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Website : www.yojana.gov.in

Let noble thoughts come to us from every side
Rig Veda

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EDITORIAL OFFICE : Yojana Bhavan, Sansad Marg, New Delhi Tel.: 23096738, 23717910, (23096666, 23096690, 23096696- Extn. 2509, 2510, 2565, 2566, 2511). Tlsm.: Yojana. **Business Manager (Hqs.) :** Ph :24367260, 24365609, 24365610

For new subscriptions, renewals, enquiries please contact : Business Manager (Circulation & Advt.), Publications Division, Min. of I&B, East Block-IV, Level-VII, R.K. Puram, New Delhi-110066, Tel.: 26100207, Telegram : Soochprakashan and Sales Emporia : Publications Division: *Soochna Bhavan, CGO Complex, Lodhi Road, New Delhi -110003 (Ph 24365610) *Hall No.196, Old Secretariat, Delhi 110054(Ph 23890205) * 701, B Wing, 7th Floor, Kendriya Sadan, Belapur, Navi Mumbai 400614 (Ph 27570686)*8, Esplanade East, Kolkata-700069 (Ph 22488030) *A' Wing, Rajaji Bhawan, Basant Nagar, Chennai-600090 (Ph 24917673) *Press road, Near Govt. Press, Thiruvananthapuram-695001 (Ph 2330650) *Block No.4, 1st Floor, Gruhakalpa Complex, M G Road, Nampally, Hyderabad-500001 (Ph 24605383) *1st Floor, 'F' Wing, Kendriya Sadan, Koramangala, Bangalore-560034 (Ph 25537244) *Bihar State Co-operative Bank Building, Ashoka Rajpath, Patna-800004 (Ph 2683407) *Hall No 1, 2nd floor, Kendriya Bhawan, Sector-H, Aliganj, Lucknow-226024(Ph 2225455) *Ambica Complex, 1st Floor, above UCO Bank, Paldi, Ahmedabad-380007 (Ph 26588669) *KKB Road, New Colony, House No.7, Chenikuthi, Guwahati 781003 (Ph 2665090)

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No. of Pages : 56

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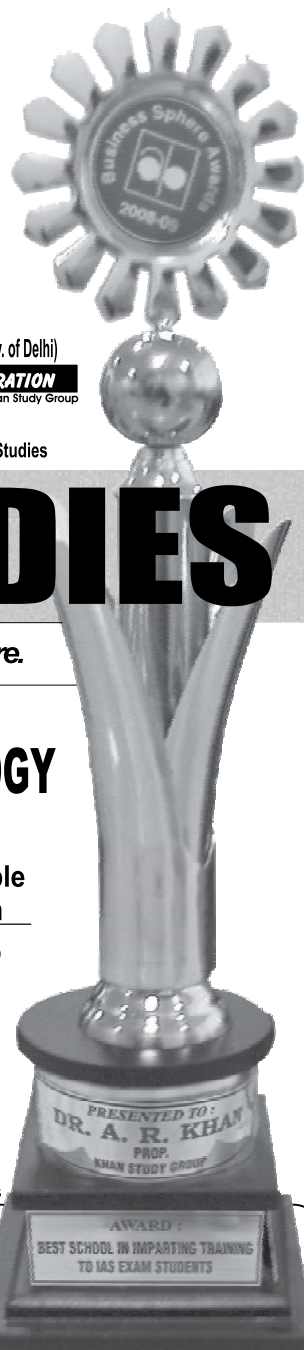
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About the Issue

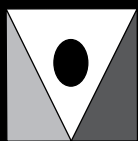
With regard to climate change, India has some real tough tight-rope walk before it. With temperatures poised to rise by 2.5 to 5 degrees Celsius over the century, monsoon patterns threatening to go haywire and sea levels likely to rise, as it is there will be problems of food security, water scarcity, livelihood, and health to reckon with. To be balanced with this are the imperatives of sustaining a high economic growth as a prerequisite to poverty alleviation, and the need to raise per capita energy consumption to provide a minimally acceptable level of well being.

India has rightly been looking both inward and outward in its efforts to balance its varied and often seemingly contradictory concerns. This is reflected in our comprehensive domestic agenda for mitigating climate change, adapting to it and aiming to cut the emission intensity of GDP by 20-25 % of the 2005 level by 2020; This is also reflected in our proactive climate negotiations in international fora where we have persistently been upholding the principle of common but differentiated responsibility, fighting for the rights of the developing countries to economic growth without the impediments of immediate formal caps on emissions, and insisting that developed countries respect their obligations to reduce emission and help developing countries to get on to the path of sustainable development.

Climate change is not just about the environment. As Copenhagen has proved, for some it means clinging on to their high consumption lifestyles while finding out ways to sweep the products of such lifestyles under the carpet. For others it means safeguarding their rights to grow, and for yet others it is a question of their very existence. Certainly not the best backdrop for world consensus. India and the other BASIC group of countries have however, done the best they could have under the circumstances. Emerging as a powerful force in the climate change negotiations, the coordinated efforts of this quartet has ensured that the negotiations under UNFCCC will continue on the two tracks laid out at Bali - one leading to long-term cooperative action and the other leading to the second commitment period of Annex I Parties under the Kyoto Protocol. The 30 billion dollar "Copenhagen Green Climate Fund" for the period 2010-12 would also be a useful support for adaptation and mitigation efforts in the lesser developed and more vulnerable countries.

As of now, our feet seem to be steady on the tight rope, but there is still a long distance to be traversed. Both on the outward and inward fronts, there is still a lot that needs to be done. The articles inside discuss what the phenomenon of climate change means to India, what we have done so far to tackle the various issues that this phenomenon is likely to open up, and which are the areas where we need to do more. □





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Facing The Challenge

R.R. Rashmi
S Satapathy



Increasing awareness about climate change and concentrated action of the central and State governments will help fulfill the global goal of climate stabilization

CLIMATE CHANGE, is primarily caused by the building up of greenhouse gases (GHG) e.g. carbon dioxide, methane, nitrous oxide and others in the atmosphere. The global increases in carbon dioxide concentration which have been responsible for the largest part of this build-up, are due primarily to fossil fuel use and land-use change, owing to human activities taking place since pre-industrial times, while those of methane and nitrous oxide are primarily due to agriculture.

Climate Change can be accompanied by higher average temperatures near earth's surface, changed rainfall patterns, and increased severity and frequency of floods, droughts and cyclones, which can severely impact livelihoods, especially of the poor in developing countries. The change in climate could lead to impacts on freshwater

availability, oceanic acidification, food production, flooding of coastal areas and increased burden of vector borne and water borne diseases associated with extreme weather events, etc.

The Challenge of Climate Change

Climate change can slow down the pace of development either directly through increased exposure to climate variability or indirectly through erosion of the capacity to adapt.

Climate change necessitates that the developing countries, though not responsible for climate change, adapt to it and implement response strategies so as to minimize impacts on livelihoods and natural resources. Further, mitigation measures have to be adopted at the global level with a view to minimise further change in climate, and eventually stabilize it. Both these strategies

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cast additional social, human, and economic burdens on developing countries. Large amount of national resources have to be committed for adaptation measures. Besides, actions for mitigating climate change that may involve emissions reduction have huge implications for the growth of developing countries, particularly in those sectors e.g. energy generation, and transport where emissions emanate largely from consumption of fossil fuels and the use of alternative sources of energy is limited by resources, technology and access/availability.

India's vulnerability to climate change

India is already facing high degree of climate variability and may face additional challenge because of climate change. A significant part of the annual variation in India's GDP growth over the past half century is attributable to yearly variations in rainfall. The Himalayan ecosystem, so vital for our water security, is vulnerable to climate change. Moreover, increases in mean sea levels will affect large populations and communities in peninsular and coastal India.

Although there is no significant long term trend in monsoon rainfall or floods in the summer monsoon season at all India level, a warming of 0.4°C in surface air temperature has been noticed over the period 1901-2000. Total frequency of cyclonic storms forming over Bay of Bengal has, however, remained almost constant over 1887-1997.

It has been noticed, on the other hand, that the Gangotri glacier, one of the largest in the Himalayas,

has been retreating since long and more rapidly in recent decades. As the glaciers retreat, they become more fragmented and the smaller glaciers are more sensitive to global warming. As per the Geological Survey of India, glaciers worldwide in a phase of recession as a natural cyclic process. The accelerated melting which these glaciers are experiencing as a result of the earth's warming may have a profound effect on future water availability.

It is projected that, by the end of 21st century, rainfall in India may increase by 15-40% with high regional variability. Warming may be more pronounced over land areas with northern India experiencing maximum increase. The warming could be relatively greater in winter and post-monsoon seasons. The annual mean temperature could increase by 3°C to 6°C over the century.

Under these circumstances, it is projected that India may suffer huge losses due to the increased incidence of extreme weather events and additional risks to the livelihoods of people.

Global regime for addressing climate change

In response to the concerns about the potential impacts of accumulated and rising stock of GHG emissions and the need to address climate change, an international regime of actions was agreed in form of the United Nations Framework Convention on Climate Change (UNFCCC), 1992. The Convention seeks to achieve stabilization of greenhouse gas concentrations in the atmosphere at

a level that would prevent dangerous anthropogenic interference with the climate system. The Convention affirms that climate change is a global problem requiring global efforts from all countries, but also recognizes the primary contribution of the developed countries to the high stock of CO₂ emissions in the atmosphere, and expects the developed countries to necessarily take the lead. This principle of, "common but differentiated responsibilities and respective capabilities", is the basis of burden sharing between Parties while working towards reaching the objectives of the Convention.

As per the principle of 'common but differentiated responsibilities and respective capabilities', developing countries including India have no obligation to reduce the green house gas emissions. The Convention recognises that the economic and social development and poverty eradication are the first and overriding priorities of the developing countries parties, and that, in course of meeting the developmental needs, the emissions of developing countries are bound to rise. Any mitigation action by the developing countries must, therefore, be taken in the context of sustainable development and be consistent with their national priorities. Further, the Convention also recognises that the extent to which developing countries parties will effectively implement their commitments i.e. taking actions to mitigate emissions under the convention will depend on the effective implementation by developed countries parties of their commitments relating to provision

of financial resources and transfer of technology.

All industrialized countries are required under the Convention to have binding commitments to reduce their emissions. Kyoto Protocol was signed by the Parties to UNFCCC in 1997 to agree on quantified and specific emission reduction targets for each of the 37 industrialised countries that are listed in Annex-I of the Convention. The Kyoto Protocol lays down binding quantified emission reduction targets for all industrialised countries for the first commitment period 2008-2012, although the US, the world's biggest emitter of greenhouse gases, did not ratify the Kyoto Protocol.

In December 2007, after the publication of the 4th Assessment Review of the Inter Governmental Panel on Climate Change which established that climate change is unequivocal, the Parties to UNFCCC adopted the Bali Action Plan to enhance the implementation of the Convention. The Bali Action Plan (BAP) calls for full, effective and sustained implementation of the UNFCCC through long-term cooperative action, now, up to and beyond 2012. It is a comprehensive dialogue to address the four major building blocks of climate change, i.e. GHG mitigation; adaptation to climate change impacts; technology development and cooperation; and finance. In pursuance of the Bali Action Plan, negotiations to define the aggregate targets of emission reduction for developed countries including the US and other issues relating to adaptation and financing of adaptation, mitigation and

technology in developing countries are underway. On a parallel track, the negotiations to determine the individual quantified emission reduction targets of the Parties to Kyoto Protocol for the second commitment period beginning from 2013 are continuing.

International Negotiations on Climate Change

In the recent international negotiations conducted under the UNFCCC, the industrialized countries have called upon developing countries to contribute to the global effort to address climate change. Specifically, it has been suggested that while the developed countries will take appropriate emission reduction targets in the mid term, the developing countries should follow a low carbon development path and deviate in terms of GHG emission from business as usual scenario. It has also been suggested that the developing countries should place their domestic mitigation actions at the same level of international review as the mitigation commitments of developed countries. Implicit in the arguments of the developed countries is the suggestion that the international support for adaptation to and mitigation of climate change in developing countries will depend on willingness of developing countries to subject their national action plans to review and progress in terms of low carbon development.

India's approach to the negotiations is fully anchored in the UNFCCC and the Kyoto Protocol. India has argued in the

international negotiating fora that the developed country parties must take actions in accordance with the principle of equity and 'common but differentiated responsibilities and respective capabilities' in order to achieve the objectives of the convention. Such actions of the developed countries should include deep and ambitious targets for emission reduction in the second commitment period (post 2012) of the Kyoto Protocol. The starting point for a fair and equitable agreement in the climate change negotiations is, therefore, the acceptance by developed countries of the principle of per capita equity, their historical responsibility, and their undertaking to make credible cuts in GHG emissions of 25-40% by 2020 over 1990 reference levels.

India has stated that the actions of the developing countries will depend on the support in terms of finance and technology provided by the developed countries. While India is willing to accept monitoring, reporting and verification (MRV) as per agreed procedures for those actions that are supported by the international community in terms of finance and technology through agreed channels, its voluntary actions financed from its own domestic resources can not be subjected to international review. While India has taken a number of steps, on its own, to adapt to climate change and mitigate its emissions in the interest of its energy security and sustainable development, India will take further voluntary and nationally appropriate actions for addressing climate change strictly

in accordance with the priorities and objectives laid down under the National Action Plan for Climate Change.

Copenhagen Conference, December 2009

15th Conference of the Parties (CoP 15) to the UNFCCC was held in Copenhagen from December 7-18, 2009, with a view to reach agreed outcomes on the negotiations. The Copenhagen conference was a culmination of two year process that began in Bali in December 2007. The negotiations have proceeded in two parallel tracks since Bali -one relating to the long term cooperative action of the Parties under the Bali Action Plan- known as LCA track and the other relating to the commitment of the Annex I Parties for the second commitment period under the Kyoto Protocol-known as the KP track.

At the Copenhagen Conference, the talks in the two tracks were to be concluded and outcomes to be reached. India participated in the negotiations constructively with a view to contribute to outcomes in accordance with the principles and provisions of the Convention, Kyoto Protocol and the Bali Action Plan.

However, differences among Parties on several critical issues, particularly those relating to mitigation and finance for climate change persisted, despite some movement on issues relating to e.g. technology, adaptation and Reducing Deforestation and Degradation in Developing countries (REDD plus). As a result, the talks at Copenhagen could not be concluded and it was decided that the negotiations in

two-tracks will continue till CoP 16 scheduled at Mexico from Nov 29- Dec 10, 2010.

At the Copenhagen conference, an attempt was also made by the Danish Prime Minister i.e. the President of the Conference of Parties (CoP), to forge a consensus on outstanding issues through informal consultations amongst a select group of countries including India and presents it to the parties in form of a 'Copenhagen Accord'. However, there was no consensus and the 'Accord' could not be adopted. In the absence of adoption under the multilateral process, the Accord was only taken 'note of' by the parties.

India's actions on climate change

India, being vulnerable to adverse effects of climate change, is very conscious of its global responsibilities towards climate as also the need to minimize adverse effects of climate change on its large population. Although India's total CO₂ emissions are about 4% of total global CO₂ emissions, India is committed to contribute to climate protection by de-coupling the growth of its emissions from the rising economic development. Even with 8-9% GDP growth every year for the next decade or two, India's per capita emissions is likely to be well below developed country averages. India's energy intensity of production has been falling with improvements in energy efficiency, autonomous technological changes and economical use of energy. India's climate modeling studies show that its per capita emissions will be around 2-2.5 tonnes of carbon dioxide equivalent by 2020

and around 3-3.5 tonnes of carbon dioxide equivalent by 2030, as compared to around 1-1.2 tonnes presently. Prime Minister has already stated that India will never allow its per capita emissions to exceed that of the developed countries. Accordingly, India has announced that, it will endeavour to reduce 20 to 25 percent by 2020 in comparison to the 2005 level. This will be achieved through actions in specific sectors with necessary provision of financial and technological resources including the domestic and international support

While engaging constructively with the international community on the issue, India has pursued a strong domestic agenda for addressing climate change. India recognizes that a strategy for addressing climate change has to be based on the strategy of sustainable development. This is reflected in the major programmes addressing climate variability. Current Government expenditure in India on adaptation to climate variability exceeds 2.6 per cent of the GDP, with agriculture, water resources, health and sanitation, forests, coastal zone infrastructure and extreme events, being specific areas of concern and action.

National Action Plan on Climate Change:

In pursuance of its voluntary actions to address climate change related concerns, India released its National Action Plan on Climate Change (NAPCC) on 30th June 2008. The National Action Plan advocates a strategy that promotes, firstly, the adaptation to Climate Change and secondly, further enhancement of

the ecological sustainability of India's development path.

The National Action Plan stresses that maintaining a high growth rate is essential for increasing living standards of the vast majority of people of India and reducing their vulnerability of the impacts of climate change. Accordingly, the Action Plan identifies measures that promote the sustainable development while also yielding co-benefits for addressing climate change.

Eight National Missions e.g. National Solar Mission, National Mission on Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for sustaining the Himalayan Ecosystem, National Mission for a Green India, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change form the core of the National Action Plan and represent multi-pronged, long term and integrated strategies for achieving key goals in the context of climate change. Besides the 8 Missions, the NAPCC also outlines 24 Initiatives aimed at promoting technologies and actions in the sectors pertaining to energy generation, transport, renewable, disaster management and capacity building that will have substantial benefits in terms of addressing climate change, when integrated with the development plans of the Ministries.

The National Missions are to be institutionalized by the respective Ministries. The Prime Minister's Council on Climate Change,

set up in June, 2007 monitors the preparation of and approves the national missions, while the Ministry of Environment & Forests coordinates the implementation of the Action Plan and other climate change related actions in India. Documents in respect of the national missions as prepared by the nodal Ministries are at various stages of adoption and approval.

It is notable that India's Five Year plans outline a strategy for sustainable growth resulting in low carbon sustainable development. 11th Five Year Plan includes an indicative target of increasing energy efficiency by 20% by 2016-17. The National Mission on Enhanced Energy Efficiency implemented by the Ministry of Power through the Bureau of Energy Efficiency seeks to pursue this goal.

NAPCC will guide India's further actions in regard to low carbon growth strategy. Based on the exercises for Mid-Term Appraisal in the 11th Five Year Plan that indicates that the emission intensity has declined by 17.6 per cent between 1990 and 2005, the Planning Commission has concluded that a 20 to 25 per cent reduction in emission intensity between 2005 and 2020 is possible.

This will require that necessary actions in specific sectors are undertaken to reduce emission intensity and corresponding emission reduction outcomes with necessary provisions of financial and technological resources. These could include specific performance targets in industry, energy, transport,

agriculture, buildings and forestry for the year 2020 & 2030. These could be institutionalized through either legislative or executive action under the NAAPC and the Five Year Plan documents. Actions may also be taken to enhance such domestic actions in line with specific domestic targets as outlined in 11th and subsequent five-year plans with domestic and international resources as available.

State level Action Plans on Climate Change

Prime Minister in his address to Ministers of Environment and Forests from various states on 18th August 2009 had called upon all state governments to prepare State level Action Plans on Climate Change consistent with the strategy outlined in the NAPCC. The state level plans will enable communities and ecosystems to adapt to climate change effectively and help achieve the objective of the NAPCC. Accordingly, a programme for preparation of state level plans has been initiated.

Some of the States have already responded and initiated positive action. Government of Himachal Pradesh has drawn up a programme and sought technical assistance and funding from the World Bank for the projected activities. Government of Delhi has prepared an Action Plan outlining the activities which was launched in November 2009. Government of Karnataka has initiated activities and proposed a technical assistance programme with the World Bank for this purpose. Kerala Government has constituted a steering committee to oversee

the preparation of an Action Plan. Gujarat has taken proactive steps to set up a dedicated department for climate change and prepare its action plan.

India's international obligations

As a part of its international obligations under the UNFCCC, India prepares periodically the National Communication (NATCOM) that gives an inventory of the greenhouse gases (GHG) emissions in India, and assesses the vulnerability and impacts and makes appropriate recommendations regarding social, economic and technological measures for addressing climate change. Preparation of NATCOM is an exercise based on an extensive network of research and scientific institutions in India and draws upon expertise and excellence from different institutions. 131 research teams collaborated to prepare India's first NATCOM and present it in 2004. India's Second National Communications (NATCOM-II) which will put together an even more detailed assessment of national GHG inventories and of the vulnerabilities faced by the key sectors in India is under preparation. This is expected to be available by late 2010 and will be presented to the UNFCCC in 2011. Systemic improvements to enhance the scope and transparency of India's national communications are also being considered with a view to better inform the various relevant stakeholders of the actions and initiatives that India is taking on climate change.

Clean Development Mechanism:

India has participated effectively in the Clean Development

Mechanism (CDM) which is designed to help developed countries in meeting their emission reduction targets while contributing to sustainable development in developing countries through purchase of Certified Emission Reduction Certificates (CERS) from developing countries by the developed countries businesses and governments. India's CDM potential represents a significant component of the global CDM market.

The Government of India has set up the National CDM Authority in December 2003 with its office in the Ministry of Environment & Forests. The National CDM Authority evaluates and recommends CDM projects for host country approval. At the end of 2009, India has a profile of 1551 approved host country projects in the sectors of energy efficiency, fuel switching, industrial processes, municipal solid waste and renewable energy. Out of these, 478 projects (against total number of 2011 globally registered projects) are registered by the CDM Executive Board and have the potential of generating 74.22 mn CERs out of total 366.17 mn registered CERs. If all the approved projects get registered, the projects can attract an overall inflow of approximately US\$ 6.27 billion by the year 2012 at a conservative price of the US\$10 per CER.

CDM is an important subject of negotiations under Kyoto Protocol. India is of the view that CDM has helped the developing countries enhance their sustainable development and should be further strengthened in the 2nd

commitment period of the Protocol from 2013.

Institutional Mechanism for addressing climate change

Government of India has set up an elaborate institutional mechanism to consider and address issues relating to climate change. A Council chaired by Prime Minister called Prime Minister's Council on Climate Change was constituted in June 2007 to coordinate national action for assessment, adaptation and mitigation of climate change. The Council provides the overall guidance to climate change related actions taken by various Ministries in the Government and other agencies. Ministry of Environment & Forests is the national focal point for UNFCCC and coordinates various activities relating to the NAPCC and other climate change related policies and actions.

An expert committee set up under the chairmanship of the Principal Scientific Adviser to Government of India has studied (2008) the impact of anthropogenic climate change on India and has come out with its first set of findings and the research agenda that the ministries need to follow and implement in order to address India's vulnerability to anthropogenic climate change impacts.

Conclusion

With the pro-active measure pursued by governments in the domestic and International fronts, it is hoped that climate change issues will be addressed significantly and seriously in future years. Increasing awareness about Climate change and concentrated action of the central and State governments will help fulfill the global goal of climate stabilization. □

(Email : ssatapathy-mef@nic.in)

What India Needs to Do

Urmi A Goswami



***If India
seeks to be
a world leader,
then it should
take a
proactive
role keeping
in mind its
long-term
interests***

EVEN AS the world recognizes the threat of climate change and the need to contain emissions of greenhouse gases, there has been little movement towards achieving this objective. A key reason for this is that climate change is marked by first mover's disadvantage. There has been no demonstrable economic gain for countries that moved to a regime that adheres to the health of the planet. Given that countries are at different places on the development curve, coupled with unequal access to finance and technology, a complete shift in economic trajectory is near impossible.

It is the first mover's disadvantage that could explain why the developed world has sought to increase the web of those who have to shoulder the burden of responsibility of reducing emissions. Clearly not wanting to lose out on its economic advantage,

the industrialized nations would like to see advanced developing countries like China and India share the burden.

The United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Bali Action Plan remain the bedrock of climate change negotiations. However, the changing economic realities of some developing countries will mean an attempt to rework the "common but differentiated responsibility" principle agreed to at the Rio Summit of 1992. Being one of the rapidly growing countries and in close partnership with China, which is now the world's largest net emitter, India will need to rework its climate change strategy to maximize its goals of development and aspirations to be a global player.

India's position on climate change

India maintains that climate change is not taking place due

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to the current level of GHG emissions but is the cumulative impact of the accumulated stock of emissions in the atmosphere. The stock is the result of carbon-based industrial activity of developed countries over the last two hundred odd years. This historical responsibility mandates that the industrialized countries take the lead in reducing emissions, and enable developing countries to make a shift to a low carbon development path through finance and technology.

Developing countries would take domestic measures on reducing emissions but their “first and overriding priority” is social and economic development and the poverty alleviation of its people. In recognition of the fact that as countries develop, their emissions will increase, New Delhi has pledged that even as it pursues its social and economic development objectives, it will not allow its per capita GHG emissions to exceed the average per capita emissions of the developed countries.

India’s sustained growth has meant that the industrialized world is unwilling to let it hide in the crowd of developing countries. While its growth rate and partnership with China has opened doors for India, it has also meant making some concessions, such as on allowing for “international consultation and analysis” on its domestic actions to deal with climate change. The pressures on India are bound to increase, and New Delhi will have to find a way to leverage its

place at the high table to fulfill its development agenda.

India’s considerations on climate change and negotiations

The absence of any demonstrable economic incentive to move to a low carbon path is a key reason for the unwillingness by countries to move to an alternative paradigm. In the case of developing countries like India, another factor that promotes the business as usual approach is the impediment to poverty eradication that a shift to a low carbon economy represents.

Small and medium enterprises form the backbone of the Indian industrial-manufacturing structure, an important component of India’s growth story. Many of these are export-oriented units and a transition to a more expensive platform would undermine the cost advantage on which these units thrive. Manufacturing growth in 2009-10 has been at 8.9 per cent compared to 3.2 per cent in 2008-09. Unlike in industrialized countries, for SMEs to make the transition would necessarily impact the growth story.

While India does enjoy a high growth rate, and is expected to sustain it, the growth is far from inclusive. More than 50 per cent of India’s populace is still underserved when it comes to electricity, an important determinant of development. India’s per capita energy consumption (2006 figures) is at 510kg oil equivalent compared to the world average of 1,818 kg oil equivalent. China has a per capita energy consumption of 1433 kg oil

equivalent, which has been rapidly rising since 2002, and the US average of 7778 kg oil equivalent. The annual growth in India’s per capita energy consumption has been minimal.

As a developing country, India can reduce the rate of growth of its future emissions. A long-term deviation from business as usual would be difficult as India lacks the stable and structured markets of the industrialized countries. This would make it difficult to shift investments to a low carbon pathway.

The focus for India needs to be on renewable energy and energy efficiency. India’s submission to reduce the emission intensity of its economy by 20 to 25 per cent by 2020 can be bettered through these two options. India has already announced its national solar mission and an enhanced energy efficiency mission is in the works.

The future course

Over the past year or so, India has stressed that it should “negotiate from a position of strength”. In doing so it would like to assume a leadership role. At Copenhagen, India did in partnership with China, Brazil and South Africa play a crucial role in the formulation of the Copenhagen Accord. In that sense, India now sits at a “high table”. Environment minister Jairam Ramesh has consistently advocated “flexibility” in negotiations. The question is whether this flexibility allows India to set the agenda or merely enable the rollout of the path set out at the high table. If India is to rise above being an enabler or

a broker, and set the agenda say like China or United States then it needs to be seen as contributing with out of the box thinking that can move the world towards a viable agreement that is both fair and equitable.

It is not that India has not taken the lead at all. In technology, New Delhi has been a key player suggesting the concept of regional innovation centres. Several formulations put forward by India, including the hub and spoke structure, are now among the areas of consensus in the negotiating text. India's proactive role in organizing a technology summit in October 2009, under the aegis of the UNFCCC, in New Delhi also helped set the agenda. The experience in technology needs to be replicated.

Interestingly, the government is considering a similar exercise on effort sharing in June-July this year. Though the exercise is fraught with hurdles as any consideration of the array of effort sharing models is seen as a move to shift away from our current stand of per capita emission. Nonetheless, this too could become another attempt by India to set the contours of the agenda in the climate change negotiations.

But if India is to garner a leadership role it needs to clearly delineate its interests and build a negotiating team, which includes key stakeholders. Climate negotiations have a feedback effect on domestic policies. Therefore, the negotiating team needs to have active participation of key

stakeholders. Important participants would be the Ministry of Power, which deals with close to 60 per cent of India's emissions. Any decision on curbing emissions would affect the working of this sector. India's current plan to cut emission intensity by 20 to 25 per cent will be largely met by this sector. The other important player is the Ministry of Renewable Energy. If India is to effectively reduce the carbon intensity of its energy basket, renewables will be an important component. It also provides India with the best option of garnering finance through carbon markets.

India's bid for leadership would require it to make common cause with vulnerable countries, where adaptation is a key issue. In the past, more so in the recent past, New Delhi has stressed that its vast coastline, dependency on rain-fed agriculture and its large below poverty population makes it vulnerable too. A natural corollary to this would be the inclusion of the National Institute of Disaster Management in the team.

Another area that New Delhi needs to seriously consider is that of adaption. This is the weakest component of India's negotiating stance. While the Indian leadership has paid lip service to India's vulnerability and the need for adaptation, there has been no assessment, making an effective negotiating plan, one that goes beyond rhetoric, impossible. The government has put in place the Indian Network of Climate Change Assessment, a network of 120

institutions and over 220 scientists from across the country. This network is expected to produce a study on the impact of climate change on various sectors in 2011. In the meantime, it leaves Indian negotiating position missing an important plank.

Given the realities of India's socio-economic development indices and its financial capabilities, there is a need to focus on low hanging fruits and its climate co-benefits. Energy efficiency is a key in this regard. This would include managing demand as well as curbing inefficiencies and losses on the supply side, that is, production and distribution.

India also needs to leverage the carbon markets. The clean development mechanism is not accessed by government projects, and the industrialized world has cornered the low cost mitigation options. India needs to retain the low cost actions for itself, while leaving the high cost mitigation options for the industrialized countries.

Finally, New Delhi has been on the forefront of the demand for finance from industrialized countries to enable the shift to a low carbon pathway. India needs to work out how much finance it requires and then a plan to absorb the funds, should the opportunity present itself.

If India seeks to be a world leader, then it needs to take a proactive role keeping in mind its long-term interests. □

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Maintaining Momentum post Copenhagen

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Maintaining a sustainability orientation while engaging civil society and the private sector would ensure that the momentum for climate action is integrated into mainstream development objectives

THE RECENT global climate change treaty, also known as the Copenhagen Accord, was signed on Dec 18th 2009. Delegates from 193 countries and numerous NGO's convened in the 15th Conference of Parties (COP) and more than 100 heads of states participated during the final days of the conference. Under prevailing chaos and confusion, the accord was signed by Brazil, South Africa, India, China (BASIC countries) along with United States outside the UNFCCC process. Amidst expectations of a separate negotiating text being brought out by the host country, this accord came as a shock to the rest of the participating countries. The Copenhagen Accord (CA) in many ways turned out to be a lip service to the futures of countries impacted by climate change. Most of the vulnerable countries were disillusioned by the process and

lack of political will amongst countries to come to an agreement. There is growing anxiousness in the global civil society about the future of climate negotiations post Copenhagen and the actions taken by major emitters of the world. This article is aimed towards how the current momentum on issues of climate change within India can be maintained through careful planning, engagement of the business, industry and participation of youth as members of civil society for future sustainable prosperity.

Watering down the CA (reducing the ambitious mitigation targets) and making it legally non-binding, coupled with the global economic meltdown only suggests that there is less than required pressure on the major Green House Gas (GHG) emitting countries to aggressively reduce their emissions. India and China have steadfastly

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and somewhat understandably refused to undertake absolute emissions reductions, citing the feet-dragging by some of the world's largest emitters as the reason for lack of strong mitigation action. In addition, they have recently taken a stance that the CA should be considered as a guiding document for future negotiations and gain legitimacy only when all the other 180 countries sign it. The result of this political and diplomatic bargaining is quite obvious—further reduction in the world's commitment to reduce GHG's. This directly points to a worsening of conditions for the most vulnerable countries like Maldives, Nepal, Bangladesh and India to climate change. The distrust caused by the CA will lead most of these Small Island, landlocked, least developed and developing countries to shift their focus from multi-lateral negotiations to bi-lateral agreements. However, the joint declaration of \$30 billion adaptation aid between the years 2010-2012 by developed countries can be considered as a signal towards the direction of future negotiations. The accord will change the affected countries' outward aid seeking policy to an inward looking strategy focused on adaptation, since most of the countries affected by climate change are not the ones causing it.

Projected impacts, vulnerabilities and the scope for action

High-resolution climate change scenarios for India suggest an increase of surface temperature by 2.5-5 degree Celsius and 20%

increase in annual rainfall thus making wet regions wetter and dry regions more dry. (Using the second generation Hadley Center Regional Model (Had RM2) and the IS92a future scenarios of increased greenhouse gas concentrations obtained by state of art regional climate modeling systems). These changes will lead to impacts on cereal, vegetable and fruit crop production and a loss of 9-25% net farm revenue. The forestry sector suggests a large scale forest dieback and loss of biodiversity due to a 68-77% shift in the forest types by the year 2085. The health sector has to focus on the geographical shifting of vector borne diseases like malaria in areas that were historically unaffected. Endemic morbidity and mortality due to diarrheal diseases and exacerbation of the abundance and/or toxicity of cholera are some other predictions that need to be dealt with. India's first national communication to UNFCCC in 2004 reiterates the fact that sectors like forest, agriculture and fisheries that are already under stress due to socio-economic pressures are predicted to be severely affected by climate change and these changes will affect all socio-ecological systems in the country.

India clearly is in a unique position where it not only has a significant percentage of population that is extremely vulnerable to climate change but it is also projected to be one of the major GHG emitters in the world (in terms of total output). As countries move nationally from a reactionary to a proactive protection strategy towards climate change and

development, it is in India's best interest to focus strongly on the internal issues and create a friendly image for other developing countries which have looked up to India for its development models and diplomacy.

While undertaking absolute emissions reductions are not a strong near-term possibility, instead of perceiving climate change as an inconvenient barrier to development imposed by the developed nations, India should perceive it as more of a global development challenge, and look for possible international partnerships to enable leapfrogging technologies, low-carbon infrastructure decisions, energy policies that would increase energy security and opportunities to foster innovation.

The recognition of these priorities was reflected to some extent by the National Action Plan on Climate Change (NAPCC) announced in June 2008 which establishes 8 missions on key adaptation and mitigation needs. The recognition was also seen in the subsequent renewable energy initiatives – for instance, in November 2009, the government approved a 3-phase solar power development initiative to boost solar power production from 6 MW at present to 20 gigawatts by 2022, more than a 3000-fold increase. The first phase of the project would cost about \$900 million, and the total cost is estimated between \$12-20 billion. Furthermore, the follow-up declaration to UNFCCC in January 2010 of voluntary reduction of emission intensity by 20-25% of the 2005 level by 2020

and the follow up tax credits to green technologies in its current budget are a great starting point to tackle climate change both from mitigation and adaptation stands. However, to fully operationalise the NAPCC and streamline climate change dimension into broader development plans will require technical expertise and enhanced institutional capacity on an unprecedented scale along with effective coordination between civil society, government and industry.

A lower-impact orientation to development will have several co-benefits which are vital to consider while considering the higher upfront costs of several of these policy decisions- for instance, the human health benefits from substituting fossil fuels with cleaner technologies. Thus, having proved itself as a strong negotiator and a committed party to the UNFCCC process, India should move forward with national policies targeted at “climate-proofing” its development, which are elaborated later in the paper. This is imperative to minimize India’s climate vulnerability as well as strengthen its prominent position in the UNFCCC process.

Mitigation initiatives with highest reduction potential and co-benefits

With regard to national mitigation policy, India should implement action in areas that have high emissions reduction potential, such as energy efficiency. International partnerships to facilitate these initiatives may help offset partial costs, as well as avoid

potentially higher long-term costs of altering infrastructure in the future. High emissions and high-growth sectors such as transport and the construction sector provide cases where intervention may be particularly effective—for instance, ensuring that new buildings follow certain environmental codes provide a relatively cost-effective yet widespread and efficient way of taking a step towards environmentally-friendly infrastructure. Similarly, energy efficiency provides the greatest potential for emissions reductions and the small and medium scale industries in India would greatly benefit from an easily accessible financing strategy for installing energy efficient equipment. These sectors are also those with sizeable co-benefits, such as avoiding traffic congestion costs, human health benefits from cleaner air as well as more efficient resource use.

In addition, public-private partnerships would work to ensure private sector remains globally competitive and engaged in the policy-making process. The private sector in India has been very dynamic regarding renewable technology initiatives - India is the world’s 4th largest and 2nd fastest growing wind market. Renewable energy projects constitute the largest share in Indian Clean Development Mechanism (CDM) projects (536 out of 815 projects), which if scaled up appropriately, may offer a strong potential source of funding for clean energy. Providing clear and consistent targets would facilitate

long-term investments in these sectors, which is vital since most clean technologies have longer payback periods than conventional technologies.

Integrating adaptation into national development programmes

Currently, most of India’s development policies and programs have not integrated climate uncertainties in the implementation strategies and hence they are extremely vulnerable to uncertainties of climate change. A primary concern with regard to climate proofing development would be the capacity to revisit socio-economic development projects and strategies both at state and national level, and integrate at least some level of climate change adaptation. Hybrid seed variety projects, mini/micro-hydro projects, health projects which are most susceptible to such changes should be prepared and designed such that they are climate proof.

Integration of adaptation into mainstream development policy and a conscious effort to “climate proof” programs will reduce the overall cost of implementation and increase chances of success. One such opportunity would be to incorporate measures that increase adaptive capacity in national programs like the National Rural Employment Guarantee Act (NREGA) in India, since local institutions are actively involved in NREGA. Involving local institutions would be critical

in ensuring that measures on the ground are consistent with local best-practices. For instance, about 60 percent of the 1 million-odd projects carried out under NREGA were related to replenishing, repairing or creating water bodies. Expanding the scope of such initiatives and incorporating them into related poverty alleviation and employment generation policies would fulfill development objectives as well as enhance adaptive capacity at the local level. It is important to notice that while major decision making happens at the national level, the major adaptations will have to be locally informed and designed. Since most of the actors of local level adaptation will also be local it is important that such policies are specially designed and flexible enough to integrate local stakeholders. Climate-oriented development programs would also facilitate effective channeling of the additional international adaptation funding received through the UNFCCC process to programs that would provide higher adaptation benefits.

Mobilizing public opinion for sustainable development

Integrating Inter-Generational Equity- Institutionalizing Youth participation in Decision making: Even though the missions introduced in the NAPCC are a great way to move forward and would like to integrate the civil society in making decisions, we need a very strong representation of the youth in this discourse. Most of the projections clearly suggest that the outcomes

of today's policies and actions will be faced disproportionately by the future generation and hence the principal of inter-generational equity needs to be recognized and upheld as the main driving force in current decision making. The youth in India have been very active in driving the climate debate and actions. The current momentum on climate change cannot be sustained with the same vigor unless we have a stronger representation of the youth in this decision making process.

Rights vs. Duties – Maintaining public involvement: Most of the article so far has stressed the need for governmental action and the rights of civil society and local level stakeholders regarding the climate policy process. A recent international survey (2009) showed that relative to other major economies such as China, Brazil, the UK and the USA, a higher fraction of the Indian population believes that climate change is an imminent problem, is positive that the problem is a solvable one and wishes strong government incentives for change in individual behavior. The poll clearly indicates that the population is aware of the potential of collective individual actions and that there is a window of opportunity wherein the civil society and the government can work together to enable individual actions as duties to reduce the environmental footprint at the local and national levels. While government is looking at its own methods to provide electricity

and fulfill energy needs of various sections of the population, it also needs to maintain pressure on the industry to reduce its environmental footprint, which can then be further encouraged by collective public action.

Conclusion

Even if we argue that the Indian diplomacy at Copenhagen was able to safeguard its national interests by protecting its right to develop, we cannot lose the sight of predicted dangers that we face by maintaining the business-as-usual path of development. Climate change is the most imminent environmental challenge faced by the global community, and one that requires a concerted response at global, national and local level. In addition, there are several economic opportunities that a more sustainable development path offers, such as more efficient resource use and greener industries. India is uniquely positioned with regard to the issue of climate change, and thus should aim to contextualize its economic growth objectives with an awareness of these opportunities, as well as its climate vulnerabilities. Several recent policies have had a sustainability orientation, and maintaining this while engaging civil society and the private sector would ensure that the momentum for climate action is sustained as well as integrated into mainstream development objectives. □

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Indian Environmental Law and Climate Change

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These can be the foundations of an emerging climate change jurisprudence which does not compromise its developmental pursuit, but at the same time addresses the larger issues of inter-generational and intra-generational equity

INDIA HAS a rich and well developed environmental law. The Indian Constitution is one among the few constitutions in the world that has provisions on environmental protection. Articles 48 A and 51 A (g) inserted by the 42nd Constitutional Amendment Act in 1976 imposes the duty of environmental protection on both the state and its citizens. However, the development of Indian environmental law is piecemeal and responsive to certain trigger events. Three trigger events can be discerned in the evolution of the Indian environmental law. The United Nations Conference on Human Environment held at Stockholm in 1972 led to the enactment of many legislations in the field of environment. The enactment of Water Act, Air Act, Forest Conservation Act and the inclusion of provisions relating to the environment in

the Constitution are examples of this. The Bhopal Gas Tragedy of 1984 exposed many lacunae in the Indian legal system. The legal battle that the victims had to fight, and are still fighting in various courts in the US and India is a case in point. A number of statutes were enacted in the wake of the tragedy, Environment (Protection) Act, 1988 being the most important. The Rio Conference in 1992 also saw some legislative activity in the Indian environmental scene. The Biological Diversity Act, 2002 was enacted to implement the Convention on Biological Diversity adopted during the Conference.

But a mere enumeration of the statutes and various constitutional provisions will not capture the essence of Indian environmental law. The stellar role being played by the Indian judiciary has strengthened the environmental jurisprudence in India. Public Interest Litigations

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(PILS) became effective tools in the hands of creative judges to impart justice in the field of environment. Many doctrines were advanced by the judiciary to protect the environment. New principles and concepts like the *Polluter Pays Principle*, *Precautionary Principle*, *Principle of Absolute Liability*, concept of sustainable development, and the notion of inter generational equity were used by the courts to wake up a lethargic executive to deal with many an environmental crisis. It would appear that it is in the field of environment that the Indian judiciary is most active. In ordering the cleaning up of rivers, restoring monuments, cleaning up the pollution caused by hazardous substances, restoring the altered course of rivers, conserving forests and in addressing the problem of vehicular pollution in cities, the courts adorned many roles ranging from super administrator to policy maker.

Climate change presents many challenges at the legal level. At present, India does not have a separate statute on climate change. It is also not necessary at this stage to enact a law imposing restrictions on developmental activities to tackle climate change. The principle of *Equity and Common but Differential Responsibilities* enshrined in the United Nations Framework Convention on Climate Change and embedded in international environmental law recognize the need for a developing country like India to ensure right to development to its billions of impoverished citizens. The per capita argument is also in India's favor, as the per capita emission

of India was 5.7 tonnes per person as compared to 128.7 tonnes of the United States during the period 1994-2007. But all these do not obliterate the fact that India is one among the five major emitters of Green House Gases. The fact that the poor and underprivileged classes, on whose number strength the low per capita argument rests, do not contribute to climate change in any significant way but are most vulnerable to its negative impacts raises serious equity issues at the national level. A legal system which tries to ensure the dignity of the individual has to address this issue in a serious manner.

There are certain legal, regulatory and policy frameworks which can be used in the mitigation efforts of climate change. The Energy Conservation Act, 2001, enacted to promote the efficient use of energy and the National Tariff Policy, 2006, mandating compulsory purchase of certain percentage of renewable energy are important tools in the mitigation efforts. National Action Plan on Climate Change is a major policy document that gives direction to mitigation and adaptation efforts in India.

In addition to these, many concepts in Indian environmental jurisprudence can be used to address the concerns raised by climate change. Precautionary Principle/Approach is the bedrock on which the UNFCC and Kyoto Protocol rests. *Precautionary Principle* mandates that 'when there are threats of serious and irreversible damage, lack of scientific certainty should not be

used as a reason for postponing measures to prevent environmental degradation'. A plethora of Indian judgments has categorically stated that *Precautionary Principle* is a part of Indian law. In the specific Indian context, pPrecautionary Pprinciple imposes additional responsibilities on the governments. The environmental measures carried out must anticipate, prevent and attack the causes of environmental degradation. *Precautionary Principle* also shifts the burden of proof. Under the principle, the onus of proof is on the actor or the developer or the industrialist to show that his actions are environmentally benign. (Vellore Citizens' Welfare Forum v. Union of India, AIR 1996 SC 2715) *Polluter Pays Principle* is another major rule which can play a central role in an emerging climate change jurisprudence in India. *Polluter Pays Principle* means that 'once an activity carried on is hazardous or inherently dangerous, the person carrying on such activity is liable to make good the loss caused to any other person by his activity irrespective of the fact that he took reasonable care.' (*Indian Council for Enviro-Legal Action v. Union of India*, AIR 1996 SC 1446). The fact that Article 21 of the Indian Constitution which guarantees right to life has been used as the legal foundation of these principles means that any legal or executive measure cannot circumvent them.

The recent advances in the climate change jurisprudence at the global level poses greater challenges at the national level. Recent years witnessed the emergence of a body of literature

and authoritative statements analyzing climate change from a human rights perspective. This was a welcome shift, changing the focus from states to individuals. Climate change negotiations, according to this perspective, can no longer be a forum for state trade-offs and climate change is no longer a mere issue squarely belonging to science and politics but an essentially human process with demonstrable human cause and effect. The filing of a petition by an alliance of Inuit in the US and Canada in 2005 at the Inter – American Commission on Human Rights, arguing that the green house gas emissions from the US is violating the human rights of the Inuit, was the first major attempt in linking climate change with human rights. Though this petition was rejected by the Commission, it gave a different dimension to the whole issue of climate change. Mainly because of the initiatives of Maldives, the Human Rights Council by resolution 7/23 requested the Office of the United Nations High Commissioner for Human Rights (OHCHR) to conduct a detailed study of the relationship between climate change and human rights, taking into account the views of States and other stakeholders. OHCHR published its report in January

2009 (A/HRC/10/61) It found that climate change will potentially have implications for the full range of human rights. In particular, right to life, right to adequate food, right to water, right to health, right to adequate housing, and right to self determination will be affected. Interestingly, the report also found that certain mitigation efforts like agro-fuel production may have adverse secondary effects on human rights, especially right to food. The report also focused on the impact of climate change on the rights of specific groups like women, children and indigenous peoples. But the report notes that these effects cannot be qualified as human rights violations in a strict legal sense. The hesitation to hold it a violation stems from practical difficulties like the issue of causation and the fact that climate change effects are future projections. It is impossible to disentangle the causal relationship linking historical green house gas emissions of a particular country with a specific climate change related effect. Similarly, human rights violations are normally established after the harm has already occurred or is imminent. But when it comes to climate change, the adverse effects are projections about future impacts.

Nevertheless, the report argues that addressing these impacts on human rights remains a critical concern and an obligation under international law. The finding of this intrinsic link between human rights and climate change is of special relevance to a country like India. The adverse impact of climate change on a range of fundamental rights recognized under the Constitution is already observed. This places a constitutional obligation on the Indian state to address climate change impacts from a human rights perspective.

Climate change can mark the beginning of a fourth phase in Indian environmental jurisprudence. Though a statute limiting green house gas emissions and thereby halting the economic progress of the country is not warranted at this stage, already there exist many concepts both in the environmental and human rights jurisprudence that mandates state action. These can be the foundations of an emerging climate change jurisprudence in India which does not compromise its developmental pursuit, but at the same time addresses the larger issues of inter-generational and intra-generational equity. □

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DELHI BECOMES THE FIRST INDIAN STATE TO LAUNCH ACTION PLAN ON CLIMATE CHANGE

The National Capital Territory of Delhi announced an action plan comprising 65 specific actions to address climate change as part of the State's development policy framework by 2012. Jairam Ramesh, India's Environment Minister and Sheila Dikshit, Delhi's Chief Minister, jointly released this agenda on 5th November 2009, which is aligned with the country's National Action Plan on Climate Change.

A Short Appraisal of Climate Change Data

S Chakrabarti
S Suresh Kumar



Measuring the net effect of the factors is therefore, a cross-cutting issue, which requires cross-pollination of domain-knowledge elements

THE INTER-Governmental Panel on Climate Change (IPCC) defines climate change as ‘a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity’. The definition provided by the United Nations Framework Convention on Climate Change (UNFCCC) is slightly different, as it emphasizes on ‘a change that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over a comparable time periods’. Leaving aside the semantics involved, the essential point that these definitions try to signify is all about how and to what extent

the changes in the weather pattern over an extended period can be related to human activity, directly or indirectly.

Evaluation of Some Contributing Factors

Given the fact that human civilization and industrialization have amplified the emission of ‘Green House Gases’ (GHG), the question is whether they really are the main causal factors accelerating climate change. GHGs constitute Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (NO₂), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphurhexafluoride (SF₆). In addition to these, water vapor is considered important, which absorbs the heat radiations from sun and traps such radiations in the atmosphere making the earth warmer. Emission of GHGs beyond certain limits makes earth’s atmosphere hotter and can induce climate change. The extent of GHGs in the atmosphere

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increased phenomenally from 280ppm (1750) to 379ppm in 2005 (IPCC-AR4). The available global data on CO₂ since 1970 indicates that the annual emission has increased by about 80%, from 21 to 38 gigatons, which represents 77% of the total anthropogenic emission. The global increase in CO₂ concentration is primarily due to increase in fossil fuel use, land-use change, changes in agricultural activities, industrial development and loss of forests. CO₂ originates from burning of fossil fuel (56.6%), deforestation and decay of biomass (17.3%), agriculture etc. As per the estimates of United Nations Development Programme, the total emission of CO₂ in India is 1,342 Mt in 2004 which is 4.6 percent of the world total. The CO₂ emission is growing at the rate of 6.9 percent and the per capita emission is 1.2 tonnes which is 17 times lower than that of USA and 8 times lower than that of European countries.(HDR 2007/2008)

The energy sector is the major producer of CO₂ in India. Our energy needs are met from coal (53%), which is abundant, locally available and cheap when compared to alternative fuels. As per the data published by Central Electricity Authority, CO₂ emission in the power sector is continuously increasing at the annual rate of 4.43 percent in all parts of the country. Compared to global consumption of coal for energy production (about 40 percent), the use of coal for energy production in India is high. It is therefore, important to maintain statistics on CO₂ emission by sources. Interestingly, about 14 percent of the world production of coal is consumed by USA, out

of which 37 percent is used for electricity generation.

The global atmospheric concentration of Methane has increased from pre-industrial value of about 715ppb to 1774ppb in 2005(IPCC-AR4). Methane is generated from the activities like agriculture, biomass burning, coal mining and handling, flaring of natural gas, waste disposal, land-use pattern, forestry and shifting cultivation practice. In India, the Methane emission in the year 1994 was 18,583 Gg., out of which 78% came from agriculture, 16% from energy production and 6% from waste disposal. The measure of methane emission due to various activities needs to be estimated for analyzing temporal changes in its concentration in atmosphere.

There is considerable reduction in the forest cover in the past few years due to encroachment and land use change, economic development activities like construction of roads, canals and power stations. However, there is a slight improvement in the forest cover as per the 2007 assessment as reported by the State of Forest Report-2009. Forests are the major source of carbon sequestration and the womb of the biodiversity, which acts as the main artery of sustainability of environment and the ecosystem. National Action Plan on Climate Change (NAPCC) estimates that 68 to 77% of the forest areas in the country are likely to experience change in forest types by the end of the 21st century, which needs our immediate attention. Since the enactment of Forest Conservation Act, 1980, a huge portion of forestland has been diverted for

non-forest use. The reported figure for the year 1981 is 1331 hectors whereas the cumulative figure till 2004 is 9,54,839 Ha.

Economic development and urbanization are positively correlated. As per the United Nations Human Settlements Programme (UNHSP) figures, the global urbanization has increased from 2% in 1800 to 47% in 2000. As reported by TERI (2007), the daily generation of waste in Delhi alone is 5922 Tonnes, out of which 54.42% are compostables and 15.52% recyclables. Wastes pollute water and atmosphere and degrade land. If left untreated, they ferment and generate bio-gas, which contains 65-70% of methane. The heat trapping capacity of Methane is 34 times higher than that of CO₂. The present data is insufficient to gauge the amount of recycling that happens at the source level and the amount of methane and other pollutants emitted by the solid waste.

Issues Concerning Impact Assessment

The resilience of the ecosystem is likely to be disturbed in the future due to abrupt climate change, which could appear in the form of floods, drought, wildfires, ocean acidification etc, inducing further loss of biodiversity and jeopardizing the earth's latent capacity to mitigation and regeneration. The rise in temperature, change in precipitation patterns, sea level rise, melting of snow cover and mountain glaciers, coastal erosion and occurrence of health hazards and disaster events are perceived as the visible impacts of climate change.

In India, an increase of about 0.40C in the surface air temperature has been observed in the past century. A trend of warming is visible along the west coast, central India, interior peninsula and the North-Eastern India, but some cooling trends are also visible in the North-West India and parts of South-India (NAPCC-2008). India Meteorological Department (IMD) is the nodal agency to provide and analyse long-term series of temperature data.

Indian monsoon rains are the backbone of Indian economy as most of our agricultural activities, river flows and replenishment of ground water sources depend on monsoon rains. Rainfall data are collected by the IMD in respect of the meteorological subdivisions of the country on a day-to-day basis. A significantly long series of rainfall data is, therefore, available to analyze patterns of change in distribution, intensity and duration of rainfall. About 10 to 12% increase in monsoon rains are reported to have taken place along the west coast, northern Andhra Pradesh and north-western India during the last century. A decrease of about 6 to 8% has been observed over eastern Madhya Pradesh, north-eastern India and some parts of Gujarat and Kerala (NAPCC-2008).

The ice and snow deposits on the Himalayan ranges are the lifelines of northern India. They provide a perennial supply of water through many rivers, which cater to the livelihood, drinking water, and water for industry and irrigation. The available data

on snowfall in the Himalayan ranges shows a recession of snow cover in some parts of the Himalayan ranges. The river systems of the Brahmaputra, the Ganges and the Indus draw water directly from melting of the Himalayan glaciers. The National Remote Sensing Agency (NRSA) and Snow and Avalanche Studies Establishment (SASE) are responsible for collection and supply of data on cryosphere.

India is one of the species-rich countries in the world and about 6% of the world's biodiversity is reported from India. The existing data does not provide any insight into the loss of biodiversity in the country which happened over the years due to rapid economic growth, urbanization and land-use change. The NAPCC also emphasizes on the need for 'creation of biodiversity registers' (at national, district and local levels) for documenting genetic diversity and the associated traditional knowledge. Zoological Survey of India, Botanical Survey of India, Forest Survey of India and the State Forest Departments are responsible for collection and supply of data related to biodiversity.

IPCC has estimated a sea level rise of 1 to 2 mm per year globally. In India, a study conducted by Unnikrishnan and Shankar also showed a trend of 1.06 to 1.75 mm rise of sea level per year. No official data is however, available in India to empirically check the authenticity of these estimated figures. Due to sea level rise, the fresh water sources near the coastal areas will suffer from salt

intrusion and inundation of coastal areas, where a large section of the population is highly dependent on sea for livelihood activities.

India is predominantly an agrarian economy, as 52% of the population directly depends on agriculture either as farmers or agricultural labourers out of which 76% resides in villages. Climate change will have a direct impact on the livelihood of these people. Food production in India is sensitive to climate change effects on temperature and monsoon rainfall. Rise in temperature is likely to have a direct impact on the Rabi crops as every 10C rise in temperature will reduce wheat production by 4 to 5 Million Tonnes. Every small change in temperature and rainfall has significant effect on the quality and quantity of production of fruits, vegetables, tea, coffee, basmati rice and aromatic and medicinal plants. It is predicted that a loss of 10 to 40% in production of food grains may occur by 2100 due to climate change (NAPCC). Time series data on area, production and yield of major crops, season-wise and State-wise and for all-India are available from Department of Agriculture & Cooperation, Ministry of Agriculture. However, the production figures are required to be analyzed with reference to the climate change data over time.

Population in coastal regions are vulnerable to natural disasters like cyclones, floods, droughts, soil and land erosion. These phenomena may accentuate due to climate change leading to irreparable loss or damage to sown areas. About 40 million hectares of land is flood-

prone, including river-deltas on three sides of the country stretching over 6000 Km of coastal belt, affecting about 30 million people on an average each year. National Disaster Management Authority (NDMA) is responsible for the collection and compilation of the disaster data. State governments are also going to engage their system to compile data on disasters at district levels.

Conclusion

Roles of different government agencies as envisaged in

the NAPCC are highly compartmentalized. As a result, the data related to different constituents of Climate Change are resident in different domain-specific systems under the control and administration of independent agencies. The inter-connectivity of these data-systems under an over-arching system for management and technical knowledge-mix is largely missing. The atmosphere is one single entity, but what goes into it emanates from various sources. Measuring the net

effect of the factors is therefore, a cross-cutting issue, which requires cross-pollination of domain-knowledge elements in every possible way they may fertilize to meaningfully signify reasons of change and their quantitative measures. Is Indian Network of Climate Change Assessment (INCCA) an answer to this? We think it should be able to provide adequate space to knowledge integration and data blending. □

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Announcement

The Post-Doctoral Fellowship (PDF) Programme at NUEPA, 2010

Applications are invited from eligible scholars/candidates desirous of undertaking post doctoral research in specialized areas of educational policy, planning and management at the National University of Educational Planning and Administration. Candidates, preferably below the age of 35 years will be considered for these fellowships.

The amount of Fellowship for pursuing Post Doctoral research will be Rs.18000/- per month. Interested candidates may visit University website www.nuepa.org for further details regarding eligibility, application modality, and other terms & conditions. Details are also available on the Notice Board of the University. Last date of submission of application form is **20th April 2010**.

(Registrar)

YE-4/10/6

NOW GET PASHMINA FROM RARE GOATS CLONED IN SRINAGAR

Lovers of pashmina have a reason to cheer. Soon, there will be an abundance of the fine fabric that is derived from the wool of the rare pashmina goat. Scientists at the Srinagar-based Sher-e-Kashmir University of Agriculture Science and Technology (SKUAST) are engaged in cloning the pashmina goat.

Funded by the World Bank, the university has taken up the project because pashmina fibre is high in demand in India and abroad. The pashmina goat is indigenous to the higher altitudes of the Himalayas and its wool is used in making shawls famous for their softness and warmth.

The Rs. 9 crore joint project to clone the pashmina goat by SKUAST and the National Dairy Research Institute (NDRI) in Karnal, Haryana started last April and is expected to be completed by 2012. Scientists say the cloning would considerably increase the yield of pashmina wool that fetches handsome money to the rearers in the tribal area of Changthang in Leh, as well as those engaged in handicraft.

Vice-chancellor of SKUAST, Anwar Alam, said the cloned goat would yield about 900 grams of wool per year against the 300 grams by the traditional specie.

It will subsequently improve the livelihood of the tribals whose per capita annual income ranges between Rs. 3,000 and 5,000.

Following the ban on shahtoosh – the world's finest wool derived from the hair of an endangered Tibetan antelope – shawls made from pashmina wool are considered the finest and are exported worldwide. □

MODERN COMMUNICATION MEANS REVIVE KASHMIRI MUSIC

Modernization may have its curses on culture, yet for Kashmir, it seems to have played a positive role in the preservation and revival of Kashmiri music. The growth of internet, youtube, cable channels and remixes have rendered a new life to the old and forgotten music of Kashmir.

Some years back, the Kashmiri music and songs were limited to radio broadcasts and television programmes, besides being sung on occasions like wedding.

The growth of media, and introduction of cable network, diverted people from the old habit of listening to radio and watching conventional television channels. This diverted people, particularly the youth, from the music of Kashmir. While the elder population longed for hum of Kashmiri music, the youth were almost totally ignorant of it.

Nevertheless, the introduction of youtube and availability of Kashmiri music on CDs and DVDs, gave a new dimension to the Kashmiri music. This was rather triggered by the making and production of remixes of old Kashmiri songs. The intermix of contemporary music with traditional lyrics in form of remixes, provided a treat for the youth. As these videos and songs found way to people with the introduction of local cable channels, they at the same time, became internationalized through youtube.

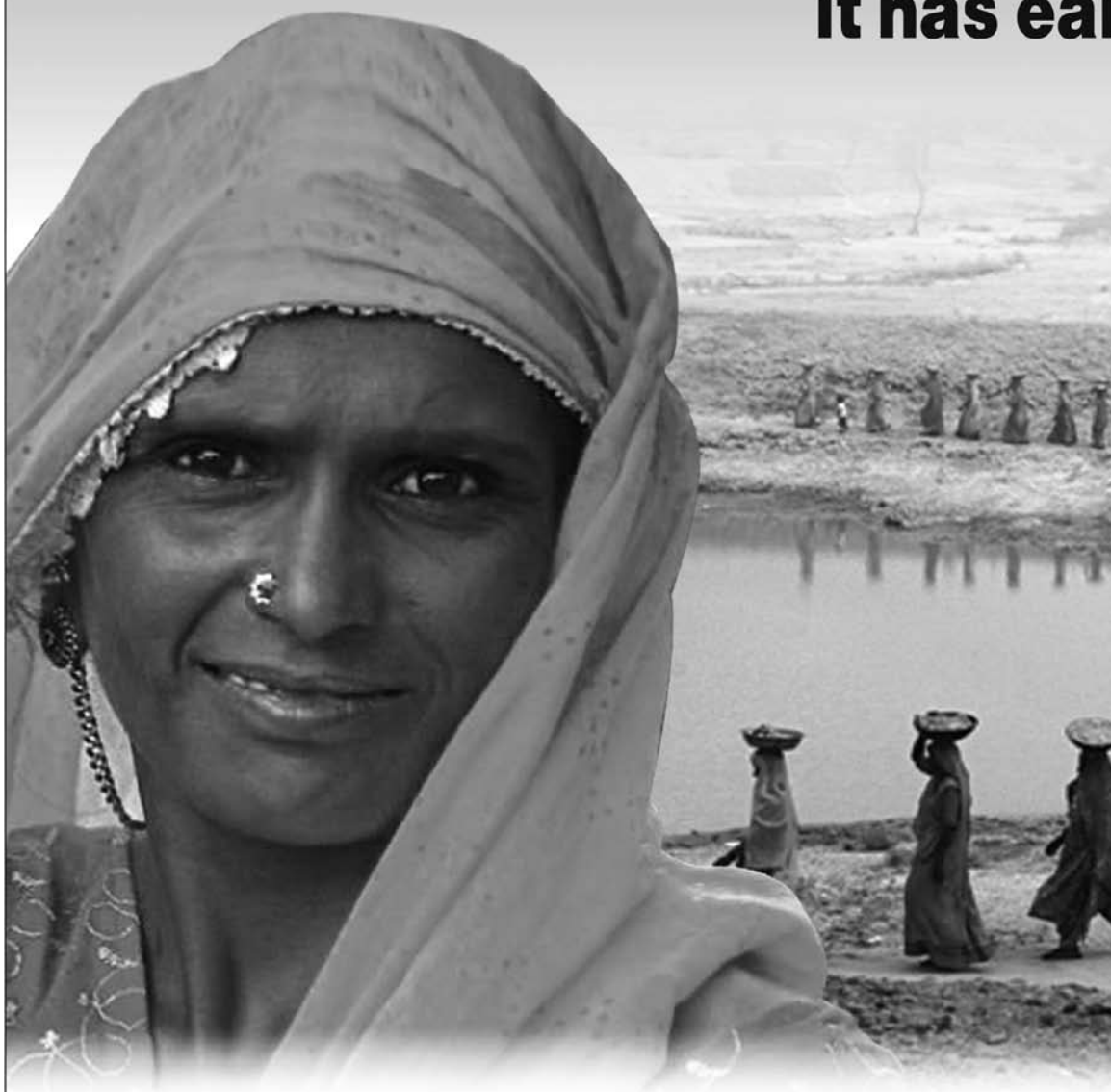
While people could watch and listen to the Kashmiri songs at home through the cable channels, youtube helped youth, particularly the internet buffs to stay connected with their rich music culture all the time. □

(Courtesy: Newspapers)



Ministry of Information & Broadcasting
Government of India

“Not just live
it has ear



clavp 22201/13/0016/0910



**Villages & cities will move along,
our nation will move ahead**

Mahatma Gandhi

- Highest ever allo
- About 4.19 crore
- 33 lakh works ge

elihood,
rned me respect too.”



National Rural Employment Guarantee Act

Allocation of Rs. 39,100 crore

100 million rural households provided jobs

Generated in 619 districts



Smt. Sonia Gandhi
Chairperson, UPA



Dr. Manmohan Singh
Prime Minister of India

YE-4/10/5

Community Action to Fight Climate Change

Awanish Somkuwar



It is a small but perhaps immensely significant step to enable those at the receiving end of climate change to transform themselves from potential victims to keepers of their own destiny

HARI SINGH Maravi, Sarpanch of Tume Gao Gram Panchayat in Naipur block of the predominantly tribal Mandla district of Madhya Pradesh says, “I have heard people saying that some harmful gases are going into atmosphere due to which the earth is heating up. If it is so, it will threaten our lands, which give us food”

Miles away from Copenhagen, far removed from international dialogue and action forums, “Climate Change” is not a familiar term for rural communities living in tribal areas of Madhya Pradesh. Yet they are discerning a change in their immediate environment, not fully obvious but yet perceptible. 75 year old Vir Singh, farmer from Dubdi village around 60 km. from Sheopur district headquarters in north M.P articulates this “The only change I feel is that nothing is on time. Rains, summer or winter”. He elaborates “Ek baat pakki hai ki ab to mausam bhi dhokhebaj hao gaya hai. Mausam ke bhorose chalne ka time gaya.” (One thing is sure. Even seasons have turned deceptive. One can no longer depend on it).

This new understanding has not come from policy forums, academicians or experts, nor from the media, but from their own observation of the changing patterns of life around them. It is entirely plausible that climate change would probably affect these and other communities in rural regions all over the country. It would hit agricultural patterns on which the livelihoods of our multitudes depend. But in this pocket of M.P, local communities seem to have grasped the fact that all is not well with the world, a world they inherited from their ancestors, a world based on harmony between human beings and their environment.

This awareness has not come from the community alone. They have been guided along in this new discovery of correlating the changes they perceive to the larger issue by an initiative of 3000 Livelihoods Promoters as part of the Madhya Pradesh Rural Livelihoods Project. Perceiving a potential threat to natural resource based livelihoods due to global warming, this project aims to educate the rural masses about climate change issues. This



THE GRAM SABHA COULD BE THE FORUM TO EDUCATE THE VILLAGE COMMUNITY

Green Army is active in nine predominantly tribal districts of Dhar, Jhabua, Badwani, Aalirajpur, Mandla, Dindori, Anuppur, Shahdol and Sheopur.

There is a growing awareness on the role of the Gram Sabha in addressing the issue. And the Livelihoods Promoters are aware of the potential to reach out directly to the communities with this core message of understanding and coping with Climate Change. Hari Singh Maravi is a worried Sarpanch. As he understands it, with the earth heating up, there could be possible loss of livelihoods which he is keen to bring to the attention of the Gram Sabha.

The Gram Sabha could be the forum to educate the village community or prescribe a code for collective action. Says Dev Singh Varkade, Sarpanch of Khudia Gram Panchayat "If the poor villagers have to suffer then they have the most effective solutions too and there can be no better forum for such solutions to come up."

How will it work on the ground? Lamu Singh Maravi, who is Panch in

Jaltara Gram Panchayat in Mandla district has some guiding principles "“Let us simply do what we have been doing for years- saving water, caring for plantations, making our fields chemical-free, rational energy consumption, conserving available flora and protecting fauna. That is what I understand and everybody should.”

“Learn to behave well with the Mother Earth and everything will be right,” says Bhuvan An Singh of Behadvi village 15 km. from Jhabua district headquarters in the western part of Madhya Pradesh. In essence they would do what comes naturally to them based on the innate wisdom handed down the generations which tells them ways to keep the Earth green and cool.

Bhuvan Singh led the village community to undertake massive plantations on 13 hectares. For last three years, they have grown fodder worth Rs. 50 thousand. “We are also managing 15 hectare tank for fishing activity, informs Khum Singh of the same village saying that “we have nothing but natural resources. We

have to survive on it somehow. He is weary about the terminology that has suddenly been doing the rounds “We do not know in what measure our efforts contribute to mitigation of carbon.”

Others involved in the project have come to grips with the nitty-gritty. Ram Singh a Livelihood Promoter in Tikdijogi village of Ranapur block in Jhabua district expands on this ““We would deliver important information to poor families on how carbon emission can be mitigated in villages, what indigenous methods or modern ones like bio-gas plants, solar energy systems can be adopted while improving livelihoods.”

Spreading climate literacy is one of the top priorities of the Livelihood Promoters “It has become urgent to orient the Gram Sabha about the climate change and its dire impact on livelihoods, says the Project Coordinator L.M. Belwal.

It is a challenging task, the move to raise awareness on the issue not as an esoteric concept but rooted to the ground, through action related to their daily lives. Correlating the perceived changes in their environment, impacting their life patterns with concrete solutions to mitigate its effects. ,to open out new options and innovative practices and help the tribal communities to side-step and in fact ride the problem rather than be overpowered by it. In a way, it is a small but perhaps immensely significant step to enable those at the receiving end of climate change to transform themselves from potential victims to keepers of their own destiny and harbingers of harmony in their environment. □

(Charkha Features)

Impact of Climate Change on Human Health in India

K Srivani



***Above all,
protection
of health from
climate change
has to be a part
of a basic,
preventive
approach to
public
health***

THERE IS overwhelming evidence to show that climate change presents growing threats to public health security - from extreme weather-related disasters to wider spread of such vector-borne diseases as malaria and dengue. The impacts of climate on human health will not be evenly distributed around the world. The Third Assessment Report (Intergovernmental Panel on Climate Change-2001) concluded that vulnerability to climate change is a function of exposure, sensitivity, and adaptive capacity. Developing country populations, particularly in small island states, arid and high mountain zones, and in densely populated coastal areas are considered to be particularly vulnerable. For India, nearly 700 million of her over one billion population living in rural areas directly depends on climate-sensitive sectors (agriculture, forests, and fisheries)

and natural resources (such as water, biodiversity, mangroves, coastal zones, grasslands) for their subsistence and livelihoods. Heat waves, floods and draughts occur commonly. Malaria, malnutrition, and diarrhea are major public health problems. Any further increase in weather-related disasters and climate change related health effects, may cripple the already inadequate public health infrastructure in the country.

Until now, changes in the global climate have occurred naturally, across centuries or millennia, because of continental drift, various astronomical cycles, variations in solar energy output, and volcanic activity. Over the past few decades, it has become increasingly apparent that human actions are changing atmospheric composition, thereby causing global climate change. The major changes observed so far, and expected to continue in

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coming years include increase in surface temperatures, warming of seas and rise of sea levels, increase in precipitation including extreme rainfall, frequent droughts and rise in intensity of tropical cyclones

According to the United Nations Industrial Development Organization (UNIDO), climate change is likely to have a greater impact on India compared to other countries similarly positioned, on account of the unique combination of its geography, diverse population characteristics and extremely high carbon-related energy dependence (Source: The Hindu, September 5, 2008). Climate change is bound to affect the basic requirements for maintaining health - clean air and water, sufficient food, adequate shelter, and freedom from disease given the already high level of poverty, low nutritional levels and poor public health infrastructure in the country.

Impact of Climate Change on Human Health

Our personal health may seem to relate mostly to prudent behavior, heredity, occupation, local environmental exposures, and health-care access, but sustained population health requires the life supporting "services" of the biosphere. Populations of all animal species depend on supplies of food and water, freedom from excess infectious disease, and the physical safety and comfort conferred by climatic stability. The world's climate system is fundamental to this life support. A changing climate is likely to

affect all these conditions and hence have a powerful impact on human health and well-being. In its Third Assessment Report, the United Nation's IPCC concluded that "climate change is projected to increase threats to human health." Climate change can affect human health directly (e.g., impacts of thermal stress, death/injury in floods and storms) and indirectly through changes in the ranges of disease vectors (e.g., mosquitoes), water-borne pathogens, water quality, air quality, and food availability and quality. Global climate change is, therefore, a newer challenge to ongoing efforts to protect human health. The question is, how will the changing climate affect our health? Climate influences many of the key determinants of health: it leads to extremes and violent weather events; resurgence of disease organisms and vectors; affects the quantity of air, food and water; and the stability of the ecosystems on which we depend. (CSE Draft Dossier: Health and Environment, Climate Change and Diseases: The Double Jeopardy)

Direct and Indirect effects on Human Health

Climate change can have both direct and indirect human health impacts. Indirect impacts arise from changes in temperature patterns, which may disturb natural ecosystems, change the ecology of infectious diseases, harm agriculture and fresh water supplies, exacerbate air pollution levels, and cause large-scale reorganization of plant and animal communities.

Extreme high air temperatures can kill directly. Heat waves directly contribute to deaths from cardiovascular and respiratory diseases, especially among the elderly people. Daily wage earners such as laborers and rickshaw pullers are at risk. Also persons living in informal structures may be more exposed to high temperatures. Warmer temperatures, shifting rainfall patterns and increasing humidity affect the transmission of diseases by vectors like mosquitoes. They are quite sensitive to changes in temperature and rainfall and are among the first organisms to extend their range when environmental conditions become favorable. Thus, higher temperatures could influence the incidence of diseases such as malaria, dengue fever, yellow fever, and several types of encephalitis. Cold temperatures are often the limiting factor in mosquito survival, so any increase in minimum winter temperatures would likely extend mosquito ranges into temperate regions or higher altitudes where they do not survive.

Other vector-borne diseases such as Schistosomiasis, Chagas disease, Sleeping sickness, River blindness, and various strains of encephalitis all could change their ranges and patterns of infection in the course of climate change. Infectious diseases are emerging, resurging and undergoing redistribution on a global scale. Increase in temperature correlate with increased populations of some microorganisms that cause waterborne diseases, such as *Vibrio cholerae* bacterium, which causes Cholera. Higher ambient

temperatures foster the growth of pathogens that thrive in or on food, such as Salmonella. (CSE Draft Dossier: Health and Environment, Climate Change and Diseases: The Double Jeopardy)

The increase of Chloro Fluoro Carbons in the atmosphere, leading to global warming will increase UV radiation in the atmosphere, affecting the immune systems and leading to infectious diseases. Susceptibility to important skin infections such as Leishmaniasis or Leprosy might be increased by greater exposure to UV light. The UV radiation affects the immune system of the skin and hence there might be an increased number of cases of skin cancer. Other minor effects are increased incidence of skin disorders, such as prickly heat and fungal skin disorders such as ringworm and athlete's foot as a result of increased temperature and humidity.

The phenomenon of rain is caused when heat from the sun's rays on the surface of the seas, lakes and rivers induces evaporation. The water vapour formed in the process rises to a height where it condenses into moisture. If ambient conditions prevail it comes down as rain. But in the case of acid rain, water vapours reach the atmosphere, condense, and react with atmospheric gases like SO₂ and NO_x. When it rains, these atmospheric pollutants are deposited on the soil, vegetation, surface water or reservoirs. The deposition ultimately results in damage because of the acidity of

the pollutants. Acidic rainwater liberates mercury from the soil which can hinder brain development during the foetal stage. Fish-eating birds and humans acquire mercury by eating fish with high levels of the metal in them. The fish in turn ingest microorganisms, which consume mercury released by acid rain in the water. Acid rain also releases aluminum and cadmium. Cadmium can cause kidney disorders, besides accumulating in the outer layer of the kidney, causing wounds. Aluminum on the other hand, causes problems for kidney patients. In dialysis- the process of purifying the blood when the kidneys malfunction- it enters the blood stream directly without first having passed the body's normal protective barriers. This may cause skeletal and brain damage. It may also cause Alzheimer's and Parkinson's diseases. (Source: CSE Draft Dossier: Health and Environment, Climate Change and Diseases-The double Jeopardy)

Increasing traffic and exhaust as well as industrial emissions are raising concentrations of SO₂, NO_x, O₃ and suspended particulate matter, which are known to be damaging to human health. High temperatures raise the levels of ozone at ground level and other air pollutants, and hasten the onset of pollen season. Pollen and other allergens in the air trigger and aggravate asthma and cardiovascular respiratory diseases. (Dream 2047, Vigyan Prasara).

The impact of climate change on water availability is likely to

be one of the most significant for the health of populations. Higher temperatures are hastening rates of evaporation of surface water thereby reducing the availability of fresh water. Lack of fresh water compromises hygiene and hence increasing incidence of diarrhoeal disease. On the other hand, too much water, in the form of floods, causes contamination of freshwater supplies. Extreme events like sea level rise coupled with stronger storm surges and coastal flooding can be followed by outbreak of diseases such as Cholera.

Inadequate drainage resulting in stagnant water is also a cause of mosquito-borne diseases such as malaria in urban areas. Flooding also may lead to the contamination of waters with chemicals, heavy metals or other hazardous substances, either from storage or from chemicals already in the environment (for example, pesticides).

Rising temperatures, changing patterns of rainfall, and more frequent droughts and floods are projected to decrease crop yields in many developing countries causing shortages of food supplies. This could result in severe malnutrition and under nutrition, especially among children, in countries where large populations depend rain-fed farming at subsistence level.

Perhaps the greatest long-term danger to human health from climate change will be the disruption of natural ecosystems, which provide an array of services that

ultimately support human health. Biotic systems- whether in forests, rangelands, aquatic environments, or elsewhere- provide food, materials, and medicines; store and release fresh water; absorb and detoxify wastes; and satisfy human needs for recreation and wilderness. They are also intimately involved in sustaining the genetic basis of agriculture.

A potential health benefit of warmer global temperatures could be fewer cold-related deaths, as winters become milder. Yet, experts believe that the decrease in mortality will be negligible as compared to the increase in mortality resulting from global warming; studies indicate that higher mortality is generally associated with heat waves rather than cold spells (Source: CSE Draft Dossier: Health and Environment,

Climate Change and Diseases-The double Jeopardy).

More assessments of the impacts of climate change on health in different tropical zones viz. plains, deserts, foothills, hilly and coastal areas are required. Assessments are also needed at the city level for informed decision making. The World Bank has made the following recommendations in this regard: (Source: Climate, climate change and human health in Asian cities, Sari Kovats and Rais Akhtar, Environment and Urbanization Magazine, 01 Apr 2008

- reliable and comprehensive assessments of risk vulnerabilities for exposed cities, and the dissemination of such information;
- establishment of early warning

systems and evacuation plans, including emergency preparedness and neighborhood response systems;

- improved efficiency of the water supply management
- improving health educational and institutional capacity in urban environment management; and
- regularizing property rights for informal settlements and other measures to allow low-income groups to buy, rent or build good quality housing on safe sites.

Above all, protection of health from climate change has to be a part of a basic, preventive approach to public health. □

(E-Mail: srivanikoduri@yahoo.in)

CLIMATE CHANGE DEPARTMENT OF GUJARAT GETS RS 100-CRORE HEADSTART

The newly-formed climate change department of the Gujarat government, the first such department in Asia and sixth in the world, has received its first budgetary allocation of Rs 100 crore for 2010-11. The state has earmarked Rs. 10 crore for Climate Change Trust Fund to be set up to conduct research, development and commercialization of green technology. The main focus of research will be to study the effects of climate change on agriculture, health and coastal areas and estimating carbon footprints. The state government will involve renowned institutes, both from India and abroad for the purpose.

The department will work towards creating awareness among people regarding 'green projects', and towards making Gandhinagar a solar city and specific areas carbon neutral. A provision of Rs. 19.25 crore has been made for this.

There are only six countries in the world that have put in place separate ministries for climate change. Gujarat accounts for nearly 29% of the total carbon credit income in India. The government also plans to launch Green Credit Movement on the lines of carbon credit. The new department also proposes to prepare curriculums pertaining to climate change for educational purpose and regulating and financing of new technologies for controlling emission of green house gases.

(Courtesy : Newspapers)

DO YOU KNOW?

REDUCING GHG EMISSIONS : THE KYOTO MECHANISMS

The Kyoto Protocol has put in place three flexibility mechanisms to reduce emission of Green House Gases. Although the Protocol places maximum responsibility of reducing emissions on the developed countries by committing them to specific emission targets, the three mechanisms are based on the premise that reduction of emissions in any part of the globe will have the same desired effect on the atmosphere, and also that some developed countries might find it easier and more cost effective to support emissions reductions in other developed or developing countries rather than at home. These mechanisms thus provide flexibility to the Annexure I countries, helping them to meet their emission reduction obligations. Let us take a look at what these mechanisms are.

What are the three flexibility mechanisms put in place by the Kyoto Protocol for reducing GHG emissions ?

The three mechanisms are Joint Implementation, Emissions Trading and Clean Development Mechanism.

What is Joint Implementation?

Through the Joint Implementation, any Annex I country can invest in emission reduction projects (referred to as "Joint Implementation Projects") in any other Annex I country as an alternative to reducing emissions domestically.

Two early examples are change from a wet to a dry process at a

Ukraine cement works, reducing energy consumption by 53 percent by 2008-2012; and rehabilitation of a Bulgarian hydropower project, with a 267,000 ton reduction of CO₂ equivalent during 2008-2012.

What is Clean Development Mechanism ?

The Clean Development Mechanism (CDM) allows a developed country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries as an alternative to more expensive emission reductions in their own countries. In exchange for the amount of reduction in emission thus achieved, the investing country gets carbon credits which it can offset against its Kyoto targets. The developing country gains a step towards sustainable development.

To get a CDM project registered and implemented, the investing country has to first take approval from the designated national authority in the host country, establish "Additionality", define baselines and get the project validated by a third party agency, called a Designated Operational Entity (DOE). The Executive Body of CDM registers the project and issues credits, called Certified Emission Reductions (CERs), or carbon credits, where each unit is equivalent to the reduction of one metric tonne of CO₂ or its equivalent.

There are more than 4200 CDM projects in the pipeline as on 14.3.2010. The expected CERs till

the end of 2012 is 2,900,000,000

What is "Additionality" in a CDM project ?

The feature of "additionality" is a crucial element of a CDM project – it means that the industrialized country that is seeking to establish the CDM project in the developing country and earn carbon credits from it has to establish that the planned carbon reductions would not have occurred on its own, in the absence of the CDM project. They have to establish a baseline of the project, which is the emission level that would have been there in the absence of the project. The difference between this baseline level and the (lower) emission level achieved as a result of the project is the carbon credit due to the investing country. Additionality can be with reference to various terms, for example - Emission Additionality- the project should lead to real, measurable and long term GHG mitigation ; Financial Additionality- the funding for the CDM project should not lead to diversion of official development assistance; Technological Additionality- the CDM project activities should lead to transfer of environmentally safe and sound technologies and know how.

What are some of the concerns regarding CDM ?

The risk of "False Credits" is a cause for concern with regard to CDM projects. If a project does not actually offer an additionality, and the reduction in emissions would have happened anyway, even without the project, then

the positive effect that the project shows will actually be a false positive, giving the investor an undeserved or spurious credit which can actually cause emissions to rise rather than fall.

What is India's position with regard to CDM projects ?

India has a huge potential for CDM projects in areas like renewable and non renewable energy, manufacturing, chemical industry, transport, waste handling, tourism, agriculture, afforestation, construction etc. As in January 2010, there were a total of 482 CDM projects from India, registered with UNFCCC. This is 23.71 % of all projects from across the world. Total CERs issued to all CDM projects is 373.795 Mn, of which India accounts for 19.92 % at 74.19 Mn. CERs

What is Emissions Trading ?

Emissions trading is a market-based scheme for environmental improvement that allows parties to buy and sell permits for emissions or credits for reductions in emissions of certain pollutants. Under such a scheme, the environmental regulator first determines total acceptable

emissions and then divides this total into tradeable units (often called credits or permits). These units are then allocated to scheme participants. Participants that emit pollutants must obtain sufficient tradeable units to compensate for their emissions. Those that reduce emissions may have surplus units that they can sell to others that find emission reduction more expensive or difficult.

The Emissions Trading-mechanism allows parties to the Kyoto-protocol to buy greenhouse gas emission permits from other countries to help meet their domestic emission reduction targets. Parties with commitments under the Kyoto Protocol (Annexure B countries) have accepted targets for limiting or reducing emissions. These targets are expressed as levels of allowed emissions, or "assigned amounts," over the 2008-2012 commitment period. The allowed emissions are divided into "assigned amount units" (AAUs). Emissions trading allows countries that have emission units to spare to sell this excess capacity to countries that are over their targets. Carbon is now tracked and traded like any other commodity in the "carbon market." Trading can also be done in units like ERUs (Emission

Reduction Units) generated by JI projects, CERs generated by CDM projects etc. Potential buyers of credits are countries / entities that emit more GHG and potential sellers would be entities/ countries with large carbon sinks.

Emissions trading schemes may be established as climate policy instruments at the national level and the regional levels, where governments set emissions obligations to be reached by the participating entities. An example is the European Union Emissions Trading Scheme.

What is done to prevent parties from overselling units ?

To prevent parties from overselling units, and subsequently be unable to meet their own emissions targets, each party is required to maintain a reserve of ERUs, CERs, AAUs and/or RMUs in its national registry. This reserve, known as the "commitment period reserve", should not drop below 90 per cent of the Party's assigned amount, or 100 per cent of five times its most recently reviewed inventory, whichever is lowest . ☐



YOJANA

Forthcoming Issues

May 2010

**May 2010
&
June 2010**

The May 2010 issue of Yojana would focus on various aspects of the Tourism Industry in India.

June 2010

Yojana will focus on the state of Human Resource Development in our country in its June 2010 issue.

Climate Change and Indigenous Knowledge

Shashank Chaturvedi



***We need to look
for democratic
negotiation
between
indigenous
knowledge and
modern science to
carve a new path
of prosperity***

CLIMATE CHANGE has become a critical issue at the global level. Closely linked to this is the need to carefully manage our precious natural resources like water, land and forests. Climate change presents a unique risk to the livelihoods of people. As coastal and island areas confront rising sea levels, and inland areas become hotter and drier, people face the loss and degradation of the lands, waters and natural resources they have relied upon for generations. It also poses a major threat to the physical health of indigenous communities and their ability to sustain their traditional life, languages, cultures and knowledge.

The consensus of the world's climate scientists is that human induced greenhouse gas emissions are creating significant changes in the global climate system. Higher temperatures, rising sea levels and more extreme storms will

fundamentally change where and how we live. However, despite much scientific research, a considerable amount of uncertainty exists concerning the rate and the extent of climate change, and how this change will affect regional climatic processes and ecosystems. Can an expanded scope of knowledge and inquiry augment understandings of climate change and its remedy?

On Indigenous Knowledge

Traditional or local knowledge is strongly tied to local culture. This type of knowledge is also referred to as indigenous. All around the world, indigenous populations have lived in perfect harmony with nature. These populations have developed intimate knowledge on a wide array of topics ranging from environmental, biophysical, economic and social issues to spiritual knowledge in relation to their immediate surroundings. According to the World Intellectual

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Property Organization (WIPO, 2007), traditional knowledge Systems are 'knowledge that is generated, preserved and transmitted in a traditional and intergenerational context, which is distinctively associated with a community which preserves and transmits it between generations and is integral to the cultural identity of the community which is recognized as holding the knowledge'.

Role of Indigenous Knowledge in Climate Control

Environmental change associated with variations in climate has not gone unnoticed by the communities that are experiencing change first hand. Little research has been done to explore the contributions of traditional knowledge to climate change research. Traditional knowledge—the wisdom, knowledge and practices of indigenous people gained over time through experience and orally passed on from generation to generation—has over the years played a significant part in solving problems, including problems related to climate change and variability. Indigenous people who live close to natural resources often observe the changes around them and are the first to adapt to these. The appearance of certain birds, mating of certain animals and flowering of certain plants are all important signals of changes in time and seasons. These are well understood in the traditional knowledge systems. Indigenous people have used biodiversity as a buffer against variation, change and catastrophe; in the face of plague, if one crop fails, another will survive. In coping with risk

due to excessive or low rainfall, drought and crop failure, some traditional people grow many different crops and varieties with different susceptibility to drought and floods. They supplement these by hunting, fishing and gathering wild food plants. The diversity of crops and food resources is often matched by a similar diversity in location of fields as a safety measure to ensure that in the face of extreme weather some fields will survive to produce harvestable crops. Adaptation to climate change includes all adjustments in behavior or economic structure. It reduces the vulnerability of society to changes in the climate system. Whether people can adapt, and for how long, depends on the resources available.

Indigenous and traditional knowledge is being recognized for its critical role in managing climate change. More recently, mainstream attention to traditional agricultural knowledge sees increased respect for sustainable and ancient methods. Although much of the knowledge was transmitted through oral means and practical application, some documentation of the legal and administrative aspects of the knowledge is in fact held in the treatise of administration. For instance, in Kautilya's Arthashastra this issue has been dealt in detail. Social activist and environmentalist Rajendra Singh explains, "In Indian tradition, the knowledge was transmitted through practical work under the direction of respected elders and gurus. Thus the people engaged in practical work were really the pupils of the

indigenous knowledge system. The prosperous pupils provided help to the poorest who were working for water conservation, and the state provided only the land. It was a pupil-driven decentralized water management, which is another name for indigenous water management."

Traditional Coping Strategies

Many studies show that there is variety of coping strategies applied with mixed success, which suggests that local traditional knowledge could provide the basis for development of more effective strategies. The people in many communities in India have realized that water shortages are a major threat to their survival and have developed several strategies to adapt to this phenomenon. One is to reuse water, for example from washing clothes or utensils, to irrigate backyard gardens and nurseries. Households are also rationing water, trying to reduce the water use per person per day. However the practice is abandoned as soon as the rains begin. This strategy needs to be part of a behavioral change and not applied only during periods of water shortage. Most communities are actively reviving rainwater harvesting, a traditional way of collecting and storing rainwater in big barrels placed under the roofs of houses. This practice had largely been abandoned when the communities installed wells and boreholes, but has attracted interest again as a result of their drying up.

The traditional and local authorities at many places identify

the clearing of riparian vegetation as a major factor increasing soil erosion and siltation of rivers. It eventually reduces stream flow, and they are adopting measures to remedy the situation. The measures include creating awareness of the effects of deforestation around water bodies, sensitizing the communities about prevention of bush fires. Community-based management of forests is being promoted. Even fines are imposed on those who indiscriminately set fire to the forests, clear riparian vegetation or violate other measures to protect the environment.

However, these efforts by the traditional authorities are not yielding notable results because the communities, although still rural in terms of development and infrastructure, have become more cosmopolitan or heterogeneous. They no longer adhere as absolutely to traditional authority as they did in the past. The communal nature of the communities is breaking down; people now tend to be more apprehensive about their individual concerns than their collective well-being. As described above, indigenous knowledge in agriculture and water management, acquired

over many years of practice, previously helped the communities to cope well with water shortage, droughts and crop damage or losses, but traditional approaches have become difficult to apply in recent years because of changing rainfall patterns. Farmers are adapting to this constraint by planting different crops. Crops that thrive well under the current prevailing conditions are increasingly being planted in areas that previously did not support their cultivation. Vegetable growers are also gradually moving into the river plains where their crops can get more water. These are forms of adaptation but are obviously not sustainable.

The Way Forward

The partial success of the use of traditional knowledge in coping with climate change leads to the conclusion that a healthy relationship between scientific knowledge and traditional or indigenous knowledge is desirable. Especially in developing countries where technology for prediction and modeling is least developed. For example, while most precipitation models and records mainly focus on changing amounts of precipitation, indigenous people also emphasize

changes in the regularity, length, intensity and timing of precipitation. Whether or not scientific models are incorporated into local explanations depends on the status and accessibility of science within a culture. It also depends on the influence of communications media to capitalize on, develop, expand and mainstream indigenous adaptation measures into global adaptation strategies. Traditional knowledge should be further studied, supported and integrated into scientific research. Incorporating indigenous knowledge is less expensive than bringing in aid for populations unprepared for catastrophes and disasters, or than importing adaptive measures which are usually introduced in a top down manner and difficult to implement, particularly because of financial and institutional constraints. We need to look for democratic negotiation between indigenous knowledge and modern science to carve a new path of prosperity where everyone has enough food to eat and contributes in making of a just and sustainable society. □

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MERCURY RISE TO HIT HYDRO PROJECTS IN HIMALAYAS

Power generation from small hydro projects on streams fed by glacier melts would be adversely hit with just one degree rise in temperature. Just one degree rise in temperature could reduce seasonal availability of water in small streams by 8 to 28 percent, according to studies done by the Space Applications Centre in Ahmedabad for the basin of Wangar Gad, a tributary of Satluj. Scientists have developed a model that uses actual data relating to daily maximum and minimum temperatures, rainfall and snowfall to project changes in runoff by 2040. It showed that the overall reduction in stream runoff could go up to 28 percent between 2004 and 2040, with one degree temperature rise and no change in rainfall.

Lessons from an Eco - Restoration Project

*Dhaval Negandhi
Munish Sikka*



It is also imperative that proper and regular communication takes place between the actors so as to ensure that the model meets each actor's goal

DESPITE ITS economic growth, India is facing seriously sustainability challenges including inequitable income distribution, ecological degradation and depletion of natural resources. In this regard, rural development is the key to successfully overcoming these challenges. To achieve this objective of rural development, this study puts forward a model that aims at more efficient implementation and monitoring of rural development programmes and is currently being undertaken in Akot, Maharashtra in the form of a project initiated by Royal Bank of Scotland Foundation India (formerly ABN AMRO Foundation India).

Local Context

Vidharbha is one of the backward regions in India as per the statistics of census 2001. In the villages surrounding Akot block of

Akola district, the socio economic condition of the community is very poor. This study comprises of a cluster of 12 villages in Akot, Maharashtra having a total area of around 2800 hectares which is highly degraded. The degraded land experiences moderate rainfall of around 800 mm but has a very low irrigation potential. There is a large part of the land which falls under the category of government wasteland which is lying barren and unutilized. The agriculture is rain dependent and most of the farmers are able to grow only rain-fed crop, leaving the land barren and unutilized for the rest of the year. The agricultural yield is low and farmers are vulnerable in the hands of nature. There is no mechanism to conserve the rain water. Owing to the moderate slopes, there is water runoff every year causing erosion. The villagers maintain livestock for ploughing as well as for milk production,

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but due to scarcity of fodder for the livestock their yield is very less; the provision of the regular green fodder through plantation activity in the area can enhance the milk productivity in these villages. Further most of the local community members are dependent on employment as the land productivity is not sufficient to meet their needs; both the landless as well as the land owners are dependent on the employment opportunities for which many of them emigrate to big cities like Mumbai and Ahemdabad. All the 12 villages included in the project activity, are inhabited by 100% tribal population with Korku, Gowli and Bhill being the major tribal groups. A large number of community members are either landless or possess small land holdings and are dependent on

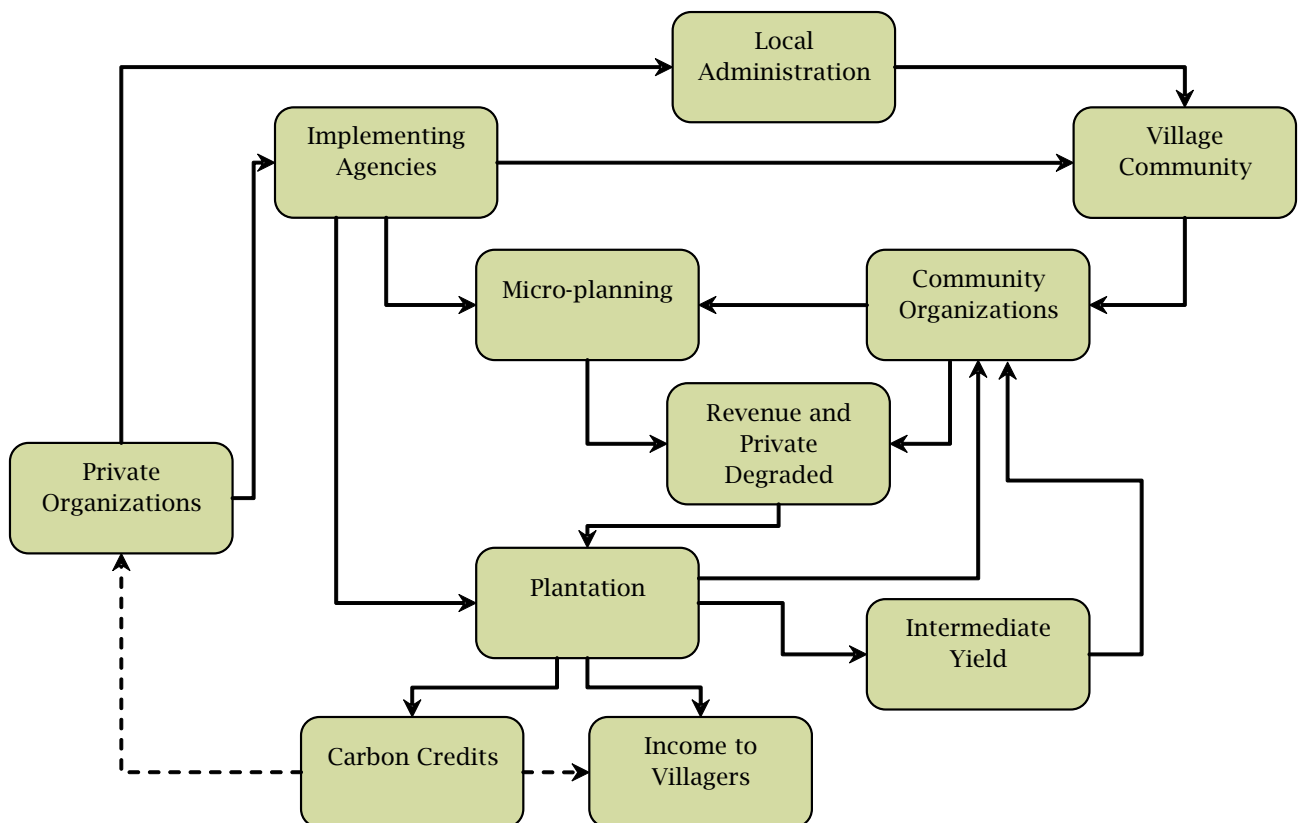
other employment opportunities to get two square meal a day.

Project at a Glance

In this context, an eco-restoration project was implemented in this cluster of villages with support from ABN AMRO Foundation India. As a part of its commitment to sustainable development, the ABN AMRO has undertaken restoration of the region by afforestation and other conservation measures, with community support and empowerment of the locals for managing their environmental resources. The restoration project has been taken up in the contiguous landscape of Melghat Tiger Reserve in Akot.

The project is to be implemented mainly on degraded land, the ownership of which spreads

across the revenue department, Panchayats and private individuals located in these 12 villages. It intends to bring the barren and degraded land under plantation bringing socio-economic benefit to the local community. The project entails field survey and collaborated planning with Govt. of Maharashtra, local communities and regional NGOs, and also includes watershed management in the area. The project is taken up by the bank as a strategy to reduce its carbon footprint and to maximise the benefits achieved for the local community. The local community has been involved in the project since its very nascent stage and at every step, from socio-economic survey to the selection of plant species and from creation of watershed structures to



the capacity building of the local people in order to effectively manage the plantations, which would be raised on both public as well as the private land. The local community will also get a share from the carbon credits generated from the project. Hence, very clearly the project not only meets the objective of creating carbon sinks but also includes the socio-economic improvement of the local community.

The project is being implemented in collaboration with the Akola district administration who is providing free lease on government land to the implementing groups. The Directorates of Social Forestry, Horticulture and Animal Husbandry will provide the technical support and the investment from National Horticulture Mission would facilitate restoration of the private lands. The implementing organization Satpuda Foundation would provide necessary community mobilization and coordination with the nodal departments.

Partnership Between Different Actors

The initiative represents a model which can be replicated across the country for meeting the dual objectives of poverty alleviation and ecological sustainability. This kind of partnership in which different actors come together, keeping in mind their own objectives, ultimately results in a 'win-win' situation for all. The study proposes to implement such a model at a wider level by customizing some of its aspect according to local context. This customizing can be done by consulting local community organizations and NGOs working

in the area.

IUCN's Forest Landscape Restoration (FLR) programme is one such initiative which aims to improve the livelihoods of people living in rural areas by working in partnership with the government. The programme has been successful in restoring large landscapes in Africa. However, the perennial problem of fund shortage has been experienced during implementation (IUCN.2005. A Study on the Social, Economic and Environmental Impacts of Forest Landscape Restoration in Shinyanga Region, Tanzania) The model proposed here deals with this problem by including private investors so as to ensure timely and adequate funding for the restoration works. The sustainability of any ecological restoration depends on the initial funding to implement the programme and the institutions entrusted with the management responsibility. The study aims to scale up the present initiative and put it forward as a model which can be replicated at a larger scale. The model establishes best practices guidelines for others to emulate. Private investors will fund the projects in order to reduce their carbon footprint and gaining goodwill among investors. While local and district administration can provide the administrative support for implementing such project, forest and allied departments can contribute by providing technical support. NGOs and implementing at local level can help in coordination the project implementation by mobilizing community and acting as a bridge among other actors. Lastly, the village community plays a critical role in project

implementation by contributing through indigenous knowledge of local context and voluntary labor.

Value of Such Partnership for Different Members

All the actors in this model are critical and play an important role that is difficult to replace. The model benefits all the actors and also increases their efficiency resulting in a 'win-win' situation. A brief description of roles of different actors in the partnership is given in Figure 4 along with the potential benefits for each actor from the partnership.

The Rural Community contributes through organizations such as SHGs and JFMCs that can act as vectors in project implementation and monitoring. The local participation along with voluntary labor (shramdan) is essential to ensure sustainability of the project over the long term. In addition, the indigenous knowledge of the community can be leveraged to develop customized regional strategies over a broad conceptual model suggested in this study. In return they can reap benefits in the form of employment opportunities during watershed and plantation activities, enhanced livestock productivity through increased water availability, the usufruct rights over plantations including fodder, fuelwood and other NTFPs. Besides, the communities also get additional income from sale of carbon credits which after accounting for transaction costs, can be transferred to community accounts. Lastly, the capacity building measures in terms of managerial and technical skills will lead to overall empowerment

of the community and participatory approach will strengthen its social cohesion.

Private Investors are essential for complementing the government funds and purchasing the carbon credits generated from the project. The professional management of the private investors also ensures

efficiency in the overall project implementation. In return they can achieve an overall reduction in their carbon footprint by purchasing carbon credits generated from the project activity. They can also justify such actions under the Corporate Environmental Responsibility banner, thus adding to the goodwill

of the organization in the eyes of its shareholders and clients.

The NGO is responsible for the implementation of the project and mobilizing local community members, capacity building, training and coordination between various players. The NGO in turn achieves its

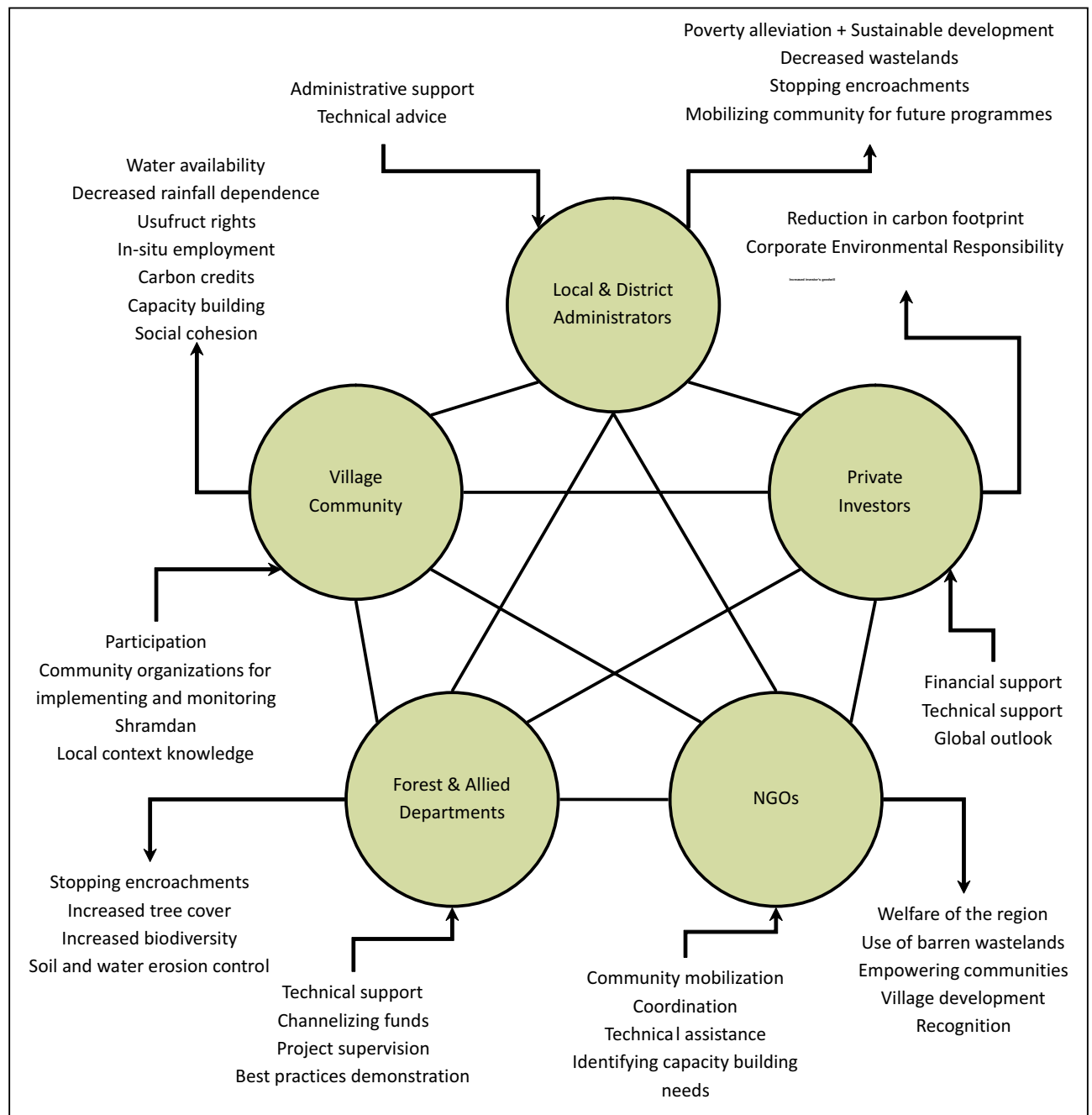


Figure 4 – Role of different actors in the proposed model and potential benefits for each

objectives of promoting ecological and economic welfare in the region besides promoting livelihood generation through efficient use of private and government wasteland. By mobilizing rural community members, the NGO can contribute in the promotion and strengthening of community organizations thus leading to empowerment of communities. All these activities can bring recognition to the NGO at local as well as national level thereby providing it the opportunity to expand its outreach and programmes to other parts of the country

Local and District Administrators can provide administrative support for carrying out project activities. The project achieves dual objectives of poverty alleviation and sustainable development of the region through ecological restoration and strengthening the natural resource base in the region. The watershed and plantation activities will lead to decreased wasteland and bring cultivable wasteland under horticulture or agro-forestry regime. The community institutions and land demarcation can also provide a check against human encroachments

of cultivable wastelands and define clear property rights over the land thus ensuring better governance. The strengthening of community organizations can also serve as stepping stone for future government development schemes in the region

Forest and Allied Departments: The forest department can provide technical support such as demonstration of best practices in plantation management including pest management, facilitate capacity building by establishing nurseries and assist in the supervision of the project. Reduced dependence of the local community on natural forests as the project activity provides sustainable firewood and fodder for the livestock. The community organizations will prevent human encroachments in forest areas. The project activity leads to an overall increased tree cover in the area, controlling soil and water erosion and increased biodiversity in the region.

Way Forward

The present study highlights a restoration project that seeks to involve multiple actors including rural communities, private

investors, NGOs and various government departments. The study puts forward the broad model with clearly defines roles and responsibilities of all the actors as well as the benefits they derive from the project. The model proposed here can provide a much needed base for implementing programmes and projects pertaining to rural development at a local level. Although initially it is necessary to keep the model simple, such partnerships would provide a platform where other actors such as farmers' cooperatives, FMCG companies, and philanthropic organizations can also be involved as the system develops further. It is however important that each of the actor involved have clear understanding of their role in the partnership. It is also imperative that proper and regular communication takes place between the actors so as to ensure that the model meets each actor's goal of participating along with meeting the dual objectives of poverty alleviation and ecological sustainability. □

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RS 15K-CR GRANT TO STATES FOR RENEWABLE ENERGY SOURCES

The Thirteenth Finance Commission has recommended three grants of Rs. 5,000 crore each to states to encourage them to adopt renewable energy sources, conserve forests and improve their water management systems.

This incentive is much higher than the Rs 1000 crore grant by Twelfth Finance Commission for preserving forests. The grant will be based on the state's performance, measured by capacity addition in the renewable energy between 1 April 2010 and 31 March 2014. While the quantum of funds for the first two years have already been released, the grants for the remaining period will be contingent upon the progress made by states.

A similar performance-linked approach has been advised for the grants to preserve forests and improve water management.



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Coping with Climate Change

Krishna Murari



***It is imperative
that we
strengthen
the capacity
to cope with
changes in the
climate, including
increase in
climatic variability***

CLIMATE CHANGE is a reality, and an important part of global warming is due to human activity. A two-fronted effort is needed to counteract the impacts of anthropogenic climate change. On the one hand national and international agreements are needed to reduce greenhouse gas emissions, and on the other hand initiatives are needed to help society adapt to the future climate.

Climate Change Projections

In its fourth assessment report, the IPCC concluded that since the middle of the 20th century there is a more than 90% probability that global warming is due to man-made greenhouse gases. We are facing a warmer future. Without political intervention, the average global temperature is expected to rise by between 1.1 and 2.9°C in the IPCC's lowest emissions scenario and between 2.4 and 6.4°C for the highest scenario between 2090

and 2100 compared to 1980–1999. Changes in the extent sea ice and glaciers are expected to continue and possibly increase in speed. Increased melting and warming of the oceans will contribute to higher sea levels. The occurrence of weather and climate extremes is expected to increase sharply, which will mean more intense precipitation events and longer periods of drought. If greenhouse gas emissions are not reduced significantly, the consequences of warming are expected to be significant.

Accelerating Emissions in India

Taken in absolute terms we are today, the fourth largest emitter of greenhouse gases worldwide, although our per-capita emissions are among the lowest in the world. The most recent IPCC report suggests that India will experience the greatest increase in energy and greenhouse gas emissions in the world if it sustains a high

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annual economic growth rate. The International energy Agency predicts that India will become the third largest emitter of greenhouse gases by as early as 2015. India imports large quantities of fossil fuels to meet its energy needs, and the burning of fossil fuels alone accounts for 83% of India's carbon dioxide emissions. Nearly 70% of our electricity supply comes from coal.

Possible Impact on India

In developing countries like India, climate change could represent an additional stress on ecological and socioeconomic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development.

- The various studies conducted in the country have shown that the surface air temperatures in India are going up at the rate of 0.4 degrees C per hundred years, particularly during the post-monsoon and winter season. Extreme temperatures and heat spells have already become common over Northern India, often causing loss of human life.
- Climate change has had an effect on the monsoons too. India is heavily dependent on the monsoon to meet its agricultural and water needs, and also for protecting and propagating its rich biodiversity. Subtle changes have already been noted in the monsoon rain patterns by scientists .
- Relatively small climatic changes can cause large water resource problems, particularly

in arid and semi-arid regions such as northwest India. This will have an impact on agriculture, drinking water and on generation of hydro-electric power.

- Apart from monsoon rains, any intensification of the monsoon is likely to contribute to flood disasters in the Himalayan catchments. Rising temperatures will also contribute to the raising of snowline, reducing the capacity of this natural reservoir, and increasing the risk of flash floods during the wet season.
- Increased temperatures will impact agricultural production. Higher temperatures reduce the total duration of a crop cycle by inducing early flowering, thus shortening the 'grain fill' period. The shorter the crop cycle, the lower the yield per unit area.
- India has a coastline of 7,516 km. A trend of sea level rise of 1 cm per decade has been recorded along the Indian coast. Sea level rise due to thermal expansion of sea water in the Indian Ocean is expected to be about 25-40 cm by 2050. This could inundate low lying areas, drown coastal marshes and wetlands, erode beaches, exacerbate flooding and increase the salinity of rivers, bays and aquifers.
- Deltas will be threatened by flooding, erosion and salt intrusion. Loss of coastal mangroves will have an impact on fisheries.
- Increase in temperatures will result in shifts of lower altitude tropical and subtropical forests

to higher altitude temperate forest regions, resulting in the extinction of some temperate vegetation types. Decrease in rainfall and the resultant soil moisture stress could result in drier teak dominated forests replacing sal trees in central India. Increased dry spells could also place dry and moist deciduous forests at increased risk from forest fires.

- Rise in temperature and change in humidity will adversely affect human health in India.

Coping with the Change

The most important step towards fighting the challenge of climate change is to understand its causes, processes, and impacts. Climate change is a phenomenon that occurs on a global scale over a time frame of centuries. Predicting this phenomenon is made highly difficult by the non-linearity, uncertainty, and inertia in the earth's climate system. Therefore it is imperative that we strengthen the capacity to cope with changes in the climate, including increases in climatic variability. In this regard, it is important that we develop adaptation mechanisms in various sectors. Adapting to climate change could be a very effective way of coping with it. Autonomous efforts in this regard need to be encouraged, whereby authorities, businesses and private citizens react to the consequences of climate change on their own initiative in a timely manner within the given legislative, economic and technological framework. In cases where autonomous adaptation is not optimal, there may be a need to initiate politically planned adaptation measures. The following

areas are relevant to consider adaptation to changing climate.

Coastal Zone: Adaptation to climate change in connection with coasts and harbours is expected to be necessary as a result of rising sea levels and more storms, if the present safety levels and operational conditions are to be maintained. New construction, dismantling or renovation of dikes or port installations may be necessary and will require knowledge of the extent of climate change and risk analyses based on the probability of extreme water levels in the lifetime of a particular construction. In addition there is a need for ongoing adaptation of rescue and storm surge preparedness as well as information on conditions significant to planning coastal constructions in future risk areas.

Buildings and construction: It is estimated that in the short term there is no need to change legislation concerning building safety under extreme weather conditions. There will be a need for greater attention to indoor climate, especially temperature and humidity conditions. There may be a need to authorise new construction technology solutions as a means of supporting the reduction of extreme indoor temperatures during heat waves. A compulsory labeling regulation for small individual cooling units that are spontaneously installed may be necessary. Finally there may be a need for an information campaign aimed partially at construction technicians concerning recommended future design parameters and partly at building owners concerning typical weaknesses in load-bearing constructions, including how to improve conditions.

Transport: Road regulations and rail standards must be harmonised with the expected climate changes, just as extension and renovation of roads and railways must be adapted to expected climate changes. Road drainage systems must be considered in light of the risk of increased precipitation intensity. The transport sector has already taken initiatives for new road regulations taking into account the expected climate changes. Rising temperatures will increase the need for insulation of safety installations and signal boxes along railway tracks. A risk analysis must be undertaken with respect to possible wind damage to roads and railways. A risk analysis is needed of sewer systems including standards and regulations for road and railway drainage systems.

Water supply in arid areas: Adaptation to climate change with respect to drinking water might include reorganisation of water extraction, taking into account the future groundwater resources and water flow/quality of watercourses and wetlands.

Making India energy efficient: Changes in energy supply are expected, including greater production of renewable energy and altered consumption patterns with less heating in winter and more cooling in summer. A targeted focus on promotion and use of biomass energy for rural development, emphasizing power generation from biomass and renewable energy sources are the best alternatives of increasing needs of Indians. Climate change with higher average temperatures and higher wind speeds will affect energy consumption. A winter temperature rise of 2–3°C

is expected to reduce heating requirements significantly. A rise in summer temperatures, on the other hand, could lead to increased cooling needs. Increased wind speed can on the one hand lead to greater electricity production from wind turbines, but on the other hand, in storm situations wind turbines must be shut down to avoid storm damage.

Agriculture: Agriculture is of vital importance to the Indian economy as it contributes about a quarter of the GDP and provides livelihood to two-thirds of the population. The challenge for Indian agriculture is to adapt to potential changes in temperature and precipitation and to extreme events without compromising productivity and food security. Furthermore, changed precipitation patterns are expected. Increased insect pressure is expected to lead to the use of more and different pesticides. The consequences of these changes may result in a need to adapt existing regulations with respect to environmental-policy goals. The government should emphasise on climate change adaptation issues in development strategies and programmes.

Biodiversity management: India is one of the 12 mega biodiversity countries of the world. From about 70% of the total geographical area surveyed so far, about 46 000 plant species and 81 000 animal species have been described. India has 13 biosphere reserves for conservation of biological resources representing various ecosystems of the country. Conservation of wildlife and its habitat must be accorded highest priority for the long-term ecological and environmental security of the

country. A number of activities are needed to be explored to ensure a healthy and robust nature, for example reducing the use of ozone depleting substances (CFC) used in the production of foam and the manufacture of refrigerators and fire extinguishers. Plantation right now to ensure the future oxygen supply can be the best gift, we can offer to our generation.

Barren Land use planning: The state of Rajasthan, Jammu & Kashmir and some hilly areas

has unproductive land which can be utilized by implementing proper framework. We have live examples from different states (see Box). Further non-proliferation of barren land and converting it in to productive purposes, is the area which can be a panacea for the rural India at the time of adverse changing climate. Relevant risk analyses will be included as an important decision-support tool in the form of a risk map. The Central Government spends billions of rupees annually for agricultural growth but villagers

in the small areas are not able to avail of these facilities.

Health: Adaptation of programmes for public health emergency management, prevention and treatment, infectious disease monitoring, etc. may be relevant in connection with more heat waves and other health risks associated with climate change (infections, allergies, etc.). There may also be a need for increased information efforts targeting risk groups. Attention to health is otherwise integrated into many of the other sectors' efforts.

Rescue preparedness: India has always been vulnerable to natural disasters like floods, droughts, cyclones, earthquakes and landslides. Its geo-climatic conditions render about sixty per cent of the landmass prone to earthquakes of various intensities, over forty million hectares susceptible to floods, about eight per cent of the total area vulnerable to cyclones and sixty-eight per cent susceptible to drought. So, natural disasters are a bitter reality for us. More frequent and dangerous storms, flooding, powerful rainstorms, drought, etc. create a need for more resource-demanding efforts and assistance from rescue preparedness. Rescue preparedness can be deployed in actions to prevent, limit and aid injuries and damage to people, property and the environment. Rescue preparedness can also assist in peak load situations,

SUCCESS STORY

Jharkhand village turns barren land into lush field through cooperative farming

Farmers in Brinda village in Jharkhand's Gumla district have converted 60 acres barren area into lush agricultural land through cooperative farming.

"Previously, we used to go out of Jharkhand to earn our daily bread. But now a lot of things have changed for us ever since we converted this barren land into a cultivable one. Now, there is no need for us to go out of our village, as we can sustain ourselves by cultivating crops here," said Indu Oeron, a farmer of the village.

Sachiv Sarva India, a non-governmental organisation (NGO) working for the uplift of rural folk in Jharkhand is behind this transformation.

Sachiv Sarva India volunteers claim that they have emancipated hundreds of poor farmers in Gumla District.

"Previously, this land used to be fallow. It used to be barren, but now farmers have started collective farming in this area, and have turned this into cultivable land," said Shanicharwa Oeron, Range Forest Officer, Gumla (Rural).

Farmers in Gumla district earlier were dependent on rains, but now the Forest Department has provided greenhouse sheds and hybrid seeds, besides the latest cultivation techniques to improve their lot, having gained much in the long run.

"We have introduced the greenhouse farming system to protect seeds of these farmers. We have helped them in becoming self dependent and now they can earn their livelihood on their own terms," said Sujit Kumar Nanda, a member of Sachiv Sarva India.

One must compliment these farmers of Brinda village for not being carried away by ideologies of confrontation, and instead, opting to take up co-operative farming and reap its benefit.

where other stakeholders with emergency responsibilities are not completely capable of dealing with the consequences. It could, for example, be a matter of draining surface water and other assistance with storm and water damage, extinguishing wildfires, rescue operations of various types and accommodating and caring for distressed and evacuated people. For this, continuous consideration and decisions are required with regard to procurement, development, maintenance, composition and strategic location of equipment.

Insurance aspects: Climate change will entail ongoing adaptation from the insurance companies in the form of higher premiums and/or coverage exemptions, and it could be a question of developing new financial instruments for risk transfer between the non-life insurance companies and the rest of

the financial sector and setting rates based on expected developments in claims. Responsibility for ensuring the necessary sector-specific adaptation to climate change will lie in the sector ministries. Adaptation to climate change will often be cross-sectoral, for example in agriculture/environment/nature and health/construction/environment there will be a need for coordination between the ministries and regulations and developments in the India and other international floors. This will be ensured by the cross-sectional Coordination Forum for Climate Change Adaptation and the national information centre recommended to be established for this purpose.

Conclusion

The impact of human activities on the earth's climate has been receiving increasing attention with

the recognition of the problem of global warming. Even if all GHG emissions were to cease immediately, the earth would still experience a certain degree of climate change, due to the long lifetime of GHGs in the atmosphere and the inertia of the climate system. Consequently, it is imperative that we strengthen the capacity to cope with changes in the climate, including increases in climatic variability. Visionary efforts are needed in India, which help in enhancing the adaptive capacity, while addressing concerns of food security, water scarcity, biodiversity loss, and environmental degradation, health & insurance must be looked into for predicting a safe future. □

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Abdul Razzak



This innovation distinguishes itself by achieving simultaneous cooking of rice and cereals, at the same time facilitating the draining of residual water

ABDUL RAZZAK is an electrician by profession. Over the last two decades he has developed a number of innovations including a multipurpose twin chambered cooking vessel, a burglar alarm system, a phone with built-in charger, a dual faced fan, a letterbox with an audio alarm amongst many others.

He stays with his family in Bibikulam in the temple city of Madurai. His father was a cook with limited means. Razzak could only study till matriculation. Though average in studies, he was bestowed with a good observation and used to notice gadgets minutely to understand their functioning. After leaving school he joined a small workshop where he gradually picked up the skills of repairing electrical gadgets, progressively moving into coil winding and fabrication of household items.

Multipurpose twin chambered cooking vessel

Razzak noticed the hardship faced by his wife in handling the

hot rice cooking pot. He realized that this was a universal problem faced by housewives as well as caterers who cooked rice in open vessels. As these hot vessels/pots could not be comfortably held, tilted or carried, they faced difficulty in completely draining off the residual water from them, often causing injury to themselves. Across the length and breadth of the country this water has its own use; some discard it as waste, some use it to starch their clothes, while others from low income groups, consume this drained water for its nutritive value. He also noticed that most of the rural folk had only a single cooking stove. This meant that if one wanted to prepare rice and sambar or lentils it had to be done sequentially taking a lot of time. He then decided to make an improved cooking unit that would facilitate quick and effective cooking of various items simultaneously. It would also provide a facility of filtering the residual water safely while keeping it separate for consumption.



CYLINDRICAL COOKING VESSEL

The multipurpose twin chambered vessel is a stainless steel cylindrical cooking vessel with two compartments and a lid fitted with two pressure valves. It is also provided with a perforated aluminium plate to be used in one compartment. The two compartments are used to cook rice and sambar simultaneously. In the compartment where rice is boiled, the perforated aluminium plate is kept. On the same side of the vessel, a drain valve or tap is provided for the user to drain out the residual water after cooking. While cooking, when the steam pressure increases inside the vessel, the two pressure valves on the lid open up to release the extra steam. These valves can also be opened to view the status of the cooked rice or to take out the rice grains to check their softness. The vessel is provided with handles on the top as well as on the sides, allowing easy

handling. The whole unit weighs one kilogram.

This unit facilitates simultaneous cooking of rice and sambar thereby reducing the total cooking time to almost half. This unit can easily be scaled up and built as a large unit suitable for catering operations. There are other references of such vessels available in the patent literatures. However, Abdul Razzak's innovation distinguishes itself by achieving simultaneous cooking of rice and cereals, at the same time facilitating the draining of residual water. He has filed a patent for this device in 2006. His innovation has been covered by national dailies like The Hindu and various local newspapers. Abdul Razzak has made and sold over 100 units in and around Madurai. The user feedback has been very good and marketing is mostly through word of mouth. The five liter vessel based system is sold at a cost of Rs 550 and

has good dispersion potential among low-income households and caterers.

Revolving ceiling fan

Razzak has mounted a ceiling fan on a circular ceiling rail so that it can be manually moved to obtain proper air flow in different parts of the room. He plans to make it remote controlled. Abdul Rasheed Qureshi from Delhi also has a similar idea.

Dual face table fan

In the existing table fan, Razzak has extended the shaft to the other side and fitted another set of fan blades. This dual table top configuration can be placed centrally. When switched on, it can fan air all around using nearly the same energy.

Burglar alarm system

This system can be installed on a door. When a burglar breaks in, the system would alert the police or the owner by dialing the set of fixed numbers. In case the system cannot connect to a particular number, it will automatically dial the next number.

Letter box alarm

This is a letterbox with an alarm to alert the presence of letter in the box. The post box consists of an electronic circuit, a letter receiving plate, which senses the letter inside and triggers the circuit to produce an alarm. It is also provided with locking system and twin LED. □

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INDIGENOUS IRRIGATION COMES HANDY IN DRY SEASON

Traditional knowledge and community participation have combined to ensure that 300-odd villages in the Bhutan foothills in Baksa and Nalbari districts survive harsh water-scarce winters.

The age-old indigenous irrigation system called *dong* enables the villagers to meet their water needs throughout the year but its utility is felt more during the prolonged dry winters when water becomes scarce even for drinking purposes. The dong system has been in operation since human settlements started in the once thickly forested area since the 1930s. Under the dong, small dams are built on a river and the water is routed through canals to paddy fields and into the household ponds. *Dongs* operate on sound principles of water management, ensuring that there is no waste and water is distributed judiciously and equitably.

All the people of a village contribute through manual labour to construct small stone-dams on the river, and then regulate the flow of the water and supply it to the destinations through long canals.

A vast landscape on the Bhutan foothills is crisscrossed by a number of rivers and streams originating from the hills. Most of these turn into frothing torrents during the monsoons and flow in trickles in the winter.

This traditional water harvesting has also led to greater bonhomie and camaraderie among the different communities. □

(Courtesy: Assam Tribune)

TOURISM IN TRIPURA ALL SET FOR A BOOST

The state of Tripura is going to have a promising future in the field of tourism with its existing resources, the central government is all set to allocate substantial amount of money for the overall development of tourism in the state.

Tripura has a splendid record of tourist attraction from the days of royal reign and the state government has taken up various steps to promote the tourist industry in the state.

As of now the state is having 23 tourist spots and the department of Tourism in the state is planning to open four other tourist spots in the days to come.

The Tourism Ministry has approved the project Destination Development of Khowai in West Tripura district. Again, the central government has sanctioned Rs. 102.80 cr to make Devatamura, Amarpur in South Tripura district far more attractive to the tourist.

The Tourism Ministry has sanctioned Rs. 141.85 cr for the up gradation of the tourist spot of Unakoti. This project however, includes tourist information centre, cafeteria, watch tower, amphitheatre centre etc.

The initiatives under taken by the department of tourism would hopefully attract a large tourist population and give a boost to the state's economy. □

(Courtesy : Shillong Times)