop for their economic prosperity.

Since 80% of farmers of the region are dependant on the nature for fulfilling the water demand, they have very little choice of diversifying their agriculture. In yester years they had only cotton as the cash crop. However in recent times Soybean has assumed the status of cash crop for farmers having un-irrigated land. Soybean has become more popular amongst farmers and it is rapidly replacing traditional crop i.e. cotton. This can be seen from the following data which pertains to Wardha district

The geographical area of Wardha district is 628,900 hectares. Out of this 429,600 hectares area is cultivated during rainy season. **Cotton (*Gossipium herbacium*)** crop is the main cash crop for the people of Western Vidarbha area. Farmers having dry land predominantly grow this crop. The area covered by this crop during different cropping season in Wardha district is given below in a tabular form.

Sr. No.	Year	Area (Hectares)
01	2000-2001	153,124
02	2001-2002	158,072
03	2002-2003	126,430
04	2003-2004	110,731
05	2004-2005	108,958
06	2005-2006	096,632
07	2006-2007	081,200 (predicted)

From the table it is apparent that the area under cotton cultivation has reduced considerably. During 2000-2001 the area covered under this crop was 153,124 hectares and it was equal to 35.64% of the total cultivable area. However during 2006-2007 the area which is likely to be covered by Cotton will be only 81,200 hectares or 18.9% of the total cultivable area. A considerable (50%) reduction in the total area and that too in a period of seven years is very much apparent.

The reduction in the crop area is because the cost of cultivation of cotton has increased considerably and the returns are almost same.

Soya Bean (*Glycine max*) is recently (1995-1996) introduced cash crop in this region. It is preferred by the farmers because the cost of cultivation is less (less labor intensive), demand of water is limited (rain fed), this crop is of shorter duration, its productivity is good and last but not the least the financial benefits, as of now, are handsome. Because of these features the area of Soya bean cultivation has increased from 29.16% during 2000-2001 to 47.32% during 2006-2007.

Sr. No.	Year	Area (Hectares)
01	2000-2001	125,297
02	2001-2002	121,018
03	2002-2003	145,710
04	2003-2004	150,159
05	2004-2005	181,324
06	2005-2006	199,697
07	2006-2007	203,300 (predicted)

However there is one problem in Soya bean crop and that's if this crop is cultivated in the same land year after year than the susceptibility of crop to the pest increases several fold.

Secondly since the farmer is dependent on the vagaries of nature many a times he is unable to get enough yields in drought prone areas and therefore the financial returns are paltry. Many times same situation continues for more than one year and a farmer gets trapped into an economical whirlpool where he is unable to handle the financial burden in decent manner. This has set in a chain of events in which a farmer gets trapped into financial bankruptcy. In such cases farmer has no money to repay his loan taken either from the bank or from private money lender. He also does not have his own resources to invest for cultivating a new crop. Many farmers trapped in this hopeless situation are facing psychological, social and financial problems of high magnitude. In severe cases mentally and psychologically weak farmers are committing even suicides.

When a farmer grows a cash crop he covers almost all the prime and even secondary land with it. Thus a farming family becomes fully dependant on the market for meeting almost every need of the family. This is true in western districts of Vidarbha. If crop fails or does not give returns as per the expectations of the farmer than he needs external financial help even to meet his basic needs like feeding the members of his family.

Vidarbha is a resource rich region where Maharashtra state's 58% forest areas are located. However there is need to utilise these resources at grass-root level for generating job opportunities and income.

The non timber forest products collected from the forest areas by tribals are sold in their raw form to organised sector at almost throw away price. This process takes away job

opportunities and the income of the rural & tribal people. If tribals and villagers are to get benefit of forest resources there is need to transfer technologies and methodologies, which makes collection, processing of raw NTFP and its marketing sustainable as well as remunerative.

In agriculture sector also there is a need to reduce input costs (to the extent possible), diversify crops and cropping pattern and increase the level of income by processing raw material into value added, durable and marketable products.

Even though a substantial percentage of women of almost all villages of Vidarbha are organised into several thousand Self Help Groups (SHG) and even if they have small amounts of savings in the banks, they are not able to utilize this organisational structure and financial asset to its full capacity. This is mainly because SHG do not have access to technical skills which they can convert into trade and make their earnings. Thus there is need to address this problem by introducing S & T in the region.

In present market set up village women are exploited as seller as well as purchaser. Thus there is a need to create new marketing strategy which is based on fair deals. Village women are also facing problems of health and hygiene in their routine and normal life.

Key Themes

- **Environmental issues specific to the region**

Following are major environmental issues of Vidarbha area.

Protection of luxuriant forest in eastern districts and its sustainable utilization for economic prosperity of farmers of Vidarbha (from organized and unorganized sector) is the first major issue.

Another major issue is reducing water runoff and soil erosion during rainy season from those areas where forest cover is drastically reduced.

The third major issue is associated with farming. In this category excessive use of water, chemical fertilizer and chemical pesticide is a matter of concern not only because of economic consideration but also for environmental consideration.

In eastern districts of the Vidarbha forest cover is dense and it is inhabited predominantly by SC and ST population. The first issue ailing this area is that forest wealth is not utilized in an eco friendly manner. Non Timber Forest Produce (NTFP) is harvested from the forest in an unsustainable manner by villagers for getting maximum benefits within limited time span.

Key economic, political, social trends in the region

Economic Trends: There are two distinct trends which can be observed in the rural economic sector.

In the first case economy of villagers is dependant on farm as well as forest sector. In such cases farming is done predominantly for sustenance and not for profit.

In the second case the village economies rely exclusively on farm sector. Here farmers cultivate cash crops for realizing bumper economic gains and not for food security or sustaining their family.

In both the above cases there is no great contribution of a third sector called dairy. According to one estimate there is demand of four million liters of milk every day in Vidarbha.

But Vidarbha produces only 4 hundred thousand liters of milk every day. Thus there is a gap of about 3.6 million liters of milk each day. This demand is fulfilled from adjoining and far off areas where there is additional production of milk.

Analysis of First case: In those areas where there are good forests, people have more resources for earning their livelihood. If these forest wealth is taken into consideration and its direct benefit to the people living in the forest villages is taken into account, than a vital picture starts emerging.

For example According to a survey, conducted by Mr. D. P. Sadavarti, Assistant Conservator of Forest (ACF), Forest Department, Government of Maharashtra, Gondia in this district there are about 1.5 million trees of Mahua (*Madhuca indica*) in the forest and private land. One tree of Mahua gives at least 50 Kg of flowers (dry weight). At a rate of Rs. 7/- per Kg total income to the forest villagers from these single tree species is about Rupees 525 million every year. On similar lines the chances of forest dwellers to get direct benefit from other forest resources is also very lucrative. The money obtained from gathering Lac shellac is to the tune of about Rupees 100 million every year. The net income for the forest villager from Beedi leaves (*Diospyros melanoxylon*) is about 40 million every year. All this income comes to the tribal / villagers in a season when there is no work for them in the farm sector. Thus there is no competition for the labor between farm and forest sector and therefore the work is distributed evenly during different seasons of the year. In addition to above listed non timber forest produce there are many more resources at the doorsteps of the forest people like honey, gum, medicinal plants, non edible oil seeds, wild fruits and berries. All these produce give direct financial benefits to the rural masses.

If we add up these entire amount and distribute amongst the forest dwellers, (predominantly schedule cast - SC and schedule tribe - ST population-half a million), living in the 35% forest area of the region than net income per family is about Rupees ten thousand every year. This amount comes by putting in only labor and that too in that season when there are no chances of getting other occupation. There is no investment in whatsoever form from the people and the returns are realized immediately without any delay.

Other indirect benefits of the people living in or around forest area are that they get many things free for their domestic and veterinary purposes. It includes green vegetables, wild fruits & berries, fire wood for cooking and fodder for cows, buffalos, goats, sheep etc. By procuring these materials they may not be getting monetary benefits directly but indirectly it strengthens their economy as well as health.

The situation is not much different in other eastern districts of Vidarbha namely Chandrapur (forest area about 33.44%), Gadchiroli (forest area about 78.40%) and Bhandara (forest area about 33.33%).

In all these eastern districts another striking feature which has lot of bearings on the food security of the family is that, here each farmer is giving first preference to growing food crops (i.e. Paddy) for meeting the demand of the family. This reinforces security of a family as far as food is concerned. For growing paddy a farmer doesn't invest much money either from his own resources or from borrowings from banks or money lenders. Thus the economy of these farmers is that of a subsistence living and does not involve any risk.

Thus one may conclude that because of presence of better ecological and environmental condition farmers and villagers of tribal belt are financially better off.

Analysis of Second case: As mentioned earlier in the second case economies of farmers of western Vidarbha rely exclusively on farm sector. Here farmers cultivate cash crops for realizing bumper economic gains (and not for food security or sustaining their family). For meeting the expenses of cash crop a farmer invest money either from his own savings or by borrowing it either from banks or private money lenders. If the returns of the crop are realized as per the expectations in that case there is no problem but if because of vagaries of nature the returns from the cash crop is not realized as per the expectations of the farmer then he has to depend on loan for meeting even the basic needs of the family. This means that family does not have any kind of security. If crop fails year after year then the farmer gets trapped into a financial burden which he is unable to handle. In such distress financial condition he commits even suicide.

If this issue is discussed in little details then a clear picture may emerge. In yester years farmers of western Vidarbha were predominantly growing Cotton as a cash crop. This farm sector was protected even by policy decisions of Maharashtra Government till **1998**. The scheme was called **Cotton Ekadhikar Yojana (Cotton Monopoly Scheme)**. In this scheme government of Maharashtra was purchasing all the cotton on a fixed rate from the farmers through cotton federations. At one period of time government gave as much as Rupees 2,500/- per quintal of cotton. Because of such reasons this scheme was very much popular amongst farmers.

However in recent times farmers who are practicing dry land farming for cultivating cash crops (like cotton) adopting

expensive inputs for farming are facing acute problems, because input cost in farm sector has gone up considerably. The securities, which farmers were getting for their cotton produce, because of implementation of monopoly scheme are not enjoying same status in these times. Now farmers are given Rupees 1800/- to Rupees 2050/- per quintal. Because of this policy decision small and marginal farmers having dry-land are facing acute problems. If we study and compare the price patterns of different commodities during 1975 and 2005 than probably we will have more sound ground for assessing the situation of farmers in the region.

Compared to 1975 the input cost of agriculture inputs has increased several folds. How many fold cost of some commodities has increased during last 30 years is given here as example: Seed (15 times), Fertilizer (10 times), Pesticides (15 Times), Labor (20 Times), Transportation fuel (15 Times). Thus each and every farmer is paying more for cultivating his crop.

In contrast to above the price of agriculture produce has not increased in the similar proportion. For understanding the issues the difference between the price of selected crop in the year 1975 and 2005 are given here: Cotton (3 Times), Sugar Cane (4 Times), Paddy (4 Times), Ground nut (2.5 Times), Fruits (2.5 Times). In nutshell above information indicates that, over a period of time agriculture is becoming less remunerative business or in other words agriculture is a loss making venture.

In contrast to agriculture field the picture of service sector is remarkably different. If increment in the salaries of government service sector is taken into consideration then one find that salaries of officers of various 1st to 4th classes (1st to 4th classes) has increased dramatically (i.e. 45 times).

Following tables will give more details of cost of various items in the year 1975 and in the year 2005.

Table 1: Comparative Prices of Commodities in Trade during 1975 and 2005

Sr. No.	Name of Commodity	Rate in the year 1975 in Rupees	Rate in the year 2005 in Rupees
01	Beetle Nut	700 per quintal	15,000 per quintal
02	Simple cloth	25 per meter	250 per meter
03	Chilli	5 per Kg	50 per Kg
04	Salt	10 per quintal	1000 per quintal
05	Edible oil	250 per quintal	5000 per quintal
06	Spices	20 per Kg	300 per Kg
07	Jaggary	250	1250
08	Sugar	400 per quintal	1600 per quintal
09	Tea	1000 per quintal	15,000 per quintal
10	Soap	0.15 per pieces	15 per piece
11	Bidi	8 per 1000 pieces	200 per 1000 pieces
12	Detergent powder	5	40
13	Shoes	10	150

Table 2: Comparative Price of farm produce during 1975 and 2005

Sr. No.	Name of Commodity	Rate in the year 1975 in Rupees	Rate in the year 2005 in Rupees
01	Jwari Millet	100 per quintal	450 per quintal
02	Whet	250 per quintal	750 per quintal
03	Toor	300 per quintal	1500 per quintal
04	Chana	2.5 per quintal	1250 per quintal
05	Paddy	240 per quintal	1000 per quintal
06	Jaggary	160 per quintal	1400 per quintal
07	Sugar	400 per quintal	1500 per quintal
08	Mung	450 per quintal	2000 per quintal
09	Udad	50 per quintal	2000 per quintal
10	Ground nut	500 per quintal	1400 per quintal
11	Milk	2 per liter	16 per liter

12	Eggs	0.4 per egg	1.2 per egg
13	Cotton	550 per quintal	1800 per quintal
14	Sugar cane	200 per quintal	800 per quintal
15	Banana	40 per quintal	200 per quintal
16	Fruits	300 per quintal	1200 per quintal

Table 3: Comparative Price of Products of Factories during 1975 and 2005

Sr. No.	Name of Commodity	Rate in the year 1975 in Rupees	Rate in the year 2005 in Rupees
01	Petrol	3 per liter	45
02	Diesel	5 per liter	32
03	Kerosene	0.40 per liter	12
04	Cycle	500 per piece	2000
05	Four wheeler car	50,000 average	500,000
06	Television	2000 per piece	10000
07	Radio	400	1000
08	Furniture	400	4000
09	Fan	200	1200
10	Watches	100	800
11	Normal m/c	2000	10000
12	Pen	1	5
13	Paper	10 per rim	200
14	Cosmetics	5	50
15	Medicines	2 per strip	40
16	Chemical fertilizers	40 per bag	400
17	Seeds	50 per Kg	750
18	Pesticides	70 per liter	1000
19	Tools	100	1800

Table 4: Comparative Salaries or wages of Officers/ Workers / Farm laborers/Government workers in 1975 and 2005

Sr. No.	Type of Workers	Monthly Salaries during 1975 in Rupees	Monthly Salaries during 2005 in Rupees
01	Officers above class 1	1500 to 2000	40 to 50 thousands
02	Class 1 officers	800 to 1200	30 to 35 thousands

03	Class 2 officers	600 to 800	25 to 30 thousands
04	Class 3 officers	300 to 400	15 thousands
05	Class 4 officers	100 to 150	5000
06	Farm laborers	100 per month	2000
07	Salaries of Factory workers	120	6000

In addition to the economic loss there is an environmental price which is being paid by the people of cotton growing areas. Maximum consumption of chemical fertilizer and chemical pesticides is reported in the cotton field. Because of excessive and unscientific use of chemical inputs the land has become unfertile, water sources and human food chain has become polluted with poisonous pesticides.

In this kind of economy farmers are dependent on single source of money for their economic needs. Unlike their counterparts in forest districts they have no other source for strengthening their economy. In such situation if a farmer loses his cash crop he loses almost every thing for that particular year.

Political trends in the region

The *Panchayat Raj* Institutions are not able to address the issues of village community primarily because the politics of the village have not taken the issues of economy and ecology or environment very seriously. This can be made clear by considering two developmental models as examples 1) Watershed management and 2) Organic farming.

Watershed Management:

As a director of eco-technology division of Centre of Science for villages (a Non Government Organization, located at Wardha where I am working) I am looking after the work of watershed management programs in six districts of Vidarbha as a **Mother NGO** appointed by the Maharashtra state

government. Over last five years I have found that the program of watershed management has lot many things to offer to the village people. The program is being implemented as National Watershed Development Programme for Rain-fed Areas (NWDPA), Drought Prone Area Program (DPAP), *Hariyali* etc.

However because of failure on the part of political figures as well as common people of the village to understand the issues in its right perspective this program did not bring about desired changes in the villages. As far as *Hariyali* program is concerned it is to be implemented by the village *Panchayat* by taking in confidence all the people who have voting rights (*Gram Sabha*). At *Panchayat* levels this program did not perform as desired because of following constraints.

- People's participation, especially at the planning and implementation stage was not satisfactory because the question of what constitutes planning and how does these plans ought to be implemented were not clear to the people.
- There was no accountability on the part of people and their representatives at village or *Panchayat* level. Only officials associated with PRI were made accountable. Because of this situation they were over cautious and did not deliver their duties freely.
- Funds were not released as per the time schedule (either by the state government or by the Central Government) and these funds were tied up giving very little scope to the people or their representatives to make their own program. Because of this situation people and their representatives never considered PRI programs as their own.
- There was no technical support at official or people's level for implementing the program in an effective manner. The staff was not trained professionally. Thus even though

the project under consideration had good component they could not be implemented in its right spirit.

- Places where agencies were successful in involving people there the results of the whole program were excellent. In all the successful cases people were first given the demonstration of technical input and once they were convinced they willingly participated in the entire program. In fact in some cases the result was more than 100%.

Organic Framing

- This movement is basically a movement of voluntary sector and now it is made a policy of the government of India. In this case also there is need of people's participation, participation of voluntary organizations and technical institutions. Since all these components are missing at grass root level therefore there is no visible difference at grass root level. If this program is taken to the farmers in an effective manner, then there is a scope for restoring village environment.
- For making the program successful at PRI level few measures will be necessary. Give PRI functional autonomy; involve people right from the beginning in decision making process; develop planning capability of people so that they may plan for themselves. Teach them how to priorities their demand in accordance with the scheme; build the capacity of people, officials, members of PRI etc. so that they may internalize the concept of the scheme;

Social trends in the region

- In general people have developed psychology of defeat and therefore they do not think positive about any scheme proposed to them by any agency (NGO or Government) or individual (Government official or political figure).

- However if people are involved right from the beginning of the schemes results are extremely encouraging;

Recent and relevant community action

All over the world there are about 15,000 plant species which can be used as food. However at present only 1500 (i.e. 10% of the potential) are used on large scale by the mankind. Thus the scope of introducing new food items in the main stream market is unlimited.

While working on the natural resources it was very strongly realized that each area (including Vidarbha) has an ethnic flora which has potential of acquiring the status of regular crop or even cash crop if and only if the details pertaining to its production in the field, processing for preservation, product diversification & value addition and marketing is thoroughly worked out in scientific manner. The whole system is to be derived in such a manner that the production, processing and marketing activities remain ecologically sound, economically viable and socially just.

Ecologically sound means the cultivation of the new crop should be done organically i.e. use of compost, biological system of pest management, application of minimum amount of water, productive utilization of natural forces like different wavelengths of light, shade of tree, moisture in the soil, humidity of air in the close vicinity of the tree, favorable association of plants amongst themselves and with microbial population, maintenance of biodiversity and formation of multistoried plant community. The production system should not drain or pollute the means of primary productivity i.e. land, water, air and genetic pool.

Economically viable system stands for making the system economically competitive from market point of view. The cost of production of biomass should be cheaper than the existing competitive production cost, its processing should be done in the nationally recognized standard methods which is not expensive and still produces high quality products and the demand of the value added product should be large so that the activity gathers the momentum and it becomes economically remunerative for those who want to earn their living by adopting it.

Socially Just system means it should not exploit anyone who is participating in any of the activities i.e. people involved in the production of crop, processing and packaging of material, selling of the finished goods and the consumer of goods.

In principle and even in practice many organizations have evolved a viable system of biomass production, processing and marketing (from arable land, forest land and waste land too) which is ecologically sound, economically viable and socially just. The dynamics of this system is described below:

- * The field group produces or collects biomass at small village level and partially processes it.
- * Semi processed quality good is purchased at fixed rate by the processing unit at medium size village where weekly bazaars are held. The biomass is processed further either for consumer or big industries and sold at reasonable rate.
- * The big industries at nodal or big village level are those which process the raw or semi processed goods into the finished consumable items on medium to large scale. At present these industries are working as per their norms (i.e. for profit making). However at later stage such industries can be made a partner in the system which

believes in the fair trade of quality goods made by the women's or tribe's field group.

- * Whenever the chain linking producer and consumer is short, in that case both the parties are benefited i.e. the best quality product is available at fair and affordable price even to the poor people of the society. Hence rural based micro enterprises are the key to the rural employment.
- * Thus the production, processing and marketing of consumable commodities can become an income generating activities in a cluster of villages and it may include a vast range like
 - Food
 - Medicine
 - Textile
 - Cosmetics and toiletries
 - Building material etc.

The main focus of the program should be to identify plants which have potentials to provide nutritious food, develop methods to process them in as many diverse way as possible and then introduce the product range in the mainstream market at grassroots as well as national and international levels.

By taking up the activities related to cultivation, processing and marketing of new plant species several field groups of women and farmers can self employ themselves. These neo leaders will have leadership qualities and they will function as agents of change.

Challenges that face any or all communities

One successful example from one of the tribal district is a silver line on otherwise gloomy atmosphere. This example is of a village namely Mendha (Lekha)

As per the study conducted by Mr. Mohan Hirabai Hiralal the faults do not lie only with the people and policies of state or central governments but they are present even in the structure or frame of the program and its modus operandi. If the strength of people is to be exhibited then the structure and method should also exhibit a new look. The salient feature of this structure and function are listed below

Decision at village should be taken by all the members of the village council (and not by the elected representatives as is done presently). This means that in the village the people have the say and not their representatives.

At a higher level like group of village or block level or even at district level people's representative (preferably selected) will take the decision.

Decision at village level should preferably be taken by consensus and not on majority basis.

Issues which can be sorted at lower level should not be referred to higher level of governance. It can be social, technical, financial or even legal.

People will be the first citizens of the village and then they will be the citizens of the global community.

In this model almost all the power of governance will be given to the villagers. It will be executed by participatory method. In the village council each and every decision, pertaining to routine work, will be taken by all people of the village

Conclusion

The development of village can not be brought about by ignoring environmental issues. Forest, Water, Farm, Rural industry sector etc. are all associated with environmental issues.

At organizational level village should be considered the most basic unit and for human resource development an individual is the most fundamental entity. No development plan can work unless individuals are made the part of the programme right from the beginning. The psychology of defeat can be converted in to psychology of success if the moral of individual is raised above. For achieving this goal there are no short cuts. Once the moral is high, villagers will make their own plans, implement it and bring about desired changes in their community.

Participatory planning for natural resource management is the only way to protect the existing forest, water resources, and fields & farms. As mentioned elsewhere people having forest resources have better opportunities to handle vagaries of nature as compared to those who do not have such wealth at their disposal.

Forest resources can be made more remunerative if they are processed at village level for preservation, product diversification and value addition. Same thing holds true even for farming sector. If the village based organizations are given technical inputs for production of seed, fertilizer, bio-fertilizer, and pest repellants (i.e. if the organic farming is promoted) then and then only villages can be made free from exploitative and polluting systems.

Save Earth and Conserve Moisture Through Continuous Contour Trenching (C. C .T.)

***Vasant G.
Talkalkar***

Introduction

Environment has been considered as the aggregate of all external conditions and influences affecting the life and development of an organism. Development without regards to the ecological equilibrium has led to an environmental crisis in recent past.

Our late prime minister, Mrs. Indira Gandhi, in her speech in Stockholm conference said “The extreme forms in which question of population or environmental pollution are posed, obscure the total view of political, economic and social situations. It is sad that in country after country, progress should become synonymous with an assault on nature.

Among the rest of mankind, we in India- inspite of Ashoka- have been guilty of wanton disregard for course of our sustenance.....”.

Environmental degradation in India is increasing at an alarming rate. According to estimates made by the Ministry of Agriculture in March 1980 as much as 174 million hectares out of country's total land area of 329 million hectares for which the land records exist, create various environmental problems. The area subject to floods which was estimated to 20 million

hectares in 1971 increased to 40 million hectares after ten years.

India's total land area is 32,87,263 sq. km. and total forest cover is 6,40,107 sq. km (1993).which is 19.47% of the total geographical area of the country. Per capita availability of forests in India is 0.08 hectare only which is much lower than world average of 0.8 hectare.

Mahatma Gandhi said, "The earth provides enough to satisfy every man's need but not for every man's greed." Even today it holds good provided the natural wealth is protected, conserved and utilized judiciously. Due to mismanagement of natural resources whole world is facing shortage of potable water.

Over-exploitation of forests has resulted into denudation of the land. As a result there is heavy soil erosion affecting food grain production. Every year about 600 crores tonnes of soil is displaced in our country, out of which 30% goes to sea (permanent loss). Most of the rain water flows away resulting into scarcity conditions.

Ex. President of America has said "the country who does not save their soils can never save their country". It is therefore very necessary to save our soils and to harvest every drop of water and recharge the same into the ground to meet our living requirements. With thousands of dams we are able to arrest and store only about 10% of the annual rain water and remaining water flows away to sea. In India rains are seasonal and almost all water rushes towards the sea.

Water is one of the basic needs of the human beings as well as of all living beings on the earth. Out of the total

quantity of water available on the earth 97% is in the form of saline water and only 3% is sweet water. Out of this 3% water, 2% water is in the form of ice and only 1% is available as fresh water from rains.

With increase in human population, cattle population and industrialization, the requirement of water has increased by many folds. The natural resources have not increased in same proportion as a result the supply is not up to or as per requirements. In order to meet our demands we are overexploiting the underground water ruthlessly and excessively. As a result of this, there has been imbalance in the environment. The excessive exploitation of underground water has caused serious problems and the life is at stake today. Our demands are increasing faster than the resources available. Unless we manage our resources judiciously, the situation will be out of control.

It is said that India is blessed with plenty of natural resources. Perhaps this might be true for the past, today we can not boast so since majority of the people are either below poverty line or near the poverty line. Regarding water, every third Indian is suffering for water.

“Water is like explosive not to be shunted loose”. In fact it is a problem both ways, due to its’ hazardous effects of floods, covering large chunks of areas and scarcity during summer season .Specially the floods have very bad effects on the life of people, both in rural as well as urban areas. Another difficulty is that the rain falls during certain limited period of the year say during rainy season, which varies from 40 to 110 days. Majority of the precipitation is received in less than half period of the season. Hence water has to be stored for longer period of the year. During rainy season many times it rains

torrentially. The degraded forests and the waste lands are not in a position to retain / withhold the rain water. As a result the water starts flowing along with the slopes, and carries along with it the upper fertile layer of top soils. This has adverse effect on food grain production of the country.

The irrigated land in the country is between 20% to 30 % barring the example of Punjab state. It is very necessary to increase the food grains production of the country to meet the requirement of our ever growing population.

Objectives: To achieve this, it is equally important to

1. Protect our soils from various destructions first, along with
2. Harvesting rain water and recharge the same in the ground on sustainable basis for the benefits of mankind.

The methodology to be adopted has to be cheaper, economical and easily replicable throughout. So far, the most suitable and proven methods of collection of water are either neglected or not attended scientifically viz. Flood system of Dhule dist. Almost more than two thousand years before, local people of Dhule district used to construct small bunds up to certain height limits in the riverbed. The excess water used to overflow and was available for down stream people. The water from the bund (small dam) was circulated to the Agricultural fields by gravitation. Excess water was again diverted to river keeping the river alive through out year. The traditional methods of water harvesting needs to be reviewed and modified where ever necessary

In order to satisfy the above objectives economically and efficiently CONTINUOUS CONTOUR TRENCHING(C C T) method is the best solution.

The "Top to Bottom" principle is adopted in CCT, so that total area is treated not only with retention of soil in situ but also arresting every drop of rain water and infiltrating in the subsoil instead of allowing it as surface runoff causing soil erosion. It recharges downstream water sources such as wells, Nalla, Tube wells etc.

This CCT method is applicable in various agro-climatic zones from low rain fall area to very high rain-fall area and from flat planes to very hilly areas with 75% steep slope. The plant growth on such trenches is very promising with survival more than 90%. This technique is suitable for planting of all species, This technique is easy and cheapest as against traditional methods /systems for water harvesting. The expenditure per hectare is approximately Rs.18,000 for four years. The benefit cost ratio works out 8.33 from indirect benefits for one year only.

The CCT work has been carried out over 36000 Hectare on forest area only. The work can be seen in about 700 villages in Solapur, Ahmednagar, Nandurbar, Dhule and Jalgaon districts of Maharashtra state. The total length of CCT is more than 45000 Kms.

Drinking water problem is so severe in most of the areas that water tanker supply becomes compulsory for survival of the people. With annual average rainfall of 500 mm the CCT works supply 250 tankers per hectare per year worth Rs.1,25,000. Many of the tanker fed villages have become tanker free.

The Principle of CCT

“ONE WHICH IS RUNNING MAKE IT TO WALK
ONE WHICH IS WALKING MAKE IT TO STOP

ONE WHICH HAS STOPPED ALLOW IT TO BE
ABSORBED IN THE SOIL”

Benefits of CCT

- Barren land gets permanent biomass cover and soil protection.
- Soil loss in cultivable area becomes nil
- Every drop of rain is held in-situ [no surface runoff]
- Augmentation of ground water without grouting
- Good soil moisture and good ground water available in the wells, tube wells and tanks
- Increase in life of dams, prevention of floods by avoiding silting
- No displacement of communities or creation of environmental refugees and hence no rehabilitation costs
- Accelerates soil formation and natural succession dramatically Increases fodder resources for feeding cattle and livestock
- Increased agricultural and biomass production
- Guaranteed mass employment generation to rural people at their doorstep
- Land value increases significantly
- No migration of villagers to cities as the local water availability ensures livelihood sustainability
- Decentralized and democratic water management
- Evaporation losses are negligible as compared to tanks and dams
- No separate Nullah bunding, Gully plugging and such other civil structures
- Increases crop intensity and biodiversity

- Women free from the drudgery of finding and fetching water, fuel and fodder from distant places
- Clean water for drinking purposes

The details of watershed work, effect of this work on wells and socio-economic aspect of the work are discussed here.

Hivare-Bazar village from Ahmednagar taluka and district is an example of development after watershed treatment.. About 15 years before this village was famous for liquor, quarrels. The farmers used to grow rain-fed cereal crops only. Most of the villagers were going out in search of jobs in neighboring villages and beyond. Systematic watershed development and enthusiastic leadership totally changed the face of the village.

Instruments Used

1. **Contour Marker:** contour marker consists of two staff members of equal size and height with piezometric transparent plastic tube of 10 to 12 meter length. This is used in finding out the contour points and laying out the contour lines on the ground.
2. **Pick-Axe:** For digging the trench all along the contour lines.
3. **Fawada:** For removing the dug soil from the trench and refilling the trench.
4. **Central Line Marker:** It is simple instrument with pegs at both the ends 35 centimeter apart with handle at the centre. This is used for laying out the central line on the refilled trench.

5. Spacement Marker: The instrument consists of three pegs equidistance at specified spacing with handle at the centre. Spacement marker works across the central line .starting from one end with reference to the last point as first point for next position .The point where the central line is crossed that point is point of planting the seedling.

Process of Laying out Contour

The process starts from the top of the hill. The contours are laid with the help of contour marker. One staff holder stands at the starting point and another staff holder 10 to 12 meters away from starting point. The first staff member is called "FOLLOWER" and the other person is called "LEADER". The follower is not to make any movement till the line is completed, only leader has to make movement to and fro or up and down .Once the reading on both the staff is same the two points under the staff are of equal height. Both the points are marked on the ground .Once the points are fixed the leader comes closer to the follower and marks points of equal height between the two first selected points. Once the leader goes to his farthest original point he becomes follower and the follower moves from his point and becomes leader. This is called "whole to part system" in which the error is minimized. This procedure is continued till the full length of the line. New line is started based on the contour interval calculated. In this manner the whole work is completed. For speedy completion of work simultaneously number of contour markers can be used.

Trench Digging

Once the contour lines are marked digging is done all along the contour lines. To maintain the accuracy in digging the original marking is kept untouched. Size of trench is 60 Cms. Wide and 30 Cms deep. The upper fertile layer of soil is deposited on uphill side of the trench and remaining material is

dumped on downhill side very close to the trench. The trenches are kept exposed to weather for about two months.

Refilling of the Trench

After the weathering, the refilling operation starts. In this operation the good comparatively fertile top soil is put in the trench from one meter wide strip on uphill side. The refilled trench becomes inverted terrace. The depth of the refilled trench at the centre is 55 to 60 Cms.

Planting of Seedlings

On the onset of monsoon the planting operation starts. The central line is marked on the trench with the help of central line marker. Then the spacement marker is used across the central line marked. The crossing point on the central line is spot for planting the sapling. Poly pot size holes are created at the planting spots and saplings are planted carefully.

On successful completion of planting maintenance operations are carried out for three years. The maintenance operations include weeding soil workings, fire tracing and protection of the plantation area.

The After Effects / Results

The results of watershed treatment are visible and they have transformed the village totally. There were 18-20 wells in 1995-96 in the village, most of which were dry for major period of the year. The CCT work was carried out over 72 ha. forest area and planted with no. of forestry species. The area was totally devoid of vegetation and even a blade of grass was not available from that area before. With CCT work and protection of the area there was good grass growth and the village earned RS.30000 from grass growth in first year itself. The area is fully covered with vegetative growth with more than 85%

survival. Now there are more than 200 dug wells with sufficient water throughout the year. Almost 75% to 80 % land is under irrigation as against 5% in the past. There were 200 families in the village, out of which 188 families were below poverty line (BPL.). At present there is no family below poverty line out of 236 families. There is no landless person in the village. Before 15 years the per capita income was only Rs. 800 per annum .Today the per capita income is Rs.20,000 per annum, There was school up to 4th standard .Now there is middle school in the village. The farmers are growing 3 to 4 crops in a year and agricultural income has increased by many folds. The dairy business is flourishing. The village is national award winner. There is separate *Gram panchayat*, now well equipped with computers.

This is perhaps the only village where every land holding is surveyed and demarcated. They have their own rules such as no tube wells are permitted in the village. Land can not be sold to the outsider and crops requiring high water are not grown.

Co-Digestion of Cattle dung with Poultry Droppings in an Anaerobic Bio-Digester

*Shanta Satyanarayan
Rama Kant*

Introduction

Biogas production technology is an eco-friendly and also a renewable form of energy. For many years cattle dung is being used for biogas production. Additionally the problem of reduction of biogas because of slow process during winter season and shortage of cattle dung availability restricted its popularization. Thus there was a need to improve the overall efficiency of anaerobic digestion process of cattle dung in the biogas plants. This could be achieved by several means, such as optimizing the various operational parameters, addition of nutrients to encourage proliferation of microbes using high biogas yielding substrates as additives, recirculation of the digested slurry back into the digester and modification in hydraulic design details . Recently ultrasonification of the feed material has been found to enhance the COD removal rates by 10% . But very advance techniques are very difficult to follow by the rural masses. Hence it is preferable to look for some cheaper, cost effective, easy to operate, easy feed substrates such as poultry droppings to the cattle dung digester. Poultry droppings are efficiently converted by anaerobic digestion process into rich manures and methane as a by product. Digested residual sludge is stable and can be used as a soil conditioner.

Poultry droppings contain a higher fraction of biodegradable organic matter and serves as a suitable substrate for biodegradation. Poultry droppings contain high levels of organic nitrogen due to the high content of protein and amino acids. The concentration of endogenous ammonia nitrogen rises considerably during anaerobic digestion of poultry droppings, while a part of ammonium ions are being utilized by some anaerobic bacteria but excess of ammonia can inhibit the destruction of organic compounds, volatile acid formation and methanogenesis. Due to this problem the reduction of ammonia is very important during the anaerobic treatment of poultry droppings. Cattle dung being low in nitrogen level, it will be very appropriate to add nitrogen rich poultry droppings to the cattle dung digesters.

Only poultry droppings based biogas plants have their own limitations inspite of being a good substrate but protein and amino acids hampers the digestion process. Poultry droppings digestion individually is unsuitable due to low pH content. Moreover poultry waste used directly into the digester, leads to ammonia toxicity. To offset ammonia toxicity, dilution is required but it leads to a large increase in volume of waste and also digester volume, so it becomes non-viable in terms of cost. Another problem associated with poultry waste is that the increase in organic load leads to reduction in methane content along with decrease in digester's performance efficiency.

Poultry droppings are combination of both solid and liquid matter. Anaerobic digestion of poultry droppings have been reported with major operational problems of grit accumulation in the digester. This problem has been overcome by settling prior feeding. Studies on the pilot poultry based digesters report high values of ammonia (7090 mg l^{-1}), alkalinity (8020 mg l^{-1}) and volatile fatty acids (27940 mg l^{-1})

in the digested slurry, indicates imbalance in anaerobic fermentation process. While studies on laboratory scale 250 ml capacity digesters were carried out and reported that the anaerobic fermentation of poultry manure occurs in two stages at 25°C and 35°C.

Hence, it is preferable to have a co-digestion of poultry droppings with other substrates, particularly cattle dung, to have beneficial effect on biogas production. Co-digestion of poultry droppings and hog waste have been investigated and reported that this combination is not only viable but also increases biogas. It was envisaged based on the literature that the cattle dung with poultry droppings amendment may compliment each other with supplying nitrogen to nitrogen deficient cattle dung and cattle dung supplying methane bacteria for a congenial digestion.

Considering all the above factors, poultry droppings as an amendment in cattle dung digesters was studied in detail and discussed. The details of gas production, volatile solids reduction, ammonia concentration and optimal amount of poultry droppings to cattle dung digester to obtain optimal performance of the digester have also been discussed.

Materials and Methods

Fresh poultry droppings were collected regularly from a local poultry farm for the experiments. Fresh droppings were collected and prepared slurry was stored in a cold room at a temperature of 4°C. Slurry was prepared with addition of water to get a solid concentration of 8.2- 8.4%. Poultry slurry and cattle dung slurry were passed through a coarse sieve to remove feather, stone and straw to prevent choking of the feed line. Cattle dung was collected from an NGO concern's cattle shed which was taking care of sick, abandoned and old cattles. Both

poultry and cattle dung slurry were analyzed for physico-chemical parameters as shown in Table 2. Characteristics of seed sludge used in the reactor is given in Table 1. An HRT of 30 days and an organic loading of $2.18\text{--}2.30 \text{ kgVS m}^{-3} \text{ d}^{-1}$ were selected based on the work carried out earlier by senior author.

A total of six digesters made of glass aspirator bottles having a capacity of ten litres were used for the detail experiments. Working volume of the digester was maintained at six litres. Arrangements were made to feed and withdraw the slurry and also to collect the gas generation. Studies were carried out at ambient temperature. Out of the six digesters, one was kept as control having cattle dung only and other five were used as experimental digesters. They were fed combined slurry of cattle dung and poultry droppings.

Initially, all the six digesters were filled with digested seed slurry from a working biogas plant for energizing the digesters. After filling the digester with seed slurry, regular feeding of cattle dung and poultry droppings were initiated. After two turnovers, regular samplings were carried out. The influent and effluent samples were collected regularly and were composited for every four days and then they were subjected to analysis. Routine parameters of prime importance in an anaerobic digester viz. pH, alkalinity, volatile acids, total ammonia nitrogen, total solids, total volatile solids, total nitrogen and total phosphorus, capillary suction time (CST) etc. of digested slurry were estimated as per the Standard Methods. Gas production was also monitored regularly and gas analysis was carried out in a Burrell's gas analyzer once in a week. Percent vs reduction was calculated as per the literature.

Once the digesters were stabilized as could be seen from the constant gas production, studies on addition of poultry

droppings to cattle dung digester were carried out for a period of ten months. Daily 200 ml digested slurry was withdrawn and same amount of slurry was fed into the digesters. After feeding the slurry, all the digesters were manually mixed frequently for four to five times in a day. Only fresh cattle dung and poultry droppings were used in the experiments. Dry poultry droppings vary widely in composition and hence only fresh droppings were used. The nutritive value depends not only on its freshness but also on the type of their ration, age and types of birds producing the droppings. Moreover, nutritive value of dry poultry droppings reduce as time passes.

Results and Discussion

Studies were carried out for a period of ten months and the digester performance was regularly monitored. Performance of cattle dung digesters receiving different ratios of poultry droppings are given in Table 3. The pH of the seed sludge is near neutral (6.80). Total ammonia nitrogen in the seed sludge was observed to be around 84 mg/l which was much lower than the concentration of mixed slurry. Percent volatile solids of total solids were observed to be 82.22% in fresh poultry droppings. Table 4 indicates the Gas production of cattle dung digesters amended with different ratios of poultry droppings. Studies were carried out using cattle dung slurry along with poultry wastes in the ratio of 90:10, 85:15, 80:20, 75:25 and 70:30. The pH (5.48) of the raw poultry waste was on acidic side but after dilution to required concentration and its mixing with cattle dung increased the pH to a congenial range of 6.5 to 6.7.

Poultry droppings though is a good biomass for harvesting biogas, at higher organic solids concentration, ammonia toxicity sets in and the digester performance is inhibited. Total ammonia concentration was in the range of

288-308 mg l⁻¹ and 686-900 mg l⁻¹ at 10% and 30% poultry droppings mixed with 90% and 70% cattle dung, respectively. So, it was envisaged to add poultry droppings to cattle dung digester at optimal dose and prevent ammonia toxicity and also compensate nitrogen deficiency of cattle dung. Volatile solids reduction vary from 22.81-25.65% and 32.12-34.76% at 10% and 30% poultry droppings addition respectively. More gas production at higher concentration of 30% of poultry droppings with respect to lower concentration of 10% was observed (Fig. 1). Moreover, digesters working only on poultry droppings may have some limitations in terms of its availability particularly in rural Indian scenario and also the problem of ammonia toxicity which would hamper total gas production and methane production.

Manurial value of cattle dung effluent also increases due to poultry waste addition. Only cattle dung effluent generally contains 1.2-1.5% nitrogen while 10% poultry waste addition improves the nitrogen in the range of 2.1-2.3% and it gradually increased as the poultry waste addition increased. Equally phosphate content also increased thus improving the manurial value. Addition of poultry waste to cattle dung digester did not hamper the dewaterability of treated sludge significantly which is seen from capillary suction time (CST) in seconds. In general, it is very clear that the cattle dung digesters perform very efficiently with poultry waste amendment. It is also clear that upto 20% addition of poultry waste to cattle dung digester would work very efficiently without the problem of ammonia toxicity. All the parameters indicate that poultry waste is one of the suitable substrates as an amendment to cattle dung digester to enhance gas production, manurial value and volatile solids destruction.

Table 4 shows an average gas production of 2815 ml with respect to cattle dung control digester. While 10% poultry addition resulted in 3640 ml gas which was around 29.3% higher than control cattle dung digester. Amendment of poultry droppings of 15%, 20%, 25% and 30% increased the daily total biogas production to an average of 3920, 4300, 4530 and 4706 ml, respectively. It was seen that up to 20%, the increase in gas production was significant and later it increased but did not commensurate with the organic content added. In general, cattle dung digester with an organic loading in the range of 2.18-2.30 kgVSm⁻³d⁻¹ gives volatile solids reduction in the range of 20.55-23.40%. But, even 10% addition of poultry droppings resulted in 22.81-25.65% volatile solids reduction which is around 10.99-11.33% more than only cattle dung digester (**Figure 2**).

As the amount of poultry dropping increased, gas production and percent reduction of volatile solids also showed marginal increasing trend. But, it is necessary to optimize the poultry amendment to cattle dung digester to get enhanced gas production. Higher levels of poultry dropping addition may result an ammonia toxicity (Table 3). Literature has reported that 2.5% solids and above yield high ammonia concentration exceeding 1500 mg l⁻¹ and it is toxic to methane bacteria. It is very clear from the studies that beyond 30% addition of poultry droppings may gradually lead to the digester failure due to ammonia toxicity. It is seen that as the amount of poultry droppings increase, there was a gradual increase in ammonia toxicity. But the higher nitrogen content of poultry seems beneficial to cattle dung digesters to certain extent only. Only poultry waste based anaerobic digesters are difficult to maintain at higher total solids content as they gradually fail. Regular gas analysis was also carried out and the results are shown in Table 5. It is very evident that as the poultry addition increases, total

gas production increases but it does not commensurate with the total organics added. Moreover after 20% poultry addition methane volume started decreasing. Initial methane content gradually increased but later gradually showed a decreasing trend. Hence it is very clear that poultry dropping addition to cattle dung is beneficial till 20% only.

Conclusion

It can be inferred that the performance of cattle dung based biogas plants can be improved by the amendment of poultry droppings. Nitrogen deficient cattle dung and nitrogen rich poultry droppings combination in anaerobic digestion improves the digester performance. Studies also revealed that upto 20% poultry droppings amendment to cattle dung enhances gas production significantly and volatile solids destruction. Moreover addition of poultry droppings did not affect the dewaterability of the digested slurry. Thus, it can be concluded that co-digestion of cattle dung and poultry droppings is more suitable to enhance the performance of biogas digesters but upto 20% poultry addition only, beyond which it becomes counter productive.

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Table 1. Characteristics of seed sludge used in the reactor and fresh poultry droppings

Parameters	Values
Seed Sludge	
pH	6.80
Alkalinity, mg l ⁻¹	1280
Volatile acids, mg l ⁻¹	410
Total ammonia nitrogen, mg l ⁻¹	84
Total solids, mg l ⁻¹	5.06
Total volatile solids, mg l ⁻¹	3.00

Table 2 Characteristics of feed: Cattle dung and Poultry slurry

	Poultry	Cattle dung
pH	6.48-6.56	6.9-7.0
Alkalinity, as CaCO ₃ mg l ⁻¹	2700-2860	6200-6320
Volatile acids, as CH ₃ COOH, mg l ⁻¹	448-496	514-860
Total ammonia nitrogen, mg l ⁻¹	288-292	115-220
Total solids, mg l ⁻¹	8.2-8.4	8.5-8.8
Total volatile solids, mg l ⁻¹	6.70-6.90	6.29-6.82
% Volatile solids of total solids	82.60-83.0	74.0-77.5
Total nitrogen, mg l ⁻¹	4210-4320	942-996
Total Phosphate, mg l ⁻¹	296-320	136-148

Table 3: Performance of cattle dung digesters receiving different ratios of poultry droppings						
Parameters	100% CD	90% CD +10% PD	85% CD +15% PD	80% CD + 20% PD	75% CD + 25% PD	70% CD + 30% PD
pH	7.00-7.70	6.96-7.25	6.86-7.1	6.8-7.0	6.76-6.95	6.7-6.86
Alkalinity, mg l ⁻¹	4250-4625	4560-4680	4700-4864	4880-5200	5286-5400	5500-5726
Volatile acid, mg mℳ l ⁻¹	514-556	394-582	460-685	492-770	526-840	640-960
Total ammonia, mℳ mℳ l ⁻¹	115-180	288-308	296-342	420-534	546-662	686-900
Total nitrogen, %	1.20-1.45	2.1-2.3	2.5-2.66	2.72-0.84	2.92-3.12	3.26-3.42
Total phosphate, %	0.22-0.32	0.55-0.62	0.66-0.74	0.76-0.80	0.82-0.84	0.88-0.90
Total solids, %	5.6-6.32	6.07-6.51	6.25-6.42	6.16-6.34	6.12-6.22	6.08-6.28
Total VS, %	4.00-4.40	4.23-4.86	4.32-4.40	4.20-4.31	4.15-4.18	4.04-4.10
VS Reduction, %	20.72-23.68	22.81-22.65	25.75-26.75	27.75-28.85	29.66-31.38	32.12-34.76
CST , Seconds	320-342	340-380	388-420	440-500	520-600	620-740

Table 4: Average gas production of cattle dung digesters addition with different ratios of poultry droppings during study period

Obser- vation No.	100% CD	90% CD + 10% PD	85% CD + 15%PD	80% CD + 20% PD	75% CD + 25% PD	70% CD + 30% PD
1	2780	3640	3950	4320	4560	4720
2	2790	3600	3890	4300	4580	4700
3	2800	3620	3870	4280	4430	4690
4	2890	3630	3960	4270	4440	4670
5	2820	3670	3940	4310	4500	4680
6	2880	3680	3930	4340	4590	4730
7	2740	3610	3960	4350	4570	4700
8	2890	3620	3920	4290	4560	4720
9	2880	3680	3980	4270	4490	4710
10	2800	3690	3920	4280	4480	4740
11	2750	3640	3880	4300	4560	4760
12	2800	3630	3890	4320	4590	4690
13	2820	3620	3870	4310	4540	4670
14	2750	3630	3880	4330	4530	4700
15	2800	3600	3960	4260	4570	4710
Av. ml gas	2815	3640	3920	4300	4530	4706
Per kg VS _{added} (m ³ gas)	0.224	0.284	0.306	0.335	0.354	0.368

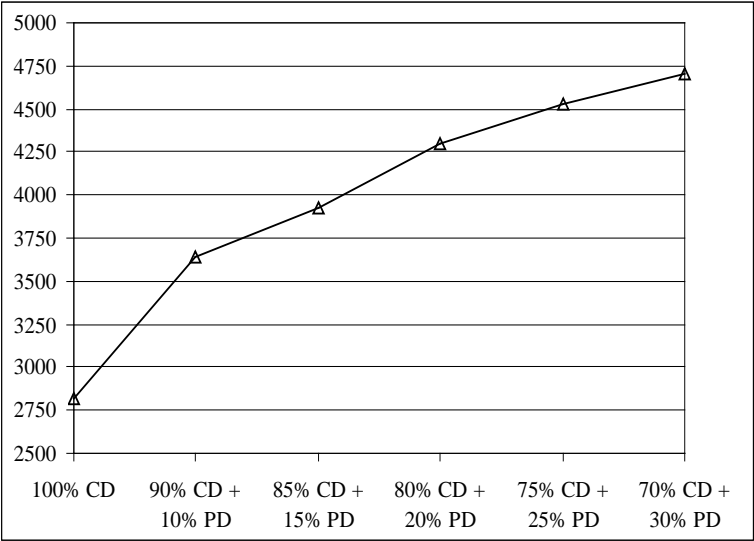
Table 5 : Composition of Biogas

Digester (CD + PD)	% CH₄	% CO₂
Control (CD only)	55	45
90 : 10	58	42
85 : 15	63	37
80 : 20	66	34
75 : 25	58	42
70 : 30	52	48

CD : Cow dung

PD : Poultry dropping

Fig. 1 : Average gas production in digester amended with poultry droppings



CD : Cow dung; PD : Poultry dropping

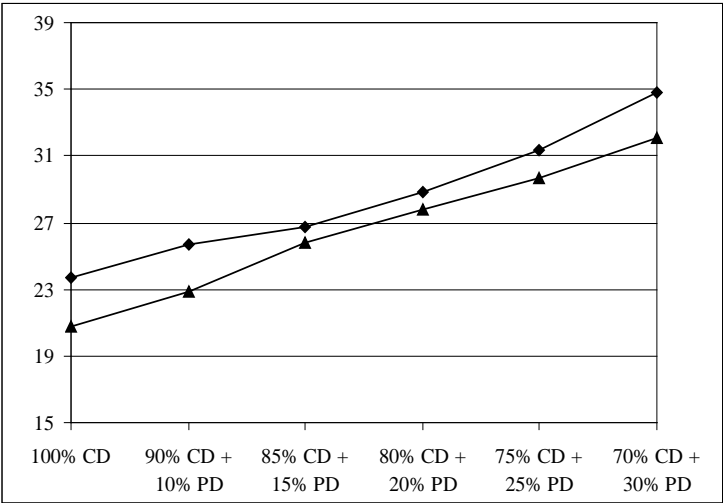


Fig. 2 : Percent Volatile solids reduction with reference to poultry addition

**Low in Water High on Hygiene
The Centre of Science for
Villages (CSV) Approach**

Sameer Kurvey

The great importance of water for mankind is generally recognized by most of us. But still it seems that we are not fully aware of the fact that water is life. From the dawn of civilization, water has been one of the major factors determining the survival and progress of society. As the permanent agriculture settlements were formed near water bodies the technologies for management of water resources for irrigation and domestic supplies were naturally the first among the technologies developed by human beings.

The importance of water resources to support life and for development is undisputed. Our complex metropolitan civilization and advanced technologies have generated additional demands for water. Sophisticated industrial processes, central power stations and advanced sanitation systems are major factors contributed to the increased use of water in modern society.

The radiant energy of the sun causes evaporation of water from the oceans, lakes, rivers, leaves and most soils of the world and clouds are formed. Then it cools down to form liquid and precipitates over nearly all around the earth in the form of rain. Yet the precipitation is uneven. There are deserts which receive scanty rainfall and there are tropical forests in which rainfall almost never ceases.

Our body constitutes 70% water. Water from the body is excreted through different excretory organs. To compensate this loss we must drink 2 to 3 litres of water every day. Per capita per day average water requirement of a person in India is calculated to be 35 to 40 litres. Major requirement of water is for maintaining cleanliness. In urban area the water requirement is 3 to 5 times more than the rural area. In order to fulfill our basic needs, we use surface water as well as ground water for our personal consumption, for cleaning, for cattles, for agriculture etc.

We always give priority to the construction of structures for storing water to fulfill our requirements. We are not much concerned about the future generation and we hardly think of saving water or pay attention to methods and techniques of water management, water harvesting and ground water recharging. We always indulge in practices that disturb the nature, e.g., deforestation, pollution of water bodies, use of excess water etc. Our demand, “I want more” is endless. As water is life we must save water in order to save our life. We all should work together to enrich the nature and save the mother Earth.

The CSV Approach

Since last three decades the CSV has been working on various technologies related to water which are economically viable, socially just and environment friendly. They are : Sanitation ,Waste Water Management, Rain Water Harvesting and Emitter Irrigation.

1. Sanitation

Village sanitation was one of the items in the Constructive Programme propounded by Mahatma Gandhi. It was always a

high priority area for the CSV. However, only after doing its home work, the CSV decided to take a plunge into it.

Having been steeped in the indigenous village culture, the CSV group knew the strengths as well as the weaknesses of the villager's psyche, and the reality of the rural water supply situation. They knew the users habits as well as the inhibitions and difficulties of the first generation "Latrines". The CSV also realised that the farms which were starving for nutrition would benefit tremendously by a possible recovery of manure from this source. The CSV rejected the idea of community latrines because they would remain unattended. The CSV take into consideration all these aspects in the choice of design and method of implementation. The main objectives of the sanitation mission were: Low on quantum of water and high on hygiene, manure regeneration and uninterrupted functioning.

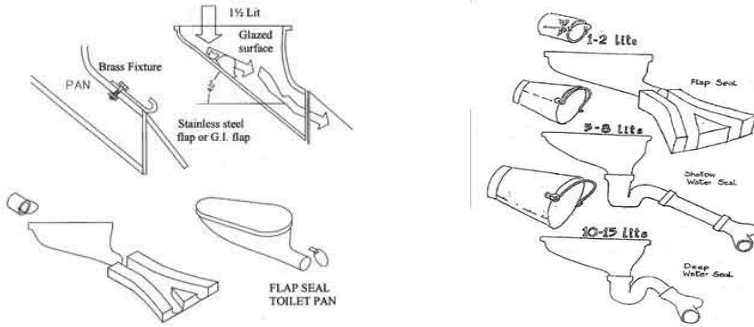
a) Individual toilet (Flap seal model)

This model requires only one-liter water for washing and flushing. It also gives very good quality of manure which is odour free. This toilet requires little maintenance and is made by using low cost ferro-cement technology.



Flap Seal Latrine Pan: The CSV modified latrine pan has a slope of 40° which is much more than the usual one. In addition the glazed surface offers the necessary smoothness to carry the solids with the flushing force of small quantity

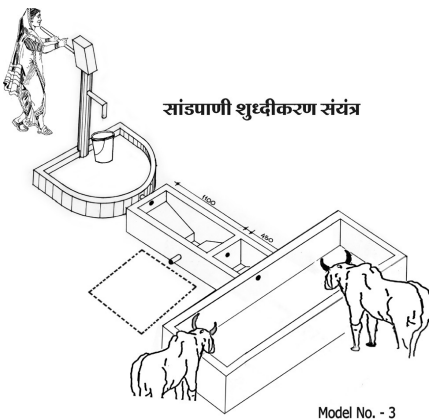
of water. If water trap is used at the outlet almost 15 liters of flushing water is required.



The large quantity of water required for flushing is also a deterrent for not using the toilets. Hence the CSV introduced the latrine pan with greater slope with G.I. or stainless steel flap hinged at the end.

2. Waste Water Management

a. Spill Water Recycling Unit



Spill Water Recycling Unit

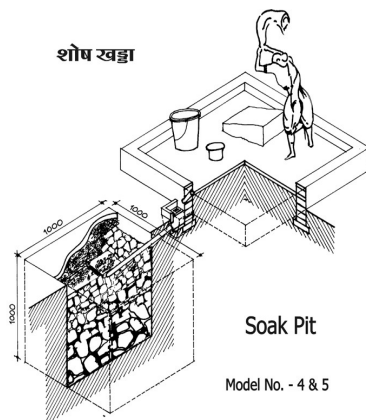
Spill water recycling unit is an innovative system designed to collect the spill water from hand pumps, wells and other similar sources. This unit makes water free from dirt and stores it for secondary use. This water is of course not potable and unfit for taking bath. But it could

be safely used for cattle
(drinking and

washing),spraying court yards,linen washing, gardening /nursery/agriculture operations, pottery works and construction.

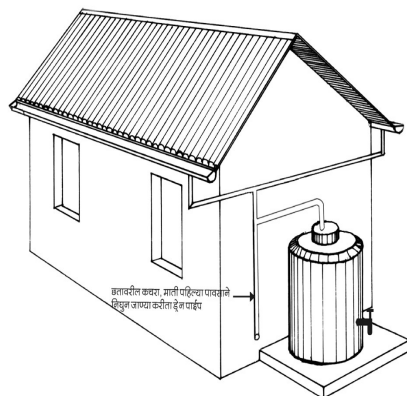
b. Soakage Pit

Household bathing water and septic tank water flows into open drain is dangerous. It is the main cause of most of viral diseases. Household waste water from cooking, cleaning, laundering and bathing that forms muddy pools and slushy lanes in villages can be drained with the help of the soak pit designed and improved by the CSV. The pit loosely filled with cobbles and pebbles is capable of percolating about 200-300 liters of water per day, deep into the soil, keeping the surroundings clean and dry. The model of soak pit is being modified continuously. Household soakage pit for disposal of wastewater is low cost and does not contaminate the nearby sources of water and avoids water stagnation.



3. Rain Water Harvesting

All water storage systems are in effect rainwater-harvesting systems. To understand its strength one would take into consideration the difference in catchment areas. Earlier the



Roof Top Rain Water Harvesting

catchments were typically far off from the urban and rural areas they served. Now the cities and villages themselves are seen as catchments for its water requirements. Rooftops, paved areas and unpaved areas and the entire city itself are therefore to be considered as water provision area. The process of Rainwater



harvesting consists of catching rainwater, directing it to an appropriate location, filtering it if required and storing it for use. Storage could be in tanks, sumps, ponds or lakes. Wherever appropriate and wherever conditions permit, recharge of ground water would also qualify as storage.

Harvested water could be used immediately as a first choice thus reducing burden on city water supplies or ground water or a decision could be taken to store it for later use, say during water shortage days. Rainwater is the most viable water supply option. Public buildings, homes, and resorts should collect rainwater to fulfill their needs.

4. Water Purification :

In collaboration with TATA Consultancy Services Ltd., Pune, the CSV has introduced a low cost water filter made from rice husk ash. The filter is very cheap and can be manufactured at the village level with very little investment. The filter is very effective and kills about 98% bacteria in the water and keeps it free from fluorides and arsenic. Village women

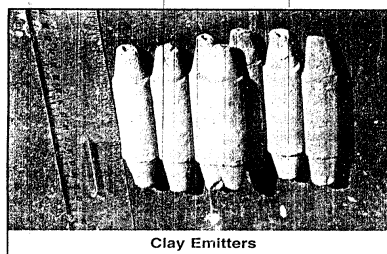


have now come out with a programme of manufacturing such filters.

5. **Emitter Irrigation :**

Water is a limiting factor in agriculture and horticulture. For increasing productivity of a given area, it is necessary to increase growth-effective days, which can be achieved by supplying water for longer duration.

The use of water could be optimised through emitters so as to maximise the production of biomass.



Drip irrigation systems reduce water loss caused by evaporation, leaching below the effective root zone and movement away from the target area etc. However the exorbitant installation, monitoring and maintenance costs, coupled with less than desired efficiency, pose restrictions on adoption of these measures especially by small and marginal farmers who need a cheap and efficient system for irrigation.

The small, cheap, efficient and locally available clay emitter serves most of the desired purposes. This system of irrigation uses small earthen tubes or emitters which can be manufactured by local potters. This system uses 50% less water than drip irrigation and produces 20% to 50% more crop per unit area. It is 50% cheaper than drip and requires neither electric current nor pump to maintain water pressure. Essentially the system is demand - or need - driven, i.e. the

amount of water actually required by the plants is drawn from the system.

Needless to say that we all must take care of the environment. Water is limited, precious and cannot be artificially produced in large quantities. Oxygen is also being degraded due to deforestation and felling of trees. These factors affect intellectual capacity of the new generations which is severely impaired. When my son asks me to talk about my youth days, I tell him about the green fields, the beauty of the flowers, the rain, how pleasant was to swim and fish in the rivers and dams, to drink the safe and potable water we needed, and how the healthy people were. I cannot help feeling guilty; because I belong to the generation which is responsible for the damage caused to the environment or ignored all the warning signals.

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