CADME-Save the Children

IMPACT OF CLIMATE CHANGE AND COMMUNITY RESILIENCE TO DISASTERS IN NINE COASTAL DISTRICTS OF ANDHRA PRADESH

Rapid assessment on impact of climate change and community resilience to disasters in 9 coastal districts of Andhra Pradesh

Analysis of district study data and preparation of report by
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Final Report (12 April 2013)

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SRIKAKUALM DISTRICT
1. SWEEP
2. YARD
3. BREDS
4. REALS

VIJAYANAGARAM DISTRICT
1. NEED
2. ASRA
3. SABALA
4. SRUJANA

VISAKHAPATNAM
1. SVDS
2. MAHILA ACTION
3. VIKASA
4. NYS

EAST GODAVARI
1. CREATORS CHARITABLE ORGANISATION
2. PALLESIRI
3. SASS
4. ARISE

WEST GODAVARI
1. NCYS
2. SPARK
3. AWARD
4. SHERDS

KRISHNA
1. CRASA
2. PPSS
3. SNEHA

GUNTUR
1. SEEDS
2. SERVICE
3. MITRA

PRAKASAM
1. SNIRD
2. SUPPORT
3. RAKSHANA
4. SARDS

NELLORE
1. CJWS
2. RDO
3. APPLE
4. NAVAJEEVANA

The author of this summary report would like to thank the International Collective in Support of Fishworkers (ICSF), whose 2011 study entitled '*Climate Change and Fisheries: Perspectives from Small-scale Fishing Communities in India on Measures to Protect Life and Livelihood*' provided the basic framework of analysis for this study.

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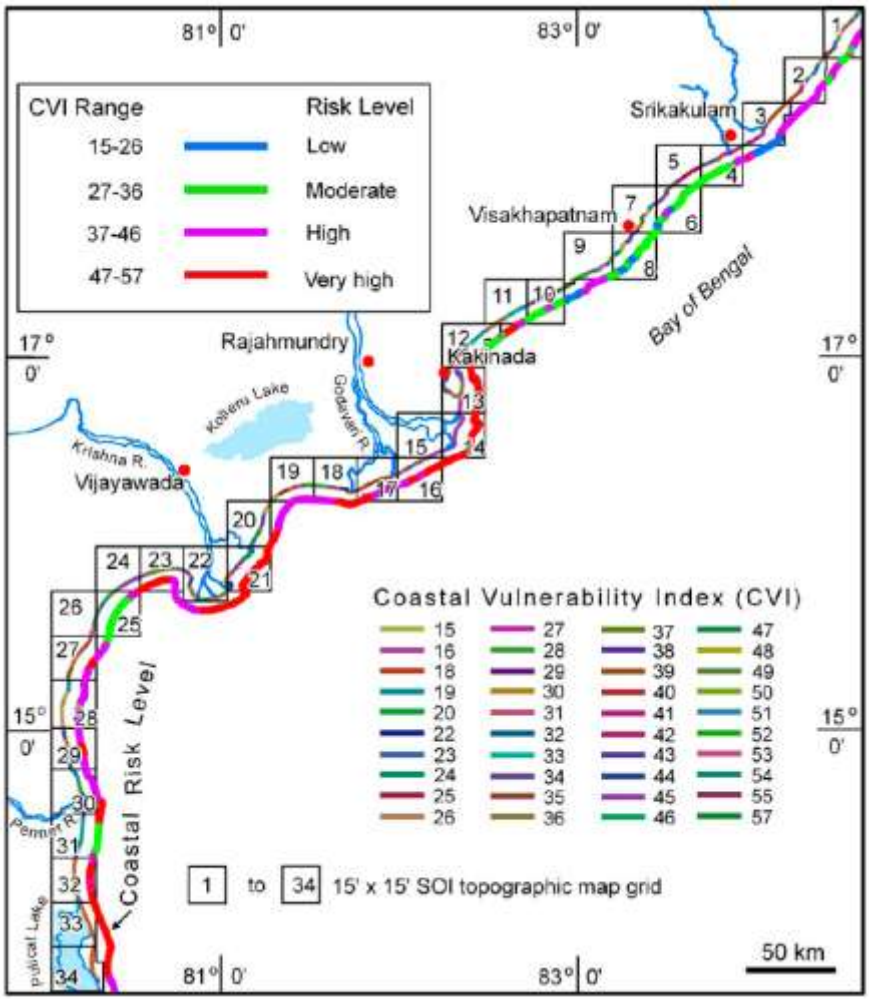
Map of Coastal Andhra Pradesh, covered by the study, highlighting the Coastal Vulnerability Index for different areas



Coastal Vulnerability Index integrates the differentially weighted rank values of the five variables: coastal geomorphology, coastal slope, shoreline change, mean spring tide range, and significant wave height, based on which the coastline is segmented into low-, moderate-, high-, and very high risk categories. The CVI for Andhra Pradesh shows that about 43% of its 1,030-km-long coast is under very high-risk, followed by another 35% under high-risk if the sea level rises by ~0.6 m, displacing more than 1.29 million people living within 2.0 m elevation in 282 villages in the region

From Ahana Lakshmi 2011, citing Nageswara Rao et al, 2008

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1. Introduction

Over the last two decades, climate change (CC) has come to be recognised as an important process posing significant threat to the global environment and the populations living in it. The impacts of global warming and its attendant changes in weather and seasonal patterns and the incidence of disasters are increasingly felt at all levels of society, but its most intense effects appear to be focused on the people and communities dependent upon primary sector occupations, i.e., agriculture, forestry, fisheries with predictions suggesting a further intensification of these effects in the medium to long-term.

WHAT IS CLIMATE CHANGE?[1]

Climate is generally defined as the weather patterns over a long period of time. The earth's climate regime is an outcome of the incoming solar radiation and its interaction between the hydrosphere, lithosphere, biosphere and atmosphere. The atmosphere has a mix of various gases which play an important role in the earth's climate regions. Gases such as carbon dioxide, nitrous oxide and methane, despite their low concentrations in the atmosphere, play an important role by trapping some of the heat reflected by the earth that would otherwise escape into space. Hence these gases are also known as the Greenhouse Gases (GHG) and this phenomenon known as the natural greenhouse effect enables maintenance of the earth's average temperature about 33°C warmer than it otherwise would be.

Of the three factors that directly influence the energy balance of the earth, viz., the total energy influx on the earth (which depends on the earth's distance from the sun and on solar activity), the albedo (capacity of the earth to reflect light) and the chemical composition of the earth's surface, only the last has changed significantly (with the increase in) Carbon Dioxide being of greatest concern in the role it plays in increasing radiative forcing which translates to increased temperatures on earth.

According to the IPCC's Fourth Assessment Report[2], since 1750, it is extremely likely that humans have exerted a substantial warming influence on climate and this estimated radiative forcing is likely to be at least five times greater than that due to solar irradiance changes. The report also states that the global average surface temperature has increased, especially since about 1950 with a 100-year trend of 0.74°C ± 0.18°C. The rate of warming averaged over the last 50 years (0.13°C ± 0.03°C per decade) is nearly twice that for the last 100 years. The impacts have been seen in cases such as the increased melting of snow in the northern hemisphere, with a consequent increase in floods in the lower plains.

The atmosphere does not function in isolation. Flows of energy take place between the different spheres. It has been found by the IPCC that surface temperatures over land have warmed at a rate faster than over the oceans in both hemispheres. It has been observed that over the period 1961 to 2003, global ocean temperature has risen by 0.10°C from the surface to a depth of 700 m. Heat and freshwater are transported by ocean currents. The biochemical status of the ocean plays an important role for life in the ocean waters. Warming seas also result in a rise in sea level which can have an impact on the coastal zone.

[1] From Ahana Lakshmi, 2011
[2] IPCC, 2007

Thus, while some of the CC processes are quite possibly natural phenomena and, in a few cases, manifestations of long – as yet uncharted – cyclical processes, it is also widely agreed that the contribution of the human actions – mostly in the form of green house gas (GHG) emissions – is also very significant and increasing. The United Nations Framework Convention on Climate Change (UNFCCC) recognises the human contribution to climate change and defines climate change as: as "*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*"[3].

Although the impacts of global warming and its attendant phenomena tend to be generally widespread and cover every area, their most immediate and direct impact is recognised to fall on the coastal areas and the coastal populations, especially the fishing communities. Sea-level rise, considered to be an important outcome of global warming, upsets the coastal ecosystems and resources on which the people depend for their livelihoods seriously, increases the potential for submergence of coastal habitations and leads to higher and more intensive incidence of natural disasters. The changes in the availability of, and access to, different natural resources on which the coastal communities (especially the poor) depend suggests that the impacts of CC on the life and livelihoods of the coastal poor are disproportionately higher compared to any other group of people. The key characteristics of coastal poverty – poor resource base and weak human capital on the one hand and the weak institutional support systems on the other – mean that the people's capacity to cope with the CC phenomena remains weak, and getting weaker.

2. Objective of the study

The study owes its origins to a number of concerns.

First of all, there is the overall lack of understanding – or even interest – among the different categories of people (including the affected communities themselves) about climate change and its real/potential impacts. Given the global scale and interest of the problem and its potential long-term consequences, it was imperative to begin the process of consolidating the local experiences of climate change and variability into a meaningful narrative.

Second, climate change and its attendant issues have largely remained the preserve of the scientific community, with very little insights on its socio-economic implications and with few inputs from the communities themselves. Given that: (i) the local communities are already feeling the effects of climate change in a direct (if not always explicit) manner; (ii) their historical understanding of the changes in the local weather and seasonality patterns are probably the only existing database to assess climate change; and (iii) their full involvement in any process to address climate change is a necessary pre-requisite for meaningful outcomes, the study was focused on highlighting the community perspective of climate change.

In other words, the study is a qualitative account of how the target communities have related themselves and their livelihoods to the climate change rather than an objective or scientific

[3] UNFCCC. Article 1: Definitions(emphasis added).

assessment of the climate change itself. This in itself is an important contribution to the climate change discourse in that it highlights the Human Angle that is frequently missing in the ongoing debates.

It is also necessary that the analysis of the Human Angle also include an assessment of the capacity of the communities to cope with climate change effectively. This becomes important because the current (largely scientifically-driven) discourses tend to focus on 'what *needs* to be done?', which ignores the more critical 'what *can* be done?' that forces one to take account of the capacity of the people to adapt to change. The idea behind the study is to assess the availability (or non-availability) of the necessary resources among the people to address the issue of climate change. This requires the intervening agencies to avoid losing sight of the equity implications of the suggested climate change responses, which tend to be focused narrowly on an ecological/natural resource sustainability perspective. On the other hand, it helps all future actions in this sphere to be based on people's strengths – which include, *inter alia*, the existence of a rich and diverse range of indigenous knowledge sources.

Finally, the predominantly science-focused nature of the enquiries into climate change also mean that the policy implications of dealing with it – in terms of better informed policy actions, implementing strategies, change of practices and so forth – remain less emphasised, with the result that current levels of action (in government as well as the NGOs) lag behind the presumed need for more vigorous and pro-active responses.

Considering the magnitude of the issue as well as of the number of critical gaps in the current understanding about climate change (which included both qualitative and quantitative aspects), the study is an attempt to kick-start some efforts towards understanding climate change and identifying measures to address it. As a beginning, this study proposed to undertake a rapid assessment of the impact of climate change and the extent of community resilience to disasters in the 9 coastal districts of Andhra Pradesh.

The specific objectives of the study were:

- To prepare a report on climate change and community resilience to disasters for each coastal district, which would be summarised into a state report;
- To facilitate a uniform understanding of issues about climate change and community resilience to disasters among the different stakeholders working on the CC-related issues.

The expected outcomes from the study were:

- To identify specific areas of concern for potential intervention and to explore possibilities for funding based on the recommendations from the study;
- To develop opportunities for a greater understanding of the climate change issues among the different institutional stakeholders (in the government and NGO sectors) in order to ensure the incorporation of climate change agendas into their ongoing and new support programmes.

3. Target groups for the study

The coastal districts in Andhra Pradesh are interesting from the perspective of this study because of the existence of a wide range of ecosystems (from coastal plains to upland forests, including a wide range of farming terrains), biodiversity and livelihood groups (from deep-sea fishers to forest dwellers), who frequently coexist within the same district. This helps to assess the impacts of a macro-level process like climate change on a number of different stakeholder groups and the varying environmental contexts in which they live.

With its focus on the coastal areas, the study worked with selected stakeholder groups considered most vulnerable to CC-induced impacts in the nine coastal districts of Andhra Pradesh. The broad categories of stakeholders covered by the study in different districts included:

- Forest dependent people
- *Yanadi* communities (nomadic tribal groups)
- Farming groups – with separate focus on wetland and dry land farmers, although no differentiation could be made between land owners and wage labourers
- Fishing groups: mostly fishing boat owners and crew
- People rearing livestock (cattle, goat and chicken)
- Mining/quarrying workers and
- industrial workers

The selection of communities to interview for the study varied from district to district based on the importance of particular livelihood activities in a district. The study placed emphasis on including the perspectives of marginalised sections within each stakeholder group, which included women, children and aged people. Alongside the target groups, the study also interacted with: the elderly people which provided an opportunity to understand the historical trends in climate change; the educated sections (teachers, government employees); and the people wielding important positions in the communities on account of their social, economic, political, and employment status. This included the representatives of Panchayati Raj Institutions (PRIs) who are an important stakeholder group in the study as a potential means to undertaking future climate-related actions.

4. Methodology of the study

The study followed a tiered approach that started with planning at the state/district level, went down to the community- and individual stakeholder-level, returned again to the district level for consolidation of the findings, which were validated and further consolidated at the state level through a series of consultative workshops.

In the first stage, Save the Children (SCF) and ACTION (the lead NGO organisation for the study) undertook district-level workshops in the nine coastal districts in collaboration with local NGOs who were partnering with ACTION in its CADME network. The purpose of these workshops was to identify suitable NGO partners to implement the study in each district. Through this process, about two to four partner NGOs were selected from each district to undertake the field studies.

The selected NGOs in each district were then provided orientation on the purpose, scope and expected outcomes of the study as well as the methodology to be adopted for the field data gathering. Based on the orientation, the NGO study partners in each district undertook the process of selecting specific stakeholder groups and villages to implement the study.

The field level rapid assessment on climate change and the community resilience aspects was undertaken over a period of one month in each district and included: questionnaire surveys among the target stakeholder groups; secondary data collection at the village- and district-levels; and interactions with key non-target stakeholders in each community, which included the member of the Panchayati Raj Institutions (PRIs).

The results of the rapid assessment conducted in different communities by different NGOs were collated into a district level report and the nine district reports were distributed among all stakeholder partners prior to a consultative workshop in Rajahmundry in January 2013, moderated by a consultant. The study reports were presented and discussed at the consultation and the consultant provided a framework to collate each district findings into a more structured and CC-focused format. This helped to focus attention on climate change and to ensure uniformity across different district studies. The revised district reports were presented at a state-level workshop in Vijayawada and finalised for consolidation into this state report.

The preparation of the state report with findings from the district studies allowed the NGO partners to focus on the next steps of action, which included the development of a proposal for funding in order to keep up the momentum that this study has generated. A proposal, highlighting some key areas that need to be addressed in the immediate future, has been developed as a participatory initiative involving the key CADME partners, SCF and ACTION.

5. A few constraints

As a starting point for a new area of work specifically in coastal Andhra Pradesh and generally among the poorer communities of India, the study needed to be pragmatic in its approach, which meant that it had to make allowance for considerable gaps in the data collection at this stage. A further constraint for the district studies has been the absence of a good literature review, which would have helped to inform the focus and outcomes of the field work based on global experiences. Furthermore, it would have helped to fit the study better into the larger global climate change discourses.

Secondly, the rapid assessment methodology – which was questionnaire-based – was a necessity in the face of the short duration of the study and the relative inexperience of some of the study partners and also to ensure some uniformity across different communities and districts. However, this proved to be a constraint in ensuring the interactions to be as free ranging as necessary. This resulted in the study teams not being able to get as much analytical data as is necessary and several insights that could be gathered from the respondents may have been missed out. It may also have resulted in missing out diverse impacts that can be understood as being CC-induced only with longer and more detailed interactions and observations.

Finally the relative inexperience of the partner NGOs to undertake a study of this nature was a critical constraint. This was due to the subject matter being new to the NGO partners as well as the constraints imposed by the need to do the study while continuing with their own ongoing development initiatives. One cannot also discount the ambiguities involved in the change in position from a development professional to a field researcher. The relationship between the development professional and the communities s/he is studying seldom allows for a dispassionate analysis of either side by the other; there are certain boundaries that cannot be pushed or crossed without affecting the relationship as a whole.

Thus, while some district studies were handled competently, overall there was unevenness in the quality of the district reports which could perhaps have been avoided if the study was conducted through one team of professional researchers who would have undertaken the assessment in all districts by taking the help of the local NGO partners. This may have taken longer but, in the ultimate analysis, not much longer than it has indeed taken.

Some of the key climate change issues of relevance to the fishing communities have been discussed in Salagrama (2012) and these are not further discussed in this study unless the district studies highlighted them as being significant to their context.

STUDY FINDINGS

Prior to discussing the specific issues arising out of the district studies, it is necessary to emphasise an important theme that runs clearly through all the district studies. This relates to the prevailing livelihood context in coastal Andhra Pradesh, which – as we shall see – has a direct bearing on the causes and consequences of climate change as well as on the adaptive/mitigating strategies by the affected communities. It also helps to fit the climate change issues into the larger livelihood context that informs and influences all stakeholder actions in the study areas.

6. Livelihood context in coastal Andhra Pradesh[4]

The coastal economy of Andhra Pradesh has remained predominantly agrarian (the term is used in this context to include fisheries, forestry, livestock and other primary occupations) into the 21st Century, with a large proportion of the population depending on the primary sector occupations. Currently some 60 percent of the population – a majority of them categorised as 'poor' – depend on these occupations for a livelihood.

From 1990s, the coastal agrarian economy has encountered a range of problems brought on by a complex set of factors, the roots of which have frequently been located beyond the coast itself. In agriculture and fisheries, productivity has remained static or even declined. Fragmentation of land-holdings, increased size and efficiency of fishing fleets, increasing urbanisation and growing population pressure reduced effective yields from the land and from the sea. High capital costs, rising costs of technology and labour and poor returns increased indebtedness, which in turn led to some significant structural changes in terms of ownership of assets and in decision making roles at the activity level. Market fluctuations became the norm, encouraged by the new economic liberalisation programmes which gave a freer hand to the market forces, while also lifting several subsidies that remained the lifeline for activities such as agriculture. The new open-market economy also allowed entry for new capital into coastal areas that were previously the domain of local communities.

Paradoxically, while the coast was heavily influenced by policies extolling free market principles, the policies became more restrictive as they moved into the forest areas where the restrictions on the collection and marketing of forest produce became stricter and the access to these products for the local communities much less freer. Within the coastal belt, mangroves and lacustrine ecosystems became subject to a host of regulatory and conservation measures that severely curtailed the traditional access rights for local communities, while not exactly adding much by way of environmental health. Community-oriented initiatives such as Joint Forest Management (JFM) yielded indifferent results owing to serious deficits of trust on both sides and insufficient delegation of responsibilities within the management systems. In general, with growing concerns about ensuring environmental sustainability, the government's measures to reduce the coastal communities' access to natural resources became more restrictive.

[4] The district studies as well as interactions with the NGO partners were helpful in providing inputs for this section.

With declining profitability of activities, increased competition from the new – and richer – players in the coast, and more government restrictions on the access to resources, the coastal communities have been facing serious problems concerning their livelihoods. Livelihood diversification – at the level of the individual, the household and the community – has become the norm as fishers and farmers travelled far and wide in droves in search of new activities. Up to two-thirds of the active fishers in Srikakulam district had migrated on a long-term basis to Gujarat by 2004, and the numbers and the districts from which these migrants come have expanded significantly since then. Women found themselves working in a range of occupations in order to maintain the households, while aged people found themselves at a loss as their children could hardly take care of them. With fragmentation of the society as a whole, social security and support systems have failed and the government has not been able to put adequate safeguards to address the needs of the vulnerable and the marginalised within the community.

Aside from some cosmetic gestures, the government's actions to understand and respond to the crisis in the primary sectors have been minimal. The planning and execution of the few remaining welfare and development programmes leave much to be desired, and the programmes themselves are hardly able to cope with the increasingly diverse needs of the people. Existing government programmes for capacity building to help with livelihood enhancement and diversification tend to be mechanical and hardly ever linked with employment guarantees. New industrial activities are predicated upon providing employment opportunities for the local youth, but going by the evidence so far, hardly any local employment is provided (especially when compared with the number of livelihoods lost as a result of the new developments) and – in several cases – there is an active disinclination to employ local people.

Where the government did come up with innovative new programmes like the NREGA, they have so far shown mixed results especially in the coastal areas. On the one hand, the poorer people do get a substantial hike in wages while, on the other, the spurt in daily wages for labourers has led the more productive activities like agriculture to become highly expensive, even leading to the farmers declaring crop holidays. In fisheries, which has a different but related set of problems, up to a third of the fishing fleets have largely remained at shore to avoid losses. Aquaculture has hardly survived the various problems it has faced since mid-1990s, while forestry has fast become a No-Go area.

A positive offshoot from these adverse conditions may have been the reduction in average family size in many small-scale households as also the increased emphasis on literacy for the younger people. However, as the study has shown, the increase in numbers of literate youth who can hardly find a good job but are also unable to continue their traditional occupations has meant an increase in unemployment in the villages.

The two conclusions that could be drawn from the above account are: that the coastal communities in Andhra Pradesh had been having serious enough problems of their own even without climate change raising its head as the newest trouble to befall them. Second, in their more immediate need for ensuring a reasonable livelihood, they could hardly bother – or even afford – to take actions to improve a long-term global condition like climate change!

7. Climate change impacts in Andhra Pradesh

7.1 Difficulties in assessing Climate Change

As the following sections will show, climate change is the cumulative outcome of a range of processes and actions (both natural and man-made), occurring at different levels within and frequently beyond any specific sector. The direct linkages between cause-and-effect are not always either clear or linear. What this study – or any such study, for that matter – shows are several trends that are at best only approximations of a possible climate change issue. In other cases, one needs to go by proxy indicators, which may or may not be always valid. Still, as a starting point, it is necessary to go along with whatever evidence is available.

The other point that needs to be made involves the difficulties in quantifying the climate change issues: it is impossible to give weightage to different factors in terms of their importance to a climate change process. Equally difficult to answer is the question of numbers; questions such as: how many people, at what rate, by how much, are being affected by climate change are difficult to answer with the limited databases that are available on the climate change issue. Consequently, this study is focused on drawing out the qualitative, impressionistic perspectives of the target communities.

The summary of the key issues emerging from the district reports are provided in four categories (4-Cs):

- The actual Climate **C**hange factors that are of importance to the target stakeholder groups;
- The possible **C**auses for the climate change phenomena, suggested by the stakeholders as well as observed by the NGO partners doing the study, based on their long association with the communities;
- The **C**onsequences/impacts of the climate change phenomena on the life and livelihoods of the target community groups; and
- Finally, the adaptive/mitigation strategies (or **C**oping strategies) that the communities have adopted to cope with the climate change impacts.

Obviously, the categorisation of the systems, processes and changes into these four groups is arbitrary, intended only to provide some structure to an otherwise chaotic picture[5]. It is however acknowledged that the issues do not lie in watertight compartments; that a change is possibly the cause of another change, while the consequence of a change might also be the cause for a change itself. All the same, to the extent that some sense could be made of the vast issue of climate change, the 4-C analysis has been found to be a handy analytical tool.

To ensure clarity of presentation, the following sections provide a summary of the key trends in each of the 4-C areas, without always going into the details of the specific geographical locations

[5] Salagrama, 2012 used the 4-C analysis to understand the fishers' perspectives of climate change.

or districts from which they have been reported. More details are available from the district reports which can be obtained from CADME, Rajahmundry (cadmeindia@gmail.com).

7.2. Key Climate Change factors of importance to the target communities

The district studies indicated a number of climate change factors as having an impact upon the communities in the coastal districts. Based on a rough prioritisation of the factors in terms of their relevance to different districts, the following changes appear to be having a critical impact for the majority of the target stakeholder groups:

- Rainfall patterns
- Temperature rise
- Seasonality and seasonal patterns
- Changes in freshwater flows
- Erosion and siltation
- Tidal actions
- Natural disasters (both incidence and intensity)
- Unusual weather patterns (tsunami, fog etc.)

7.2.1. Changes in rainfall patterns

Overall, major fluctuations in rainfall have been reported from almost all districts. The three critical changes relating to rainfall as reported include: (i) fluctuations from year to year, within the season and from one area to another; (ii) overall decrease in rainfall; and (iii) increased incidence of short and heavy downpours.

The fluctuations have tended to be in terms of:

- *Distribution by the year*: there have been wild fluctuations from one year to the next, going from very low rainfall in one year to constant downpours leading to flooding and serious damages in the next. "*If we have floods this year, then it's the turn of drought next year!*" is a common refrain in the study villages.
- *Distribution in a season*: the rainfall is not spread evenly throughout the season. It frequently happens that the entire rainfall for the year occurs in an intense burst within a very short period – sometimes as short as 4-5 days – and then dries up. This means that the annual average rainfall data hide a serious problem in that the overall quantum of rainfall may have been good, but its spread is confined to a very short span of time.
- *Distribution by geographical area*: the rainfall distribution is not uniform across even the neighbouring districts or, frequently, within the same district. Thus, while one village experiences adequate-to-surplus rainfall, a village some 20 km away suffers from near-drought conditions.

The overall impression is that there has been a decline in the average annual rainfall. Notwithstanding occasional downpours, the amount of rainfall available for agriculture is considered to have declined to an extent that the farmers have now to depend almost entirely on the irrigation canals and groundwater sources. For the farmers in the interior areas, who have

depended on rainfall as their chief source of irrigation, the consequences are serious enough to require them to stop operations altogether.

The increased incidence of sudden and intense downpours has become the norm in most districts, while its companion – a long and slow drizzle stretching across many days (called locally as '*musuru*') which was important during the planting season in order to keep the fields constantly watered – has become rare. The effect of sudden downpours is the destruction within a few hours of crops and – in case of fisheries – huge quantities of fish drying on the beaches. The absence of *musuru* means that water needs to be sprinkled by artificial means during the critical periods of planting and transplanting of crops.

Sudden and intense downpours also have effects in terms of:

- Erosion of the forest land
- Flooding hazards in the coastal plains with sudden onrush of water from the hills
- Sudden temperature and salinity drops in coastal waters, leading to mass fish kills and changes in breeding patterns
- Quick flushing of large quantities of pollutants from the industries on either side of the rivers into the sea – usually, with more moderate rainfall, the pollutants get into the sea in smaller quantities at a sedate pace which allows their effects to be minimised, but the sudden and large-scale release of the pollutants seriously disturbs the near-shore ecosystems and sometimes permanently affects the sea bottom, making it uninhabitable for fish populations.

With natural outlets for the rainwater to flow into the bigger water-bodies like the rivers and seas having been built over for industrial or urban development purposes, the impacts of heavy downpour become even more serious as the water flow is impeded by the new constructions, diverting it to new areas and intensifying their impacts.

7.2.2. Temperature rise

A directly experienced climate factor has been the increase in diurnal temperatures. Most respondents recalled that the summer peak temperatures never crossed 45^0C even until mid-1980s, but are now routinely touching 48^0 or even 50^0C. Heat waves and prolonged dry spells have become the norm, and even more alarming is the fact that high temperatures extend over a much longer duration than previously. Starting in March, they frequently extend up to early-October when the onset of winter cools things down. This implies that the duration as well as the intensity of winter has declined. Although the effects of increasing temperature on terrestrial biodiversity are not clear, these are reflected most directly in livestock, agriculture, horticulture and other related sectors.

The implications of raised temperatures are felt on the livelihoods of the target communities in terms of:

- *for daily workers*: reduced ability to work during the day,

- *for small-scale industrial enterprises*: increased power consumption leading to extended power cuts that in turn lead to reduced working hours
- *for agriculture and horticulture sectors*: increased demand for water (and electricity to pump water) and reduced profitability
- *for poultry sector*: mass kills of chicken

Overall, the increased temperatures are said to give rise to increased incidence of fevers, dehydration, cerebral haemorrhage and a host of other health complications, sometimes fatal but more frequently a financial burden on the poorer stakeholders who not only need to spend considerable sums on treatment but also lose their wages during the period of illness and convalescence.

While the effects of temperature rise in the sea are not directly perceived by the fishers interviewed during the study, there are several proxy indicators which are also scientifically supported, suggesting a major change in oceanic temperatures. These include changes in fish species composition and behaviour in a particular area. Thus, the southern coastal districts of Andhra Pradesh – right up to Guntur district – have been experiencing bulk landings of oil sardine in their catches over the last 20 years. Previously, oil sardines were a predominantly west coast species with only sporadic appearance on the AP coast. The extension of the distributional boundary of small pelagic like oil sardines – as shown in Table 1 – has been proved to be a result of changed sea temperatures[6].

Similar scientific evidence of changes in distribution of species like Indian mackerel (*Rastrelliger kanagurta*) which has resulted in a vertical extension of distribution from surface waters to depths of 50-100mt too has been proven by the experience of coastal Andhra Pradesh fishermen who increasingly catch Indian mackerel with bottom-set gillnets, as opposed to a time some 20 years ago when the species could be caught in the pelagic driftnets.

The final evidence from the fisheries of the impacts of sea temperature rise are phonological (i.e., change in the timing of life history events); in common species like Threadfin Breams, there appears to have been a shifting of seasons for spawning activity. Similar – localised – changes in spawning and availability of fish species have been reported in several locations along the coast. Also available is the evidence that several fish species have either moved away from their usual haunts along the coast and that some new species have appeared where they had rarely been seen before.

[6] Vivekanandan, E. 2008 Options on fisheries and aquaculture for coping with climate change in South Asia (presentation). International Symposium on Climate Change and Food Security in South Asia, Dhaka, 26th August 2008, cited in Ahana Lakshmi (see 2011).

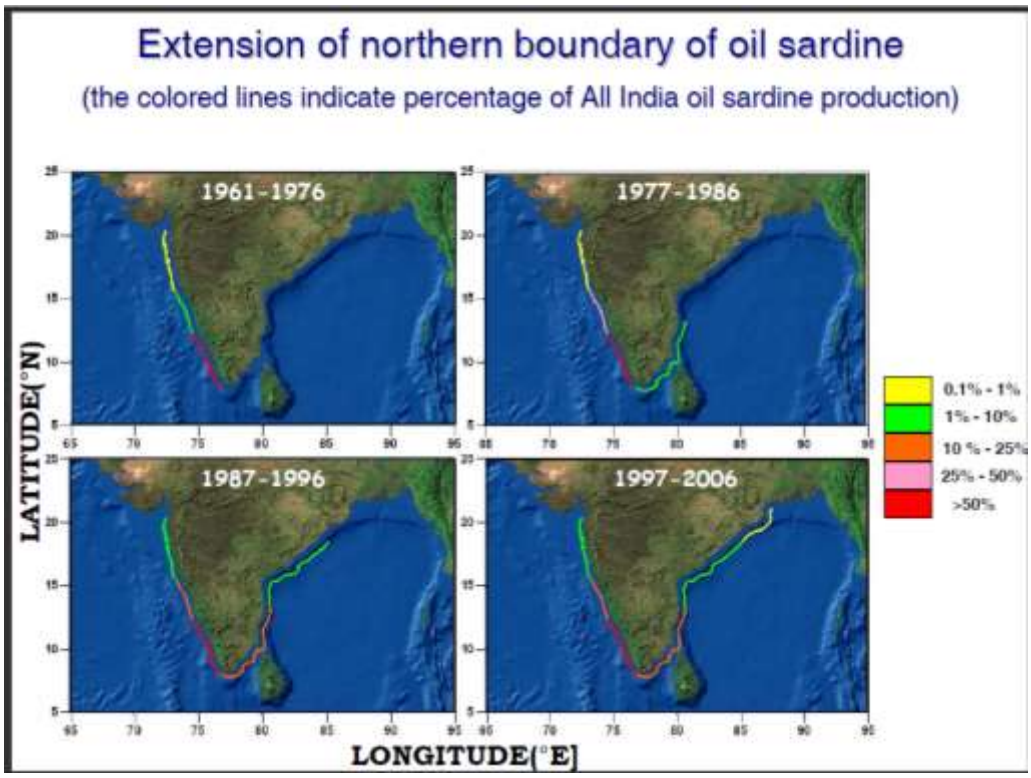


Table 1: Extension of boundaries of distribution of oil sardine along the east coast of India

7.2.3. Seasonality and seasonal patterns

The annual production cycles in all primary sectors are determined by the regular seasonal patterns, consequently different production activities are predicated upon the timely occurrence of different seasonal events. The rapid assessment shows increasing fluctuations and uncertainties in the onset of different seasons and seasonal events with severe effects on the production and marketing cycles. Monsoons, in particular, are a seasonal event that has significant importance for the Indian sub-continent and their arrival – which was largely predictable until the 1980s – has been a matter of great anxiety over the years. Staggered monsoons playing hide-and-seek and staying on much longer than usual (Southwest monsoon remaining active into November) and shifting and shrinking trends in the onset of northeast monsoon (from October-December to November-December) have been reported as becoming the norm. The effects of such changes are manifested in all sectors:

- *In agriculture*: the delays in the onset of monsoons is reported to upset nursery raising, plantation and transplantation, harvesting of crops, and leads to irrigation failures, increased pests and diseases.
- *In aquaculture*: there are reported instances of mass mortalities of the stock, stunted growth, increased incidence of pests and diseases.
- *In fisheries*: seasonal rains and the consequent floodwater discharges into the seas is said to (i) clean up the coastal waters by flushing impurities into the deeper areas; (ii) reduce the temperatures and (iii) bring fresh load of nutrients from the terrestrial environment. Delayed rains affect breeding, migratory and other life cycle events in the coastal fish

populations on which most of the marine fisheries depend. Unseasonal rains also have effects on traditional fish processing operations (fish drying), causing significant losses to the fish processors through direct drenching or by increased incidence of infestation.

- *In livestock*: the impacts of unseasonal events on the livestock – especially weather-sensitive animals like the chicken – are serious and cause frequent losses.

7.2.4. Freshwater flows

Climate change events like reduced or fluctuating rainfall, prolonged periods of high temperatures and increasing populations have led to reduction in freshwater flows and in groundwater sources in all coastal districts. In districts like Srikakulam, perennial streams and springs are reported to have dried up while in the Coringa mangroves of East Godavari, the influx of seawater upstream increases during certain seasons to an extent that the estuarine water has much higher salinities than before. The increased influx of marine waters upstream has the effect of salinising the coastal groundwater resources with the result that women in several coastal communities face the need to travel extra long distances to fetch drinking water. As we shall discuss in a following section, the reverse – i.e., reduced influx of seawater into the estuaries – also happens at certain times of the year and causes problems of a different kind.

The reduced access to freshwater also has impacts on irrigation affecting agriculture adversely. The reduced freshwater influx also leads to a change in forest biodiversity with the traditional species giving way to new species that have a potentially less economic value. The reduced influx of freshwater into the estuaries and the seas has an impact on fish behavior and breeding patterns and it is said that the river-mouths (traditionally the source of a sizeable variety of fish species) are much less productive now than before. Other implications of reduced freshwater flows include:

- Changes in sea surface salinity and temperature
- Increased incidence of siltation/erosion
- Reduced cleansing of the impurities along the river channels
- Opening/closing of channels, creeks, backwaters, river-mouths

7.2.5. Erosion & siltation

Coastal erosion happens primarily as a result of sea level rise, intense storm action, and changed or more intensive wave action. In the upland areas, the increased intensity of rains leads to the erosion of forest land. In the coastal areas, there is less evidence for sea level rise, but intense storms and increased wave action have certainly accelerated the rate of erosion in several coastal areas. This is especially significant in districts where major rivers open into the Bay of Bengal – e.g., East & West Godavari, Krishna and Guntur.

The natural processes of erosion are aggravated by the human-induced changes to the environment. The construction of reservoirs in the upstream of rivers (e.g., Bhupathipalem reservoir in East Godavari) and new ports and other coastal installations that affect the direction of water currents and wave patterns lead to increased erosion. Oil exploration initiatives, shrimp hatcheries and other coastal constructions contribute to putting new obstructions in the way of

water currents, diverting them towards new areas and increased erosion. Several coastal villages experience an increase in the intensity of erosion which leads to loss of long stretches of coastline and damage to properties annually. Erosion of the shoreline has reduced space for living and for fisheries, salinised freshwater sources, and increased population pressure in the hinterland, with Uppada in East Godavari district providing the most severe example of the impacts of erosion.

There is increasing physical evidence that even the mangroves – conventionally agreed to act as the bulwarks against coastal erosion – are themselves being eroded by the increased sea action in the Coringa area. Given the multiple threats that the mangroves are being subjected to in this area – oil exploration and refineries, shipping ports, aquaculture, effluent discharges from upstream – it is possible that the mangroves are reaching a threshold in terms of their natural resilience to cope with external threats and are unable to offer adequate resistance against the sea.

The flipside of the problem of erosion is that of siltation: increasing quantities of soil eroded from the upstream of rivers by flash floods are deposited as silt in the downstream or at another part of the coastline, with results that are often equally disastrous. Siltation is a major problem in Kolleru and Pulicat lakes as well as at the river mouths. The increasingly shallow waters of the lakes make them less attractive as living spaces for several fish species, shrink the size of the lake itself and create increased competition and conflicts for fishing space among the communities depending on them.

7.2.6. Wave/tidal actions

Changes in tidal and wave actions have been mostly reported by the people involved in fishing and related activities, although their deeper effects – increased salinisation of ground water, erosion and reduced living space – are felt more widely.

In Srikakulam district, as a result of increased intensity of wave actions, the shoreline does not slope gently into the sea allowing the tides and waves to play out their energies before reaching the beach; it drops abruptly into the sea, causing the waves to be more intense and damaging when they hit the shoreline. The result has been that launching and landing the small-scale fishing boats – which have always been beach-landed – has become a hazard for both the productive assets and the lives of the fishers. Frequent capsize of boats and reduced space for their berthing have become the norm in this area. The seriousness of the problem can be gauzed from the fact that one of the main reasons suggested by the fishers in the district for increased migration out of the district is the difficulties they face in surf-crossing.

We have discussed how the increased tidal incursion into the upper reaches of the rivers leads to salinisation of the freshwater table which affects the (already problematic) drinking water supplies and the irrigation facilities for agriculture. Conversely, the coastal communities also assert that, with increased siltation at the river mouths and along the creeks, there are also seasonal or long-term obstructions to the tidal ingress – caused by increased siltation as well as by more intense wave action – that has the effect of making the estuarine waters less saline and consequently less productive in terms of their fishery resources. The changes in tidal amplitude

and ingress upstream have had impacts upon the mangroves (which were important not only as good breeding grounds for fish, but also as the grazing grounds for cattle) and also on the coastal aquaculture which has seen a proliferation of diseases as a result of ineffective water exchanges through natural means.

7.2.7. Natural disasters

Although an increase in natural disasters like cyclones is considered to be a strong indicator of climate change, there is less evidence that this is happening in the coastal districts of Andhra Pradesh. The incidence of cyclones may have remained largely the same as ever, what may have increased is their intensity and their area of distribution. The last two cyclones to have hit the Andhra Pradesh coast – Cyclone *Laila* and Cyclone *Nilam* – have left significant damages in their wake, affecting agriculture and fisheries very badly.

Another critical change with respect to the cyclones has been that they too have ceased to be seasonal: until mid-1990s, specific months – May & November – were considered as the 'cyclone months' and the administration could be prepared to deal with them in those months. However, over the last 18 years, the seasonal nature of the cyclonic activity has proved to be no longer valid and cyclones have become more erratic.

The other natural disaster that can be linked to climate change, and that by 1980s had been considered to have been largely controlled in Andhra Pradesh, is the incidence of flash floods. The sudden and intensive downpours in the upland areas lead to sudden and excessive flooding that the existing flood banks and other preventive infrastructure are unable to cope with. The obstructive constructions built over former water drainage channels in the plains contribute to aggravate the impacts of the floods. Unlike in the case of cyclones, there are no advance warning systems to warn people of the imminent flooding of their areas, which contribute to further increasing the extent of damages.

Again, as with everything that we have discussed so far (reduced freshwater downstream vs reduced seawater upstream; increased erosion in one place vs increased siltation at another), there is also a flipside to the incidence of floods. According to the coastal fishers, annual monsoonal floods, which allowed a good mix of fresh and saline waters, reduced seawater temperatures and brought nutrients into the sea, were a necessary requisite for the wellbeing of their fisheries. However, with the loss of regularity of the floods, this is not happening and that – according to the fishers – is one reason for the poor fish catches in their areas.

7.2.8. Unusual weather patterns

The tsunami of December 2004 has been cited as the most unusual weather event that the coastal communities have ever been subjected to. Although Andhra Pradesh has avoided the worst effects of tsunami, there had been damages to infrastructure and fishing equipment in the southern districts and its occurrence was felt right up to Visakhapatnam district in the north. According to the fishers, this gave rise to a 'fear of the unknown' as they found it difficult for some time to take the sea for granted.

There is reported to be an increased incidence of fog during the tail-end of the winter months (February-March) which has consequences for agriculture and horticulture. Other unusual weather patterns recorded in the study included: extended heat waves; increased levels of humidity; and unusual rain patterns during some months when they are least expected. Another example of a changed weather pattern related to the rapid fluctuations between extremes of weather, the evidence for which came from the southern districts where, in the span of a few days, the government's proclamation of several regions as being drought-hit had to be followed up by emergency flood relief operations in the same regions!

7.2.9. Other CC-induced trends of importance to the coastal districts

Some other issues of relevance to climate change which only made a brief appearance in the district reports owing to lack of time or to orientation but are significant enough to warrant further studies on, included:

- Sea & soil salinity
- Wind & current patterns at sea
- Mud-flows and turbidity
- Changes in species mix and dominant species (flora and fauna) in the forest areas
- Primary productivity in the water bodies

7.3. Possible Causes for the climate change phenomena in target areas

As the foregoing sections have shown, climate change is the outcome of a range of factors, both natural and man-made and it is not always possible to pinpoint any particular set of causes as being responsible for climate change. This is particularly important to keep in mind because climate change is a global phenomenon and the extent to which the local contributes to the global remains unclear, especially as we have only some broad indicators to use for analysis.

All the same, the factors contributing to climate change could be considered under two heads: natural causes and man-made causes. These will be discussed in the following sections.

7.3.1. Natural causes

A few trends relating to climate change, e.g., change in wind patterns and rainfall, seasonal fluctuations and natural disasters, are attributed to the natural factors. For the respondents, the global phenomena such as sea-level rise, global warming and El Nino Effect, are totally new ideas and their ability to relate a change in their local environment to melting of polar ice-caps or a change in Pacific/Atlantic currents is extremely limited.

While this limits the extent to which one could assess the natural factors involved in climate change from the community perspective, this also highlights an important area for future work: to raise people's awareness about the global patterns of climate change and how it affects the local context one way or the other, while also allowing them to understand their own contributions to GHGs in a more direct and personal manner which is necessary for effective actions.

7.3.2. Man-made causes of Climate Change

In the district reports, the stakeholders discuss a number of factors that – though not directly understood by them as having a climate change implication – are however important to them from a livelihoods perspective and that, with hindsight, could be linked to be climate change related as well.

The critical issues having an impact on the livelihoods of the target stakeholders, besides having some climate change implications, can be categorised into: those relating directly to the stakeholders' own actions; and those relating to broader factors, frequently beyond the control of the stakeholders themselves. Also significant in this category are: the issues of population rise and the policy-institutional framework that supports or aggravates the climate change context.

A. Causes relating directly to the stakeholders' own actions

Most changes attributable to climate change are beyond the scope of the primary stakeholders to understand, let alone to take measures to address. Even if the required awareness were provided, it is doubtful as to what extent they could make a meaningful contribution to reducing its impacts as it is frequently the factors beyond the control of the stakeholder groups that have the most significant impact on the climate change. In the absence of the right awareness about the issue and their own contribution to it, alongside a certain fatalistic attitude arising out of the prevailing livelihood context and the immensity of the climate change issue, the stakeholder communities continue with their own actions irrespective of their effects on aggravating climate change.

From a strictly climate change perspective, the most significant activity of the target stakeholder groups that contributes to the emissions of green house gases (GHG) is the mechanisation of the various primary sector operations. Fisheries – both capture and culture – are largely run by motorisation and farming involves considerable mechanical activity at various stages. Besides direct operations in fisheries and agriculture, their ancillary activities – seed and feed production, fertilizer & pesticide production and disposal, packaging and transportation – also contribute to GHGs in no small measure. Although the available scientific evidence suggests that the contribution of fisheries and agriculture to overall emissions of GHGs is as yet small, they show an increasing trend which has implications for not only climate change but also for the viability of their livelihoods.

Some of the causes of climate change relating to the stakeholders' actions include:

- Resorting to potentially harmful practices (indiscriminate and excessive use of fertilizers, pesticides, destructive farming/fishing activities)
- Over-exploitation of the resources (over-fishing, intensive agriculture and aquaculture practices, excessive harvest of forest produce...)
- Destruction of sensitive ecosystems (mangroves, forest resources, mining/quarrying activities for various purposes)
- Intensification & over-capitalisation of effort (inefficient and high horsepower engines, longer working hours, monoculture) requiring higher returns to offset the input costs

- Market-driven production and trade practices (market focus leading to neglecting more basic needs; export-driven production practices in fisheries, forestry and agriculture leading to food/livelihood insecurity plus excessive pressure on the resources)

B. Causes relating to broader factors, frequently beyond the control of the stakeholders

A more significant contribution to climate change comes from factors beyond the local and the existing livelihood activities of the stakeholders. In fact, in all districts, the informants have pointed to a wide range of industrial and non-industrial activities which have a direct impact on their livelihoods as well as contributing to significant rise in pollution and GHG emissions. If a rough guess was to be made about the relative contributions of primary sector and industrial activities to the GHGs in the districts, the general consensus arrives at a ratio of 1:50. In several villages covered by the study, it has been observed that the living conditions have been badly affected by the industrial and mining activities in the neighbourhood. Also clearly apparent is the impunity with which these activities can flout the existing environmental laws, which cannot bode well for the climate change scenario.

Some of these bigger activities that contribute to climate change include:

- Growing levels of pollution (air, water, land, sound...)
- Increasing competition to traditional activities from new sectors (industrialisation, urbanisation, tourism, oil and mineral extraction, energy & irrigation projects, ports & shipping, conservation and national security)
- Unsustainable land-use patterns (intensive agriculture & aquaculture practices; conversion of agriculture land for real estate; deforestation)
- Environmental degradation (urban/industrial waste dumping in sensitive ecosystems; deforestation; offshore oil exploration; practices affecting wetlands, mangroves, and marshy lands)

C. Population pressure

A major factor underpinning the tragedy of the commons, as well as several other manifestations of stress on the livelihoods of the communities, has been the enormous growth in population size in the coastal districts over the last three decades. Most communities have doubled their populations over this period, which resulted in further demands on the natural resources as well as more pressure on the living conditions, social safety nets and access to alternative avenues. Some of the examples of the manifestation of increased population growth, as obtained from the rapid assessment, include:

- Pressure on the natural resources to increase yield
- Lack of living and working space
- Crowded and unhealthy living conditions, weak access to healthcare and other support systems
- Severe competition & conflicts over resources
- Degradation of common property resources
- Destructive practices

- In- and out-migration – mostly out-migration in case of Andhra Pradesh
- Increasing uncertainty among the youth
- Malnutrition and increased incidence of diseases among the children
- Nuclearisation of family structure, leaving the aged people to fend for themselves.

D. Policy-institutional issues contributing to aggravating CC and its impacts

The existing policy framework at the national, the regional and the local levels suffers from a lack of coherence, which is vertical (i.e., linkages from the top to the bottom) and horizontal (i.e., linkages between one line ministry/department to another and also within the same ministry/department relating to linkages between diverse policy priorities, e.g., development vs. Conservation). The limited extent to which the local governments have been empowered and enabled to take direct actions also undermines their ability to reflect the local priorities in their agendas.

The lack of coherence and integration between different policy objectives translates into counter-productive results. As things stand in the current policy atmosphere, any programme to implement a support activity to help a particular stakeholder group to overcome the impacts of climate change can well lead to a situation where the support provided further worsens the climate change situation. The provision of more efficient tools for increased harvests from the land or from the sea without ensuring a proper system of balance to check their indiscriminate and excessive usage could only mean a further aggravation of the problem, possibly beyond remedy.

Thus, there exist several examples of:

- Policies and processes that actively contribute to, or aggravate, climate change.
- Policies and processes that are not reconciled to overcome their inherent contradictory positions,
- Policies that fail, or at least only partially succeed, in addressing the adverse consequences of climate change for the stakeholder communities;
- Policies, as for instance those relating to conservation aspects, that effectively alienate the stakeholder groups both from their livelihoods and from the support systems;
- Policies that are essentially well-made but which fail owing to poor implementation processes and to institutional weaknesses

In summary, the stakeholder groups have major doubts about the relevance, effectiveness, funding, timeframes, sustainability and equity implications of various existing policies and their implementation strategies. While initiatives such as NREGA are considered to have opened up new avenues for the poorer/asset-less stakeholders, there are doubts as to its sustainability as well as its real/potential impacts upon the existing livelihood activities.

7.4. Consequences/impacts of selected climate change phenomena on the target stakeholder groups

Although the district studies have managed to capture a fair number of case studies, histories, timelines and other relevant data to highlight the target stakeholders' perspectives on various aspects of climate change, it needs to be stressed that there is still need for more such case studies in order to stress the need for bringing the human dimension into the climate change discourse more forcefully. Also problematic at the current juncture is the frequent lack of the means to ascertain the cause-and-effect relationships linking climate change to livelihoods of the poor, which makes it necessary to make subjective assumptions that may or may not be entirely valid. All the same, there is evidence that climate change has been making an impact on the target communities, affecting both the livelihood activities and the quality-of-life (at the individual and community levels).

A. Consequences of climate change on the livelihoods

The most important change impacting the livelihoods of the primary stakeholders in the coastal districts is the declining productivity of the resources on which they have depended. This is reflected in the quality, quantity, variety, and distribution of the resources. There have been significant changes in the forest/farm products as well as fishery products, which resulted in the loss or depletion of several key varieties. There have been changes in the natural biodiversity with results that are not always positive for the people.

On the other hand, decades of government encouragement for certain products with big market demand – paddy, shrimp –meant that whole sectors have become dependent on specific varieties and the fluctuations in their production are reflected on the fortunes of the whole sector. The overexploitation of specific species also led to the loss of biodiversity (and the opportunities for the producers to diversify the basket of commodities that they produced).

Changes in production systems cannot but have implications on the markets and vice versa. With emphasis on monoculture practices for specific varieties, all producers shifted to the big demand varieties, which frequently led to glut in the market supplies with predictable consequences. A domestic slump in the price of rice and a global slump in that of shrimp led to a number of production systems in agriculture and fisheries (and aquaculture) going bankrupt. Uncertain production trends are also reflected in the uncertain access to markets and in the traders having a huge decision-making role in the production activities.

The changes in availability of resources – as also the focus on specific export-oriented species – have led to problems of access for the producers; this required intensification and/or diversification of activities in order to maintain the supplies at the same level. In other words, more is being spent to obtain the same output – or even less output – than before.

The changed terms of access – requiring more costs and investments, as well as effort – changed the economic organisation of the activities. From a partly subsistence-oriented initiatives that prevailed in the coastal districts of Andhra Pradesh (agricultural produce was seldom entirely sold in the market; a part of the fish catch did go into domestic consumption of the fishers; the tribal communities lived on their own produce or at least bartered a large proportion of it), there was a shift to entirely market-oriented productions.

The need for increasing levels of investment in the primary sector activities led to at least three major outcomes.

- First, the ownership of productive assets – including land – became concentrated in fewer hands as the poorer farmers and fishers chose to sell their assets and become daily wage workers instead. This meant that the number of asset-less workers has increased in the communities.
- Second, the increased investments also meant increasing levels of indebtedness that – with regular failure of crops or fish catches – became ever more un-repayable and led to the production activities being dominated by the trader-financiers or – in some drastic instances – to suicides[7]. In a majority of cases, the medium-size farmers or mechanised boat owners found themselves in an even worse position than the workers they employed; the latter – with no investment tied down to their assets – could easily move from one activity or area to another, which is a luxury that the people with assets didn't have.
- Finally, the shift from manual to mechanical labour and the need for skilled workers willing to do hard work have marginalised the weaker and older people from productive sphere. This led to a significant rise in unemployment and underemployment in the villages, as well as a loss of job security that deprived people of the faith that things would get better if only they stuck to them long enough.

Next, as discussed in section 6, changes in the economic organisation of the dominant activities in a community led to a change in the social organisation and decision-making roles as well. With the entry of new social and economic systems and groups into the communities, the existing ownership patterns, labour and sharing arrangements, and community governance systems have all undergone radical changes from which it is impossible to retrieve the 'traditional' anymore.

With the changes in seasonality, wind and tidal patterns, rainfall, and other natural phenomena, customary knowledge systems and practices have become largely redundant. With pressure on the producers to make ends meet at any cost, the ability of the traditional governance systems to control excess and impose rules for responsible management is constrained. The shift away from traditional practices also makes traditional governance systems – already weak – even weaker and fissures are apparent in the traditional bonds and kinship relations characterising the coastal communities. Thus, in many ways, climate change makes obsolete the customary practices that have come into existence based on centuries of observation and experience.

As the numbers of asset-less workers increased and the productivity (and incomes) from the local activities declined, livelihood diversification has become the norm. This took the shape of people moving into non-traditional occupations in their neighbourhood (or at a distance), or into the same occupations in a different state. The study found several examples of large numbers of farmers moving into urban areas to work as labourers in construction and industrial sectors.

[7] It needs to be stressed here that the linkage between climate change and farmers' suicides cannot possibly be established with available evidence, but the fact that climatic conditions leading to regular failure of crops contributing to the farmers' distress cannot be denied.

Fishers from Srikakulam to East Godavari have been found to be migrating to work in fishing boats in Gujarat, Maharashtra and the Andaman & Nicobar Islands.

B. Consequences of climate change on quality-of-life

An outstanding climate-change induced consequence on the quality of life of the communities is said to be the impact of natural disasters on housing, health, roads, communications and other infrastructure. Sea level rise and erosion do extensive damage to housing, coastal farm land and infrastructure used in fishing and transportation.

Uncertain production conditions have reportedly led to growing food and nutritional insecurity, which is especially evident in tribal areas, although no less prevalent in the farming and fishing communities. In the fishing communities, it is reported that the quantum of fish consumed in the daily meal has come down, while in the farming communities the consumption of vegetables has declined. The nutritional standards of food consumed in mining and quarrying workers' households – which occasionally tend to be migratory – leave much to be desired.

Access to clean drinking water – which has seldom been very plentiful – is increasingly a serious concern in the coastal areas as the ground water table falls or – closer to the coast – becomes saline.

Migration is increasingly a fact of life in several communities and this leads to serious problems at the societal, household and individual levels, threatening health, education, family stability, social status and old age insurance. Uncertain incomes lead to higher levels of indebtedness covering a majority of people in the communities, and the problem is further aggravated by increasingly tougher terms for lending. The capacity of the traditional social systems and networks to cope with such challenges is extremely limited and further declining.

Population growth, poor housing, crowded conditions, limited access to nutritional food, clean water and sanitation, extreme events and migration, besides a weakening livelihood context are reflected in the profusion of health issues, aggravated by healthcare facilities that are either very poorly equipped or are too expensive for the people to access.

C. Consequences of climate change on women

A most significant change at the activity- and community level has also been in terms of gender relations. Women – who played a critical role in fisheries, especially in trade – became marginalised as their role was increasingly taken over by export traders. On the other hand, the women found themselves facing the need to fend for their families as the men increasingly returned home with empty hands. The story of primary sector communities since the 1990s is the story of the women trying to find ways and means to make ends meet in the face of adversity. Apart from earning to keep the family fed, the women also need to travel farther out and for long durations for collection of firewood, fodder, water and non-timber forest produce (NTFP). Although they have so far coped all right with the crisis, the informal nature of their new

opportunities and the ever-increasing competition from more women joining the race would mean that their future livelihoods remain uncertain.

The arrival of the micro-finance initiatives – specifically targeting the women – have been as much a boon as they were a bane. In many ways, the women benefited from the access to instant loans on easy terms, which led in some cases to the total disappearance of the traditional financiers from the communities. The access to loans also gave the women a status in the society as well as in the household that they had not hitherto been allowed. However, the burden of repayment of the loans – which were frequently spent on assets that the men owned – was frequently a major problem that the poorer women in particular could not easily overcome.

The study hasn't managed to gather as much information on the potential impacts of climate change on the children (especially the girl children) as it would have liked, but this is an area which requires more intensive and stand-alone treatment by itself and is flagged as a key area to explore in the future stages of this work.

In summary, it can be concluded that in most villages covered by the study, access to even basic facilities and services – good housing, food, water and sanitation, transport and communication facilities, education and healthcare – remains very rudimentary. The impacts of the various changes (whether induced by the climate change or not) have further increased their vulnerability and weakened their capacity to cope with any further changes affecting their life and livelihoods. In other words, the communities covered by this study will not be able to cope with further challenges on their own.

7.5. Community-based adaptive/mitigation strategies currently in place to cope with climate change

The adaptive/coping strategies to address climate change are not explicit but with a careful analysis of the scope of these strategies, one can discern some sort of a climate-change focus in there. The communities' responses to climate change will thus need to seen from a broader livelihood perspective, when it becomes apparent that these responses are many and varied and could occur at the individual, household, community and even larger levels. In theory, the coping strategies could fall into two broad categories:

- Those addressing the factors causing a condition/change. Activities aimed at reducing green house gas (GHG) emissions fall into this category.
- Those addressing the consequences of the condition/change. Activities aimed at coping with the effects of climate change – change in agricultural patterns, diversification of livelihood activities etc.

In practice, the communities' responses relate mostly to meeting their more immediate livelihood needs. That most changes attributable to climate change appear to be beyond the scope of the people even to understand, let alone address, is one factor inhibiting a more active response to it. Also, the capacity of the communities to cope with the challenges to their own livelihoods is limited given the weak status of their livelihoods. With their backs to the wall, the communities are in no position to address the broader and long-term agendas like climate change.

Consequently, the people's responses to the trends induced by climate change are by way of learning to live with them and their impacts.

The same weaknesses in their livelihood context also determine the quality of their responses to climate change. Most adaptations are only barely adequate to address the problems, many of them are arbitrary and temporary measures ('living-for-the-day-strategies') and at least some of them actually contribute to aggravating the impacts or forcing people into doing criminalised or hazardous actions.

A. Examples of adaptive/coping strategies among the target stakeholder groups

The adaptive and coping strategies mainly tend to take two main pathways: (i) *livelihood enhancement strategies*, which involve improving the performance of the existing livelihoods and (ii) *livelihood diversification strategies*, focusing on changing the livelihood activities to include shift to other activities or other geographical areas. Salagrama & Koriya (2008) provide a typology of livelihood enhancement and diversification (LED) strategies in the marine fishing communities of India, which – along with the specific examples provided in that study – is largely valid in this context as well. Following the same framework, the examples of LED among the target stakeholders for this study can be discussed as follows.

i. Livelihood enhancement strategies

- *Diversification of supplies, supply sources and markets*

In the study areas, changes in cropping patterns in agriculture have been reported, which include (i) shifting from paddy to pulses, cereals and oil seeds; (ii) shifting to cash crops like casuarina, cashew and eucalyptus; and (iii) shift to single crop from two-crop pattern. Such shifts not only reduce risk but also allow the farmer/household to migrate to other activities/areas for the rest of the year. In fisheries, there has been a shift from high value-less volume catches to less value-high volume fisheries.

A similar change is happening in terms of shifting the markets from the local to the distant urban centres and, wherever possible, to export. While this is a long-standing practice in fisheries, there is increasingly a trend towards distant urban and export markets in agriculture and more especially in horticulture activities. Of late, the export rice abroad has gathered momentum as controls on rice exports were gradually lifted. Many fruits and vegetables find their way into urban centres, while the opening of chain stores (Reliance, Spencer's etc.) allows some producers to supply directly to them. The direct impact of the diversion of fruits and vegetables to distant markets is the increase in prices for the same in local markets as well as marginalising several petty local traders, but to the extent that they help the producers to make a living, it is welcomed. This is a trend that is expected to strengthen over the coming years.

At the level of petty traders dealing in vegetables, forest produce, flowers or fish, the basket of commodities they have traditionally dealt with has undergone significant changes and includes dealing in: (i) a wider range of goods, (ii) the cheaper varieties as the more expensive ones are creamed off for distant market trade or (iii) the discards from the premium market trade. Their

supply sources too have frequently shifted from the local producers to centralised wholesalers/ suppliers who source their supplies from a wider area.

- *Optimising/intensifying operations*

Within agriculture, a dual trend is visible: on the one hand, an intensification of practices – with increased usage of fertilizers and pesticides – has been widely reported. There is increasing emphasis on bore wells as well as use of motors for pumping water for irrigation and aquaculture purposes, which raises the cost of production significantly. Where the bore wells already exist, they are dug deeper into the ground to ensure ready access to water. In fisheries, this takes the form of bigger and more powerful engines and more number of nets being carried onboard, besides undertaking fishing operations much farther out in the sea than previously.

On the other hand, in both agriculture and fisheries, there are also efforts to cut down on costs in some ways. A far-reaching – but widely prevalent – strategy in agriculture and aquaculture involves crop holidays. In fisheries, this involves stoppage of fishing activities during the lean periods or undertaking fishing operations by rotation where only some of the boats operate on any given day. The shift to sails – instead of the more expensive engines – for propulsion is gaining ground in fisheries, while no similar back-to-basics examples have been found in agriculture. In aquaculture, the production cycles are scaled down from semi-intensive to extensive practices to reduce costs.

Some fisheries have also moved to group-based operations both at sea and for marketing, which reduces risk and allows economies of scale by pooling together the catches from several producers as one lot. Many women producers and traders also undertake group-based activities routinely which saves on the working capital needs while also allowing division-of-labour.

While the supply chains in agricultural and fisheries commodities in the coastal districts have largely retained their informal nature, some initial steps are visible in consolidation of supply chains into streamlined efforts (bringing together the production-processing-transport-trade under one system of control). These are being implemented by large urban market chains like Reliance and the process is expected to gather more steam over the coming years.

- *Loss reduction strategies*

In general, in systems like agriculture and fisheries, where the costs continue to remain high and production static, there is an extra emphasis on reducing wastage through losses. While in fisheries, the post-harvest losses were quite high – going up to a third of the total produce – including big discards and wastage at sea and on shore, the losses in agriculture – especially in the fruit and vegetable segment – too were sizeable. Over the years, these losses have been substantially reduced in both fisheries (with use of ice) and agricultural produce (through use of chemical preservatives, which may actually have serious negative implications from the perspective of climate change and that of human health). Also, the growing demand for fruits

and vegetables, together with improved ready-transport systems ensure that even not-so-fresh goods generally find buyers.

- *Protecting turfs*

Especially visible in fisheries, this involves putting barriers to the entry of newcomers into a fishing area at sea or into the fish landing centre or market on land. The reciprocal arrangements that have traditionally existed between fishing villages and allowed fishers from one village to operate from the beaches of another are repudiated and such incursions met with stiff resistance including conflicts.

While land-based activities like agriculture – which depend on clear patterns of land ownership – do not have turfs in the production activities, such behaviour is not uncommon in the trade, especially the wholesale trade involving food grains like paddy. Even in fruits and vegetables, the market share is fiercely protected through turf control measures.

- *Self-imposed management measures*

The farmers of Konaseema area in the Godavari delta imposed a self-ban on agricultural operations for one full season during 2012 as a protest against the government's inability to provide adequate support to the agriculture sector.

- *Living for the day: subsidies and short term survival strategies*

As several farmers have pointed out, the survival of agriculture has come to be dependent upon the continued supply of subsidies and credit for at various stages in production: for inputs (seed, fertilizers and pesticides, water, insurance and electricity), for marketing (agricultural market yards, minimum support prices), and tax breaks (no levying of income tax on agriculture income). If any of the subsidies – which are effectively filling the gap between investment and return – was to be lifted, the agriculture sector would face serious crisis.

While fisheries is less dependent on direct subsidies, the fishers do receive some indirect subsidies which include their free access to the fishing grounds (open access) and infrastructure development (jetties, landing centres, auction halls), and also some fuel subsidies that do not really amount to much. Again, the impact upon the fishing economy if more services are made chargeable can be quite serious.

A big example of how far the communities have gone down the 'living-for-the-day' path is indicated by several surveys that looked into the micro-finance programmes in the villages, which discovered a large proportion of the recipients had obtained multiple loans from more than one source. The weekly repayment they had committed themselves to pay amounted to many times their actual earnings, which meant that they would never have been able to keep up with

the weekly payments. Still, the fact that a large proportion of people obtained multiple loans – frequently under false pretences – would highlight their fatalistic attitude to live for the day in the hope that tomorrow would fend for itself.

- *Boom-and-bust operations*

In increasingly desperate circumstances, people are forced into illegal/hazardous activities which include entering sanctuaries for their produce, smuggling forest produce, hunting endangered species, making illicit liquor and a range of other hazardous enterprises. It has been reported in some districts that women are forced to resort to sex work in order to survive.

- *Part-time operations*

Most people in the target communities are found to be only primarily (and not fully) tied down to a particular activity or even sector. While they still have a primary occupation as a fisher or a farmer, they are however also seen to work in other activities at times. In general, almost 40 percent of a household's income could be coming from alternative sources.

ii. Livelihood diversification strategies

- *Local options within the sector*

In fisheries, this is reflected in a large number of active fishers shifting to fish trade and trading in the local markets as well as in the distant urban markets.

- *Non-local options within the same sector*

This is widely prevalent among the fishing communities, where the fishers have moved far and wide to work in boats operating in Gujarat, Maharashtra, Goa, the Andaman & Nicobar Islands. Agricultural workers from the coastal districts also move to other districts to work in the same sector on a seasonal basis.

- *Local options outside the sector*

Some small scale farmers have moved into keeping livestock.

For the farmlands sited near expanding urban areas, the opportunity to sell them for real estate development at very high values is a very attractive option.

A majority of the youth are reportedly opting out of their traditional occupations to work in urban/industrial areas or in new enterprises like cellphone/TV repair and sales. Several youth found employment driving auto-rickshaws and other transport vehicles.

Women are seen to be involved in multiple occupations extending beyond their traditional spheres of action. They are seen to be working in areas as disparate as agriculture, petty trade, construction, domestic work and hospitality industry.

- *Non-local options outside the sector*

Diversification of livelihoods has become the norm in many communities. Migration to urban centres and outside the state in search of work has become routine in most communities. Daily wage workers in agriculture are thus moving long distances, often beyond the state, to work in activities that are alien to them until recently and that require some challenging tasks from them. Aside from their willingness to take almost any risk to earn a living, the migrant labourers also offer an attractive target for their new employers because of their willingness to work at rates much below par in construction and fishing.

iii. Adaptations in lifestyle practices

There is a change in the food consumed: in some districts, people have reported to have shifted to consuming minor millets (*ragi*) as staple food; also, as indicated, quality fish has been displaced as a staple food item from the fishers' table in favour of cheaper fish or plain vegetables. Children are increasingly sent to school if only to ensure their meal through the midday meal scheme. Even otherwise, there is an emphasis on education and children of both sexes are increasingly sent to schools. Alongside, there are also instances of increased child labour, which becomes necessary in extremely poor families which require every extra hand they can find to make some earnings.

In healthcare, in place of the existing healthcare systems that are largely inaccessible and unaffordable to most poorer stakeholders, the emphasis is shifting to indigenous alternative medicines which are more affordable but give dubious results.

iv. Dependence on government support

In most villages, some government programmes do make some difference in helping the people to survive in the face of heavy odds.

NREGA has been mentioned in several districts as offering a good opportunity not only to provide work to the unemployed workers, but also raising the daily wages substantially even in non-NREGA works in agriculture. However, for the already crisis-driven agriculture sector, this is feared to be the proverbial last nail in the coffin, which forces many farmers to abandon farming activities altogether.

The support offered through Public Distribution Systems (PDS) in terms of basic foodstuffs is another social support mechanism that has been identified as providing some of the poorest families with at least something to eat.

In the case of cyclones and other natural disasters, the government does come up with relief and rehabilitation packages but these tend to be rather arbitrary (no two cyclones will receive the same kind of assistance), rarely cover all the affected parties, and are full of leakages. All the same, the fact remains that the target communities need this support in order to get back on their feet in case of a natural disaster; conversely, what this indicates is that the communities' ability to cope with the effects of the natural disasters is very limited.

However, it has been agreed that the significant improvements in cyclone forecasting and warning systems have led to better preparedness on the part of the communities to cope with them and hence the damages have become less than before. Also important is the fact that the quality of overall infrastructure – housing, roads, transport and communication facilities – has improved significantly in both personal and professional spheres that the coastal communities are less at the mercy of the natural forces than before.

B. Institutional support mechanisms for coping with climate change impacts

At the village level, the capacity of the PRIs to assess and undertake measures to address current and future climate risks at village level is very limited. Once again, without adequate delegation of rights and responsibilities, the capacity of the PRIs to help the stakeholders to cope with climate change remains limited.

At a still higher level, while there is some awareness about climate change among the institutional stakeholders – i.e., the government and the NGOs – it is frequently no less superficial or fragmentary than that of the communities with whom they work. As important as rising awareness amongst the communities is the need for doing the same with the institutional stakeholders, which – if anything – needs to precede the former.

So far, there appears to be no centralised mechanism or an institutional framework to monitor, collate and disseminate information about climate change, or to act as a one-stop shop for people to seek advice and support from in matters pertaining to climate change. Although Disaster Mitigation Authorities (DMA) exist at the state level and at the district level, the communities' knowledge of, and interactions with, them is insignificant. In the absence of any meaningful partnerships or networks cutting across stakeholder groups, villages or districts that can be prepared to address climate change at a higher level, the stakeholders' ability to cope with climate change and its effects are mostly random and arbitrary.

C. Civil society responses to climate change

A critical concern raised by the target stakeholders relates to the weakening support from the government as well as the NGOs in the recent past. From the government, there have been no new programmes of support addressed at the emerging needs of the communities, while the existing ones are being either marginalised or revamped to fit with the new economic

liberalisation principles that frown upon subsidies of all kinds. While there do exist a lot of leakages in the social support programmes, they also contribute significantly to the wellbeing of the poorest stakeholders and hence need to continue, albeit in a more effective and efficient manner.

NGOs have been active in the coastal districts since at least the late 1970s, but there has been a drop in their activities over the last decade. This owes partly to: (i) the proliferation of NGOs all over the state, thereby leading to a loss of faith in their professed principles, (ii) the downscaling of India as an aid-recipient country in the international donor plans, which are themselves affected by the global economic crisis; and (iii) the Government of India's stricter monitoring of the NGO activities. Finally, a subject like climate change involves long engagement with the communities, demands actions that go far beyond the local community level (at which most NGOs operate) and requires continuous technical and financial support. These are conditions that are difficult to meet in the current context, which necessarily reduces the ability of NGOs to undertake meaningful actions. Several NGOs which were doing commendable work in raising the people's awareness and their access to various services and resources, have consequently become weak and unable to develop cohesive long-term strategies for sustainable climate change outcomes.

D. Role of research & academic institutions

An interesting, if depressing, point that comes out of the community interactions is the extent to which research and academic organisations – supposedly the flag-bearers of the scientific assessments of climate change – have remained almost invisible at the ground level and practically ruled themselves out of all consideration in areas that need a scientifically-backed reform in policies or even individual actions.

Information from national meteorological services, INCOIS or other sources reaches the communities only fitfully and is rarely timely. Access to weather forecasts (in times of an impending cyclone) reaches the communities more efficiently; the use of radios for receiving such weather forecasts has been replaced by the dependence on cell phones, TVs etc.

All in all, a strong case can be made for building stronger bridges between the communities and the research/academic institutions to work together on climate change issues. However, the research community needs almost as much orientation and awareness raising about the local community needs and perceptions as the latter need awareness and capacity building concerning the scientific basis for climate change assessment and mitigation.

8. Some key conclusions from the district studies

Firstly, it is unequivocally clear that climate change is an important factor affecting life and livelihoods of the target communities in all nine districts. However, as discussed above, it is frequently mixed up with a number of other factors having an effect upon the life and livelihoods of the fishers (macro-economic/global factors; growing competition for resources/markets/ services; declining productivity of the natural resource base), so much so that specific climate

change factors remain masked (or prioritised very low) in the list of key concerns for the stakeholders.

The integration of the climate change with diverse other issues would also suggest the need for holistic actions to address it, rather than specific activities targeted at climate change alone. Thus, a technological issue that involves a reduction in the emissions of green house gases (GHG) also has an economic dimension for the users in that the improved efficiency of the technology could well mean a reduction in its operating costs. On the other hand, improved efficiency of a technology could – rather than reduce its negative environmental impacts – encourage its increased use and aggravate its overall impact on the environment.

Next, concepts like 'climate change' and 'global warming' remain very broad and not easily understandable at the local levels at which the stakeholders (or even the field-level government or NGO functionaries) operate. There is a need to 'unpack' the concepts into their more easily understandable, and locally relatable, effects, so as to make them meaningful at the local levels. Without such unpacking, the concepts tend to remain 'global', i.e., at a level that is unreachable for common people, and consequently '*not-our-problem*' or at least '*nothing-that-we-can-do-to-address*'.

Linked to the above is the clear warning that emerges from all district studies: that climate change is not a distant phenomenon, like God. It is happening here and now, and virtually everyone – farmers, foresters, or fishers; rich or poor; owner or worker; coastal or upland dweller; men or women – is contributing to the process to a greater or lesser extent. It becomes imperative that the levels to which current actions are contributing to climate change and address this at every level starting from the local. This calls for a very high level of awareness-rising amongst the communities (as well as amongst those working with them) and developing appropriate mechanisms to help them undertake reforms in their own areas of work.

Another critical issue that emerges from all district studies is the extent to which the coastal commons have been experiencing the effects of a 'tragedy of the commons', which are exacerbated by the increasing intrusion of new players into the coast. In almost all districts, new activities (industrialisation, mining & quarrying, development projects) are posing serious threats to the continued survival and the livelihoods of the communities, which leads to a scramble for scarce resources that encourages destructive or illegal practices that are already having serious implications for everyone concerned as well as for the overall environment. Increased destitution of the coastal landscape is complemented by ever-growing numbers of migrants leaving their native places to seek work in distant places.

9. Suggested actions based on the findings from the study

9.1. No simple answers

Going by the complex picture of the livelihood context among the coastal communities and the impacts of climate change upon their life and livelihoods, it is clear that:

(i) the awareness necessary for the communities and their support agencies in the government and NGO sectors to undertake any actions to cope with the threat is very limited;
(ii) even if the requisite awareness were to be provided, the communities' capacity to undertake deep systemic changes in their own behaviour and practices is severely constrained because of their vulnerability to a number of more pressing issues; and
(iii) climate change is a process that extends far beyond the local communities (and even the local effects of climate change are largely the work of processes beyond the comprehension and capacity of the small-scale stakeholders to address), requiring actions concerning practices from global level down to the individual level and covering actions often excluded from the conventional development programmes.

It is also clear that the idea of, and understanding about, climate change itself is still in very early stages (it is probably not far-fetched to compare the current debates about climate change to those that had taken place among computer professionals in late-1980s concerning some radical new ideas like 'Windows' and 'Internet'). There exist no clear understanding about climate change that helps us to address it through practical means, and there are currently too many ambiguities and too much controversy surrounding the issue.

That is not to say that climate change is not a major issue of concern; as this study has shown, it has been occurring and having effects that are likely to intensify over the coming years. What is perhaps lacking is a good scientific understanding about the issue. And there does exist some good guidance – based on precautionary principles – that helps start the ball rolling in addressing and mitigating the climate change impacts.

This also means three important points that must be kept in mind when planning any climate-change initiative:

- Firstly, the conventional micro-level development actions focused on a few communities are unlikely to yield results when it comes to climate change. More concerted, broad-based actions spanning across a range of disciplines and a wider geographical area, and connected to the wider national/international forums for addressing CC, are needed.
- Secondly, this is a time-consuming process involving considerable hand-holding of the communities, with no discernible quantifiable benefits in the short-to-medium term.
- Finally, this requires that the initiatives begin at fairly low levels and build the super-structure as time goes on and we gain a better understanding of the issues.

In other words, simple answers will not work because there are no simple answers! And conventional approaches will not be sufficient because climate change is not a conventional development issue.

9.2. Potential areas for intervention

Based on the above considerations, it is suggested that any project aiming to address the climate vulnerability of the coastal communities and enhance their resilience should have four major objectives as a starting point.

1. *Awareness raising in the communities and among the support institutions on CC*
2. *Efforts to explore and reduce GHG emissions in the target communities*
3. *Mechanisms to support and streamline sustainable livelihood enhancement and diversification (LED)*
4. *Undertake programmes to enhance the community resilience to natural disasters*

These are discussed in the following sections, providing a list of actions under each objective.

9.2.1. Awareness raising in the communities and among the support institutions on CC

Given that there is as much – if not more – need to raise the awareness about climate change amongst the support institutions in the government and NGOs, it is necessary that the strategy for awareness raising be focused at two levels:

For the communities:

- There is need to 'unpack' the complex and cumbersome climate change concept into smaller chunks of information that the target communities can identify with and relate to their own experiences.
- Alongside, the awareness campaign should focus on the specific actions by which they are themselves contributing to climate change (through green house gas emissions) and
- identify appropriate alternatives for more responsible actions

For the institutional stakeholders:

- It is necessary to highlight the need to go beyond the conventional development rhetoric and develop a more nuanced and holistic understanding of climate change through a livelihoods-perspective.
- They should also be prepared to incorporate climate change concerns into all their ongoing and proposed programmes of support.
- There should be adequate awareness about the 'human costs' of climate change – especially in terms of the hardships borne by the poorer stakeholders – as well as the inherent resilience of the people to cope with the challenges, in order that an policy level actions take both the vulnerability and the resilience into account for more meaningful interventions.
- There is need to avoid the current emphasis on 'alternative livelihoods' as the sole – or even an appropriate – solution to climate change, and seek more organic and innovative means to address the issue.

9.2.2. Efforts to explore and reduce GHG emissions in the target communities

This will need to take the form of:

- Assessing the specific activities where the GHG emissions are high, and look at their costs from a livelihood perspective (*Could the reduction in GHGs also reduce the costs of operation?*) and from an environmental perspective (*Could the improvement in efficiency not lead to excessive exploitation?*);

- Undertaking participatory and technical assessments to identify:
  (i) appropriate means to reducing GHG emissions and improve efficiencies (which might go beyond technical interventions and include other socially relevant practices)
  (ii) good practices to make the existing systems less energy-intensive and destructive practices
- With the identification of appropriate alternatives and good practices, undertaking pilot scale activities to test their effectiveness in reducing GHGs and increasing efficiencies
- Where successful, dissemination and promotion of energy efficient technologies through demonstration and other extension systems
- Disseminate the concept for wider promotion through government systems (through subsidies and other incentives).

9.2.3. Mechanisms to support and streamline sustainable livelihood enhancement and diversification

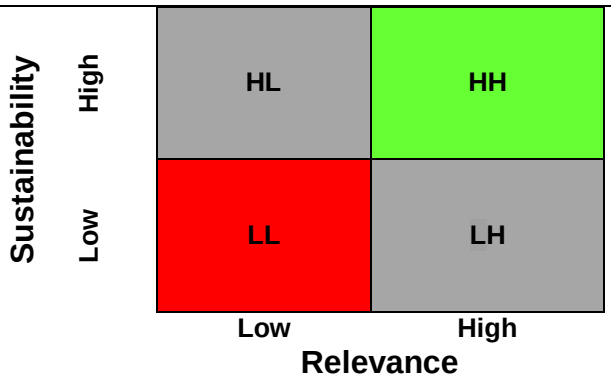
The critical starting point for livelihood enhancement and diversification is the recognition that the stakeholders have a very good understanding of the different options available to them for making a livelihood choice, which is based upon a realistic estimate of their access to different resources. Given that their own choices – however paltry and inadequate they may have proved to be – have certainly succeeded in giving them a chance to survive where most externally driven development initiatives have failed, there is certainly a case to help the communities with what they have been doing (at least so long as it does not involve activities that are outright illegal or dangerous, or pose threats to the natural resources or to their own livelihoods in the long term), only better through improved and enhanced access to resources.

AN ASSESSMENT OF THE COMMUNITY STRATEGIES FOR COPING WITH CLIMATE CHANGE

An important conclusion that can be drawn from the district studies is that, although several livelihood enhancement and diversification programmes (the latter going by the name of alternative income generation-AIG) have been implemented in various contexts by different organisations, they have hardly made a real change for the communities. If anything, by diverting attention (and scarce development funds) along unnecessary channels, they may have contributed to reducing the emphasis that was needed in improving the existing livelihood context.

In order to assess the viability and the sustainability of the various strategies undertaken by the target communities, a simple matrix is suggested here. The matrix assesses the ***relevance*** of a particular strategy in terms of its (i) **appropriateness of the strategy** to address the issue, (ii) ease of **access to the communities** (physical access) and (iii) **affordability of access** to the fishers. The ***sustainability*** of the strategy determines its long term implications on the ecological, economic, technical, institutional and social context in which the activity is undertaken.

By plotting each major adaptive/coping strategy along these two axes using participatory methods, one can classify the strategies into four categories, as shown in the following table:



Where:

- **LL** *stands for low relevance (in terms of addressing the climate change factor) and low sustainability; the chances of failure are high, and it is necessary to seek out other alternatives.*
- **LH** *stands for strategies whose relevance to address climate change may be low, but which are highly sustainable; options to make them more relevant to addressing the climate change impacts will need to be explored.*
- **HL** *stands for strategies that are highly relevant to the climate change issues, but whose sustainability remains suspect; options to assess the possibility of enhancing their sustainability will need to be explored.*
- **HH** *stands for strategies that are highly relevant and very sustainable, and these will need to be promoted widely within and beyond the area.*

The utility of this exercise is that it helps to prioritise the future interventions in livelihood support for the target stakeholder groups. Thus, for those strategies falling into LL category, which include illegal or hazardous activities, the straightforward intervention objective will be to help those people move out into sustainable alternatives. For those strategies falling into HH category, there may not be a need for an intervention strategy itself. It is for those activities – relating both to livelihood enhancement and diversification – which fall into LH or HL categories that the intervening agency (NGO) will need to undertake detailed livelihood analysis – using an SLA or similar methodology – to identify the weak spots that hinder the strategies from moving into the HH category and undertake steps to address those weak spots.

Thus, by helping fix the shortcomings in the existing livelihood enhancement and diversification strategies of the communities, this matrix will help to focus attention on community-determined livelihood support actions rather than bring solutions from outside to little effect.

Some of the suggested activities under livelihood diversification would need to consider:

- Rather than force new ideas/activities on the people, focus on the existing diversification pathways that the communities have been following and assess the need for support to strengthen them along more sustainable lines.
- Accept migration – both geographical and occupational – as a necessary choice to the communities and make efforts to strengthen/streamline the process.
- Undertake support programmes – training, credit, registration, family counselling, legal recognition – to make the seasonal or long-term migration a smooth process for the migrants and their families.
- Ensure access to the migrants in their new locations for social support through institutional means. This will involve lobbying with the concerned government departments – both locally

and in the places/states that they have migrated to – to provide support and social security to them as necessary.
- Networking with like-minded NGOs and other civil society organisations in the areas where the migrants are headed is an appropriate action to ensure ready support for the migrants.
- Highlight the role that women play in the migrant households and support their work through appropriate means.
- Assess the impacts of livelihood diversification and migration on children and the aged people and undertake suitable measures to address their special needs.

9.2.4. Undertake programmes to enhance the community resilience to disasters

As disasters and their intensity keeps increasing as a result of climate change, there is need for strong community level capacity building actions that would become self-governing and self-sufficient in a given timeframe (say 3-5 years). This will involve looking beyond the usual 'cyclone drills' and identifying critical areas that need strengthening on a more sustainable basis.

There is also need to look beyond occasional disasters like cyclones (catastrophic as they no doubt are) and focus on the myriads of daily disasters that the target groups face; an unseasonal cloudburst could essentially wipe out the entire investment of a fish processor-trader by destroying the fish she's drying. An unseasonal rain could destroy a mango crop or a freak hailstorm could affect a banana orchard. And for the farmers, as one of the respondents in this study pointed out, it rains only when it is least needed and most dreaded, effectively wiping out a whole crop within a few hours.

And the disasters are not always natural. They could be man-made too. Frequent failures of markets to absorb and effectively compensate for the farmers' produce are a major disaster for the farmers. In the absence of the necessary access to warehouses for effective storage of their goods or to the capital that they would need to continue their operations even if they could not sell their produce immediately, the farmers are forced into distress sales. Transport failures or delays or accidents have similar disastrous connotations for the farmers and the fishers.

Obviously, by focusing on these small-scale disasters and providing some sort of insurance (in real terms as well as metaphorically) to help the stakeholders cope with them effectively, the project could potentially increase their resilience to the bigger disasters when they strike. After all, the same localities where the poorer stakeholders live also happen to be the places that the richer people live. However, the issue of being hit by a natural disaster like a cyclone is never as difficult a proposition to the more affluent people as it is to the poorer people. This underlines the fact that increased exposure to natural disasters is essentially an outcome of poverty and poor livelihood conditions. As the livelihood context is sustainably improved, the threat of natural disasters too will recede in proportion.

Activities in this respect might be:

- Identify the specific disasters that a community is prone to and develop awareness and capacity building programmes aimed at the specific issues of importance for each community

- Assessing the specific conditions at the household level that make them most vulnerable to natural disasters
- Provide awareness and capacity building programmes to help the communities at large to cope with the disasters and ensure the programme's self-sustainability.
- On a pilot scale, taking measures to address the 'daily disasters' that the household is exposed to, which include setting up micro-finance and micro-insurance programmes
- Link the initiatives with the government support packages to enhance the household's access to wider resources
- Wider dissemination and promotion of the outcomes of the pilot scale activities for wider uptake and support
- Monitor how the household is coping with the daily disasters on its own.

9.3. Implementation issues

9.3.1. Facilitation, coordination and linkages

A pre-requisite to enable facilitation, coordination and establishment of linkages among various support institutions on climate change will be the setting up of a Climate Change Resource Centre (CCRC). The CCRC will:

- to act as a nodal point for collection, collation and dissemination of CC-related information and advice, with special emphasis on the 'human costs' highlighting the impacts on women, children, aged people and other marginalised and vulnerable sections
- to work in close collaboration with selected list of like-minded NGOs in each district, to help them keep up-to-date with the global and national context in climate change studies and processes and to obtain timely information from them to keep the qualitative and quantitative databases on climate change impacts in selected communities up-to-date
- to network with relevant government and CSOs to facilitate coordinated actions all along the coastal area
- to undertake regular programmes for awareness raising, experience sharing and brainstorming among the partner organisations
- explore and implement mechanisms to make the CCRC self-sustaining during the project life so as to ensure its continued long-term survival.

9.3.2. Information needs

A major area that needs to be addressed is the current lacuna in the information on climate change in relation to its impacts on the target groups. This will be necessary to develop more comprehensive understanding about the implications of CC on the target communities across (i) sectors and (ii) districts.

This will require:

- working in fewer villages more intensively to obtain a clear understanding of the CC processes and their impacts on the people;

- undertaking rapid surveys in a wider area covering larger number of villages to obtain quantitative estimates to highlight the magnitude of the problem at higher levels;
- identifying indicators to mark the climate change processes in the selected communities and monitoring them on a regular basis.
- developing databases of the potential impacts of CC on different stakeholder groups (fishers, farmers...) that are periodically updated; and
- developing a well-oiled machinery for consolidation and dissemination of information.

10. References:

Ahana Lakshmi, 2011. *Review of Literature on Climate Change*, as part of the ICSF *Study Climate Change and Fisheries: Perspectives from Small-Scale Fishing Communities in India on Measures to Protect Life and Livelihood*, Draft.

IPCC, 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Nageswara Rao., K P. Subraelu, T. Venkateswara Rao, B. Hema Malini, R. Ratheesh, S. Bhattacharya, A. S. Rajawat and Ajai. (2008). *Sea-level rise and coastal vulnerability: an assessment of Andhra Pradesh coast, India through remote sensing and GIS*. *J. Coast Conserv*. 12:195–207

Salagrama V & Thaddeus Koriya, 2008. *Assessing Opportunities for Livelihood Enhancement and Diversification in Coastal Fishing Communities of Southern India*. Food and Agriculture Organization of the United Nations, United Nations Team for Tsunami Recovery Support (UNTRS), Chennai. 129 p.

Salagrama, V. 2012, *Climate Change and Fisheries: Perspectives from Small-scale Fishing Communities in India on Measures to Protect Life and Livelihood*, Samudra Monograph, published by the International Collective in Support of Fishworkers, Chennai in collaboration with Heinrich Böll Stiftung-India, ISBN 978 93 80802 06 0

Vivekanandan, E., 2006. *Impact of Climate Change on Marine Fisheries*. CMFRI Newsletter, Oct-Dec 2006, cited in Ahana Lakshmi, 2008.

Vivekanandan, E., 2008 *Options on fisheries and aquaculture for coping with climate change in South Asia* (presentation). International Symposium on Climate Change and Food Security in South Asia, Dhaka, 26th August 2008.

ANNEXURES

Annexure 1: Study questionnaire for district studies

Proposed Components for the Study Assessment:

i. **Assessing and addressing current and future climate risks at Village level.**

Example actions/indicators:

- Has the Village Panchayath (PRI) done a **Village climate and disaster risk assessment** that included identification and prioritization of actions? (Eg. Preparedness for Disaster & Climate Change programme)
- Does the PRI keep in touch with **climate and disaster related stakeholders**, is regularly updated on the nature of changing climate risks, disaster risks and considers them in planning?
- Does the PRI have a disaster response plan that includes forecast based contingency plans at various levels? Are these contingency plans considering forecast information on different timescales (days, months, years) for pre-emptive action?
- Does the PRI have an active **climate change focal point**?

ii. **Assessing and addressing current and future climate risks with communities:**

Example actions/indicators:

- Are **community perceptions** of changing climate investigated using participatory tools? (eg. seasonal calendar) Are they documented/shared?
- Are **community methods** of dealing with climate risk (current and traditional) documented during the baseline or risk assessment phase?
- Is community access to, understanding of and need for **early warning** information assessed?
- Do structural projects consider a level of acceptable risk in the project design that incorporates **anticipated trends** in climate change?
- Are climate elements incorporated into **baseline surveying**?

iii. **Education and awareness rising:**

Example actions/indicators:

- Are the majority of PRI Members able to explain, in basic terms, the **causes of climate change** as well as the main **trends, projections** and **likely impacts** of current and future climate change in their village?
- Are public **behavior change /awareness campaigns** implemented based on the knowledge of changing climate risks?
- Are targeted communities able to **explain** the causes and threats of climate change and actions to act upon it (if relevant to area)?
- Are **schools engaged** in climate change awareness messages that are linked with locally relevant risk reduction measures where appropriate?"

iv. **Non-traditional partnerships and networks:**

Example actions/indicators:

- Are the members of PRI able to list **climate related stakeholders** (NGOs, Government, academics) as they relate to their work?
- Is there an active relationship with the **government's climate change focal point**?
- Has the PRI discussed the longer term climate change projections, their humanitarian implications and possible actions to take?
- Is the PRI linked with their **national meteorological service**? Do they (Community) receive short and medium term **forecasts for disaster preparedness; do they understand how to interpret them?**
- Are the implications of climate change being discussed with existing stakeholders such as the **Health, Agriculture, Environment and Forest Departments and DDMA**?

v. Advocacy:

Example actions/indicators:

- Does the national focal point **share experiences** working on climate change within the National Society, amongst other NS and within the broader DRR/CC/health community?
- Has the **leadership** of the Village been engaged/have an understanding of the issue?
- Are the PRI and Government departments actively contributing to DRR/**climate change groups** at the Village level?
- Does the PRI have an active, **two-way relationship** with the meteorological Department/MRO office or early warning disseminators? Does the PRI feel confident in informing the community information needs?
- Does the PRI engage in **advocacy opportunities** such as meetings, Grama Sabhas for action, forums, conferences etc.?
-

vi. Integrating climate change into existing training, plans and strategies

Example actions/indicators:

5. Does the PRI incorporate climate related and Disaster Preparedness **training** into its standard trainings for vulnerable communities and Village level workers/ volunteers?
6. Have both **health and disaster management** sections of the PRI been engaged in climate change activities?
7. Does the PRI have climate change related indicators?

Annexure 2: CADME partner NGOs involved in the implementation of the study

SRIKAKUALM DISTRICT
1. SWEEP
2. YARD
3. BREDS
4. REALS

VIJAYANAGARAM DISTRICT
1. NEED
2. ASRA
3. SABALA
4. SRUJANA

VISAKHAPATNAM
1. SVDS
2. MAHILA ACTION
3. VIKASA
4. NYS

EAST GODAVARI
1. CREATORS CHARITABLE ORGANISATION
2. PALLESIRI
3. SASS
4. ARISE

WEST GODAVARI
1. NCYS
2. SPARK
3. AWARD
4. SHERDS

KRISHNA
1. CRASA
2. PPSS
3. SNEHA

GUNTUR
1. SEEDS
2. SERVICE
3. MITRA

PRAKASAM
1. SNIRD
2. SUPPORT
3. RAKSHANA
4. SARDS

NELLORE
1. CJWS
2. RDO
3. APPLE
4. NAVAJEEVANA