Sustaining Agriculture in the era of Climate Change in India

(Civil Society position paper)

ऑक्सफैम इंडिया
Oxfam
India

Sustaining Agriculture in the era of Climate Change in India

(Civil Society position paper)

G. V. Ramanjaneyulu
Kavitha Kuruganti

Centre for Sustainable Agriculture

12-13-445, Street No. 1, Tarnaka, Secunderabad - 500 017, India.

Citation
Sustaining Agriculture in the era of Climate Change in India-Civil Society position paper
(For Private Circulation Only)
2009

Center for Sustainable Agriculture
Secunderabad - 500017, India.

Cataloguing-in-publication
Main entry under the title
Sustaining Agriculture in the era of Climate Change in India
Sustainable Agriculture, Climate Change
Centre for Sustainable Agriculture, Oxfam India, Jatan Trust
UDC 633.85:33 (047)

Documentation
G. V. Ramanjaneyulu
Kavitha Kuruganti

Financial Assistance by
Oxfam India

Published by
Executive Director
Centre for Sustainable Agriculture
12-13-445, Street No. 1, T arnaka,
Secunderabad - 500 017, India.

Acknowledgements

We thank the ecological farmers whose foresight and immense knowledge on farming methods for providing ready assurance that has both adaptive and mitigative potential to changing climate. We thank pioneers in ecological farming Bhaskar Save, Subhash Sharma, farmers from Andhra Pradesh and Maharsahtra whose farm data shows very reassuringly the potential of organic farming.

The authors would like to thank all those involved in the drafting of the position paper. The people from civil societies who took part in national workshop on "Climate change and sustainable agriculture" organized by Oxfam India in New Delhi on 3-4th November, 2008. The special contributions of Kapil Shah *(Jatan Trust)*, Claude Alvares *(OFAI)*, Devinder Sharma and Bhaskar Goswami *(Forum for Biotechnology &Food Security)*, Aditi Kapoor *(Oxfam India)* were very much helpful and there are several other friends that gave their valuable information and perspectives, we thank Neth Dano *(TWN)*, Sangeeta Sharma *(Annadana)*, Gangi Reddy *(APPS)*, Umendra Dutt *(KVM)*, Mandeep *(VPO-Panniwala Mahla)*, Debjeet Sarangi *(Living farms)*, Usha *(save our rice campaign)*, B P Suryavanshi *(KMAGVS)*, Ajit Kelkar *(AAHRD)*, Utkarsh Ghate *(CCD)*, Ram Niwas Singh and K V Amit *(GEAG)*, Gopi Krishna *(Greenpeace)*, Indrya Rai, Vanita Suneja, Anwar and Vinay Kaushik, Sneha Shetty, Nanda Kishore Singh, Nisha Agarwal and Vinuta Gopal *(Oxfam India)*, G R Dharmendar *(CSA)*, Poonam Pande *(Sustainet)*, Yudhvir Singh *(Bharatiya Kisan Union)*, Shatarupa Kashyap *(AFPRO)*, Ranu Bhogal *(UNDP Solution Exchange)*, Rajini Dave, Prakash Gardia, P S Pathak, Sukhmani Kohli, Upasna Sharma *(TERI)*, Raj Ganguly *(FAO)* and Ramesh Menon *(freelance journalist)*.

We thanks eminent scientists from various public institutions for contributing in the workshop with good information and experiences such as B Venkateshwarlu *(CRIDA)*, Raji Reddy *(ANGRAU)*, Surendranath Pasupalak *(OUAT)*, A K Yadav *(NCOF)*, U M Rao and S A Patil *(IARI)*, S K Sharma and J C Rana *(NBPGR)*, Arabinda Kumar Padhee *(IAS)*.

We thank Members from the Planning Commission Dr V L Chopra and Dr Surya Sethi who gave the larger picture on India's efforts in the direction.

We immensely thank Mr Shyam Saran (Chief Negotiator for GoI) for his commitment to fight climate change and his willingness to take ecological farmers' experiences on the larger canvas of NMSA. We thank him once again for involving the civil societies in official consultations since the workshop.

Dr G V Ramanjaneyulu

Ms Kavitha Kuruganti

This is a position paper drafted by civil society groups including farmers' organizations in India, on the potential of Sustainable Agriculture (SA) in the context of Climate Change (CC).

This paper is premised on the fact that the imperative to shift to sustainable farming is more urgent than ever in the era of anthropogenic climate change, though the imperatives for such a shift flow from other factors too (including increasing enormous public financing needs for inputs like chemical fertilizers, the lack of economic viability of the current model of farming for millions of farmers, the environmental health disaster that is unfolding in different parts of the country due to intensive agricultural technologies, the ecological degradation of productive resources in these intensive models etc).

India is predominantly an agrarian society with three-fourths of its population living in rural areas. Agriculture is the main source of livelihood for two-thirds of the population. The profound changes in Indian agriculture since the 1960s have had cascading effects on India's agrarian economy and society. The worst affected in the process are the small and marginal farmers [SMF] who constitute 70% of the farming community. As per the data from the Census Division, Ministry of Agriculture, Government of India, operational holdings below 4.0 hectares (ha) constitute 93.6% of the operational holdings in 2000-01, covering 62.96% of the operational area, or about 100.65 million ha in absolute terms.

The crises in the farmers' economy and rural ecology due to the current models of farming are well documented. The increasing costs of cultivation due to increasing dependency on the external inputs. The high dependency on chemical inputs has also created ecological crisis across the country, particularly in the Green Revolution belts. In addition now Climate change is a reality for a majority of Indian farmers even as plans are being evolved at the government level mostly to create adaptive capabilities; meanwhile, Indian farmers are being forced to adapt to several CC-related changes by themselves because they have no other choice. For no fault of theirs, Indian farmers, like the most marginalized everywhere, are paying a high price for anthropogenic climate change. The worst-hit, as usual again, are small and marginal holders in marginalized locations with social disadvantages to begin with. Such farmers have meager resources to buffer them from the new risks that climate change poses.

The macro-plans being created by the government in India are mostly meant for the National Agricultural Research System (NARS) and a re-arranging of their research agenda in the context of climate change – the NARS's linear systems of "lab to land" research have been already critiqued for their non-participatory, top-down, unaccountable nature. Such systems which are centred on unilateral knowledge generation only within agricultural universities to be then carried to the farmers for adoption through the agricultural extension system, discounting farmers' (traditional) resources and knowledge, will be grossly inadequate for the immediate needs of adaptation. The adaptation requirements are to be met urgently, with no time lost (the time taken for conventional knowledge generation by the NARS to be then 'transferred' to farmers is ill-affordable here). This is where a new learning paradigm is needed – to learn from farmer innovators, from traditional knowledge and resources and disseminating useful practices and resources to others.

This position paper, while agreeing in principle with India's international stand in climate negotiations that agriculture-related Green House Gas emissions cannot be equated in any manner with lifestyle-related GHG emissions and appreciates the 'common but differentiated action' demand, takes a stand that if sustainable agriculture is promoted and established even for adaptation reasons, it will result in mitigation of GHGs too. Sustainable Agriculture practices in farming are therefore a win-win option where mitigation cannot be interpreted as coming in the way of equitable and just growth of the nation. These practices as the following sections show, contribute to increased food and nutritional security, contribute to sustainability of productive resources and improvements in rural livelihoods. They also lead to mitigation of GHG emissions from farming.

The Indian government has no reason to shy away from understanding and stating the negative impacts of GHG-inducing intensive models that have been promoted so far. It is time that fundamental shifts are made in the agricultural technologies that are promoted in the country, to address the imperative of climate change (amongst other imperatives).

CLIMATE CHANGE & AGRICULTURE IN INDIA

India is a large country with 15 agro-climatic zones, with diverse seasons, crops and farming systems. For a majority of people in India, to this day, agriculture is the main source of livelihood. Agriculture is the most vulnerable sector to CC as it is inherently sensitive to climate variability and CC will leave its impacts on Indian agriculture in various direct and indirect ways. This obviously means an impact on the lives and livelihoods of millions of Indians.

For instance, it is reported that about two-thirds of the sown area in the country is drought-prone and around 40 million hectares is flood-prone. The poorest people are likely to be hardest hit by the impacts of climate variability and change because they rely heavily on climate-sensitive sectors such as rainfed agriculture and fisheries. They also tend to be located geographically in more exposed or marginal areas, such as flood plains or nutrient-poor soils. The poor also are less able to respond due to limited human, institutional and financial capacity and have very limited ability to cope with climate impacts and to adapt to a changing hazard burden.

Impacts of CC on agriculture: Climate change is manifesting itself in many ways across the country. Among the indicators, while long term rainfall data analysis shows no clear trend of change, regional variations as well as increased rainfall during summer and reduced number of rainy days can be noticed. In the case of temperature, there is a 0.6^{O} C rise in the last 100 years and it is projected to rise by $3.5\text{-}5^{O}$ C by 2100. The carbon dioxide concentration is increasing by 1.9 ppm each year and is expected to reach 550 ppm by 2050 and 700 ppm by 2100. Extreme events like frequency of heat and cold waves, droughts and floods have been observed in the last decade. The sea level has risen by 2.5mm every year since 1950 while the Himalayan glaciers are retreating. These are all symptomatic of climate change.

Available research indicates that climate change-induced rise in temperature is going to affect rainfall patterns – farming in India depends on monsoons and there is a close link between climate and water resources.

The organic carbon levels and moisture in the soil will go down while the incidence of runoff erosion will increase. The quality of the crop will also undergo change with lower levels of nitrogen and protein and an increased level of amylase content. In paddy, zinc and iron content will go down which will impact reproductive health of animals. Insect lifecycles will increase which in turn will raise the incidence of pest attacks and virulence. Other likely impacts are change in farm ecology viz. bird-insect relations, and an increase in the sea levels which will cause salinity ingression and submergence.

It is projected that due to climate change, kharif rainfall is going to increase and this might be positive for kharif crops. Further, for *kharif* crops, a one-degree rise in temperature may not have big implications for productivity. However, temperature rise in rabi season will impact production of wheat, a critical food-grain crop.

The surface air temperatures will increase by 2 to 4°C by 2070-2100. As mentioned earlier, the *rabi* crop will be impacted seriously and every 1^{O}C increase in temperature reduces wheat production by 4-5 million tons, as per a study by IARI. This loss can be reduced to 1-2 million tons only if farmers change to timely planting. Increased climatic extremes like droughts and floods are likely to increase production variability. Productivity of most cereals would decrease due to increase in temperature and decrease in water availability, especially in Indo-Gangetic plains. The loss in crop production is projected at 10-40% by 2100, depending upon the modeling technique applied.

The impacts of climate change are already visible. A network of 15 centres of ICAR working on studying climate change has reported that apple production is declining in Himachal Pradesh due to inadequate chilling. This is also causing a shift in the growing zone to higher elevations. Similarly, in the case of marine fisheries, it has been observed that Sardines are shifting from the Arabian Sea to the Bay of Bengal, which is not their normal habitat. In fact, fisheries are the most vulnerable sector to climate change. Crops have the ability to adapt to extreme climate variability even up to, say, 4^0C while fishes and animals do not. It has also been recorded that the pest ecology of certain crops is changing due to climate change.

Extreme weather conditions resulting in disasters will obviously have their own socio-economic impacts, especially on the poor. Further, changes in crop productivity will have implications on farmers' incomes. Changes in agronomic practices etc., can help farmers to adapt to the changing conditions.

<u>Impacts of agriculture on Climate Change</u>: While climate change affects Indian farming and farmers' livelihoods adversely, the converse is also true – Indian agriculture, even if not in the same degree as the developed world's agriculture, does contribute to Climate Change.

Capital depletion and massive additions of external inputs in a 'linear' model (as opposed to cyclical systems in ecological farming models) are characteristic features of intensive, industrialized models of agriculture. In this model, a farm is treated like a factory with inputs and outputs calculated in a monocropped situation with grain yield given the highest importance compared to any other parameter and often, the externalized costs are ignored.

Amongst various GHGs that contribute to global warming, carbondioxide is released through agriculture by way of burning of fossil fuel; methane is emitted through agricultural practices like inundated paddy fields, for example; nitrous oxide through fertilizers, combustion of fossil fuels etc. Nitrous oxide has a global warming potential 296 times greater than CO2. In India, it is estimated that 28% of the GHG emissions are from agriculture; about 78% of methane and nitrous oxide emissions are also estimated to be from agriculture.

As per the Intergovernmental Panel on Climate Change (IPCC), every quintal of nitrogen applied in farming emits 1.25 kg of nitrous oxide and globally half of the nitrogen applied to crops is lost to the environment. The greenhouse gas emissions from fertiliser manufacture and use in India reached nearly 50 million tonnes of CO_2-equivalent in 2006/07, which represents about 3 percent of total Indian greenhouse gas emissions.

Another major contributor of GHGs is the burning of crop residues. In Punjab, wheat crop residue from 5,500 square kilometers and paddy crop residues from 12,685 square kilometers are burnt each year. Every 4 tons of rice or wheat grain produces about 6 tons of straw. Emission Factors for wheat residue burning are estimated as: CO-34.66g/Kg, NOx – 2.63g/Kg, CH4 – 0.41g/Km, PM10 – 3.99g/Kg, PM2.5 – 3.76g/Kg.

Burning of crop residues also impacts the soil (fertility). Heat from burning straw penetrates into the soil up to 1 cm, elevating the temperature as high as 33.8–42.2°C. Bacterial and fungal populations are decreased immediately and substantially in the top 2.5 cm of the soil upon burning. Repeated burning in the field permanently diminishes the bacterial population by more than 50%. The economic loss due to the burning of crop residues is colossal. Each year 19.6 million tonnes of straw of rice and wheat, worth crores of rupees are burnt. Used as recycled biomass, this potentially translates into 38.5 lakh tonnes of organic carbon, 59,000 tonnes of nitrogen, 2,000 tonnes of phosphorous and 34,000 tonnes of potassium every year.

Another potent GHG is methane which is emitted in copious amounts through inundated paddy cultivation. In India, of a total area of 99.5 Mha under cereal cultivation, 42.3 Mha (or 42.5%) is under rice cultivation. It is grown under flooded conditions and the seedbed preparation involves puddling or plowing when the soil is wet to destroy aggregates and reduce the infiltration rate of water. Such anaerobic conditions lead to emission of methane and possibly nitrous oxide through inefficient fertilizer use. Emission of methane from rice paddies in India is estimated at 2.4 to 6 Teragram (Tg) out of the world total emission of 25.4 to 54 Tg from all sources and 16 to 34 Tg from rice cultivation. The average methane flux from rice paddies ranges from 9 to 46 g/m2 over a 120- to 150-day growing season.

Another indirect contribution of agriculture to GHG emissions comes in the form of large dams. Large dams contribute 18.7% of emissions in India as per an estimate. Total methane emissions from India's large dams could be 33.5 million tonnes (MT) per annum, including emissions from reservoirs (1.1 MT), spillways (13.2 MT) and turbines of hydropower dams (19.2 MT).

The livestock sector is another major contributor to production of GHGs. For the year 1997, livestock contributed 9.0 Tg methane and 1 Gg nitrous oxide which in terms of CO equivalent it is around 190 Tg. Shift to stall-fed systems of livestock rearing creates problems with the dung while shift from fodder to feed, concentrates etc. carries higher ecological foot prints.

There is also the issue of more energy use in intensive farming models in the form of fossil fuels for machinery like tractors, harvesters and so on, pumps for irrigation etc.

POTENTIAL OF SUSTAINABLE AGRICULTURE AS LOW-GHG, RESILIENT FARMING SYSTEMS

Sustainable Agriculture can be defined as an integrated farming system (with crops, trees, livestock etc.) which is based on locally adapted agro-diverse cropping patterns and use of local resources (natural resources and natural processes), based on local knowledge, skills and innovations[1]

This Position Paper would also like to highlight the potential of sustainable agriculture, in terms of mitigation of GHG emissions as well as adaptation to climate change. Further, sustainable agriculture holds great potential for meeting global and national food security requirements even as it leads to improvement of farmers' livelihoods through enhancing their net incomes and improving the productivity of their resources in the long run.

Food security: A question that is often posed with regard to sustainable agriculture or organic farming is whether it will be able to feed the growing population. We respond by saying that sustainable agriculture does not imply lowered yields, as experience of successful farmers bears out on the ground. This is reinforced by an FAO report (2007) which says that "conversion of global agriculture to organic management, without converting wild lands to agriculture and without using N-fertilisers would result in a global agricultural supply of 2640 to 4380 Kcal/ person/day". Sustainable intensification in developing countries through organic practices would increase production by 56 per cent. A meta-analysis of 133 scientific papers concluded

[1] *This document, while using terms like organic farming, organic agriculture, sustainable agriculture, ecological farming interchangeably, has this holistic concept in mind while using these various terms*

that organic agriculture was particularly competitive under lower yield environments, a feature that is common in developing countries. Organic yields on average are comparable to conventional yields although yields do decline initially when converting from high-input systems and almost double when converting from low-input systems. In India, it should be remembered that a majority of land is rainfed and continues to be low-input by default.

Improvement in rural livelihoods: While macro-level food production and availability levels are likely to increase through sustainable agriculture, at the individual and community level too, there are bound to be improvements. As FAO notes again, access to food will increase by livelihood improvement both for farmers and agricultural workers through organic farming. Organic agriculture improves food access by increasing productivity with better soil health, diversity (growing multiple crops) and conservation of natural resources, by raising incomes, improving employment and by reducing risks. It has been recorded that shift to sustainable agriculture practices can reduce the outward migration from rural areas.

Reduction in GHG emissions: Changes in farming models and practices towards sustainable agriculture offer a significant opportunity at reducing GHG emissions. Organic farms use on an average 33 to 56 per cent less energy per hectare, as per FAO (2007).

Organic farming reduces its fossil fuel dependence in many ways. For instance, for soil productivity management, internal inputs and practices are used rather than chemical fertilizers – for instance, creating the micro-climate required for increased soil (beneficial) microbial activity. This is done by returning bio-mass to the soil. Legume production, crop rotation, mixed cropping etc., are other ways of achieving this. Pest management also does not depend on chemical pesticides but a variety of local resources and practices.

IFOAM notes that avoidance of methane emission is also possible through organic agriculture – through the promotion of aerobic micro-organisms and high biological activity in soils, oxidation of methane can be increased. Through practices like System of Rice Intensification, which is mostly based on principles of ecological farming, flooding in rice paddies can be reduced and thereby, methane emissions.

Nitrous oxide, result of overdoses and losses on nitrogen, can be effectively minimized through sustainable agriculture practices. While production of chemical fertilizers is an energy-intensive process that emits carbondioxide and nitrous oxide, application of nitrogen fertilizers makes the soil emit nitrous oxide. These can be avoided through organic farming.

Sustainable agriculture also increases the Soil Organic Carbon (SOC) by incorporating organic materials into the soil. Soil can be a major source of storage of carbon, about twice as much carbon as in the atmosphere. Fertiliser use replaces soil organic matter in intensive systems, which reduces potential sequestration. Crop, tree and livestock integration with a systematic recycling of organic wastes is an integral part of sustainable agriculture. Long term studies have shown that compost application and cover crops in rotation were particularly adept at increasing soil organic matter even in comparison to no-tillage techniques. While conservation tillage is promoted elsewhere as a way of sequestration of carbondioxide, this is often done by the use of chemical herbicides and GMOs which have their own ecological implications. In sustainable agriculture however, mitigation of climate change can be addressed both by carbon sequestration in the soils and minimized emissions of GHGs. Agro-forestry is also a desired principle of organic farming which further adds to the potential of SA in carbon sequestration.

Creation of resilient systems leading to better adaptation:

Extreme and unpredictable weather conditions are part of the reality of climate change even as temperature rise and changes in rainfall, changes in pest and disease incidence etc., will also be the stark reality for farmers. What the situation then requires are resilient and adaptive farming systems with the least amount of loss to the productive resources, production and the farmer.

One of the most important requirements for adaptation would be farmers' knowledge, in negotiating complex agro-ecosystems. As a philosophical approach, organic farming has always laid thrust on farmers' skills, knowledge, innovation, horizontal sharing, observations and intuition etc. Several large organic farming projects across the world have built successful institutional models for systematic support for farmers' knowledge and innovation and constant enhancement. This forms a key part of the adaptation potential of sustainable agriculture.

To address extreme weather conditions, organic farms will be better suited. The better drainage and water holding capacity of organic soils reduces the risk of drought and soil erosion, for instance. Organic farming practices are in a good position to maintain productivity in the event of drought, irregular rainfall events and rising temperatures, notes a recent technical paper from International Trade Center (WTO) and FiBL. This paper notes that soils under organic management retain significantly more rainwater thanks to the "sponge properties" of organic matter. Water percolation is 15-20% more in organic systems. Water capture in organic plots was twice as high as conventional plots during torrential rains, which in turn reduces the risk of floods.

The most important component of organic systems - diversity - contributes a lot to the resilience of organic farms. Enhanced biodiversity of organic farms have several positive ecological implications – pest prevention, and similar effects on diseases, better utilization of soil nutrients and water etc.

Organic farming is also associated with decreased irrigation needs by about 30-50%. This becomes an important part of adaptation in drought conditions.

Given the mitigation and adaptation potential of organic systems, as well as the potential to increase food security, it becomes imperative to shift agriculture towards more ecological farming models which are sustainable.

Potential of Organic Farming beyond purely agricultural technologies: Organic farming often also focuses on consumer behaviour and encourages lower ecological footprints through localized food production and consumption and reducing food miles too. Responsible consumer behaviour also goes a long way in mitigating emissions since it is found that a significant contribution to GHG emissions is also from long food miles and any plans for addressing CC should focus on the entire chain from farm to plate.

This paper would like to reinforce that such farming, even though farmers adopting it are at a disadvantage due to lack of support systems in the form of extension, marketing, grassroots institutions etc., is already being practiced successfully in lakhs of acres all over the country. In large government-supported sustainable agriculture projects like Community Managed Sustainable Agriculture (CMSA) in Andhra Pradesh, where women farmers are taking a lead in implementing a large ecological farming project on more than ten lakh acres, it has been found that it is possible to scale up organic farming onto large areas, with sensitive support systems built along with people's institutions at the village level. The CMSA programme, being implemented since 2005, has shown that farmers do tend to adopt and spread ecological practices at a rapid pace provided they are collectivized into village-level institutions and provided that appropriate extension support is provided from the village upwards. In this programme, available data shows that there has been no fall in yields for farmers shifting to organic farming. Data shows that the village economy stands to gain a lot due to savings on expenditure on external inputs and net incomes of individual farmers rise.

INDIA'S NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC)

India has announced a National Action Plan on Climate Change in August 2008. The NAPCC's formulation processes were found to be very top-down and non-participatory by many analysts.

The NAPCC proposes to address climate change-related issues in India through the setting up of eight inter-connected Missions: National Solar Mission; National Mission for Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission for Sustaining the Himalayan Ecosystem; National Mission for a "Green India"; National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change.

The following are some of the key points that emerged as a response from civil society to the NAPCC proposals under National Mission on Sustainable Agriculture.

- **Definition of sustainable agriculture required**: Sustainable Agriculture is a misnomer for what has been proposed, under the name of Sustainable Agriculture and therefore, a correct, common understanding of the term is required. The current set of proposals would not lead to improving the soil health, central to sustainable agriculture, nor to cyclical models of farming, internalizing farm inputs (including crop waste) into farming systems, which define sustainable agriculture[2]. On the contrary, the existing suggestions would continue the conventional linear, intensive models that further the existing dependency of farmers on external agencies for everything, including for knowledge. That is one of the reasons for the current day crisis in agriculture.

- **Creating the imperative for the paradigm shift**: The NAPCC makes no mention and assessment of Green Revolution-induced climate change in India. Shying away from stating the issues with the current model of agriculture will not create the imperative for a shift to sustainable agriculture, which is a requirement both for mitigation as well as adaptation. The NAPCC should clearly specify incentives to farmers for shifting to organic farming and sustainable agriculture practices. The government should realize that the imperative to shift to sustainable agriculture is larger than climate change.

- The NAPCC, especially in the sections related to agriculture, does not bring up mitigation possibilities at all – while that could be a posture adopted at the international level, for common but differentiated responses, it is interesting to note that the only place where mitigation is mentioned is to make the entry of Genetically Engineered crops a possibility. Further, the NAPCC should expressly acknowledge the potential that exists of mitigating GHG emissions from farming through a shift to organic farming.

- **Policy approach**: Strategies should be evolved for a time-bound phasing out of climate change-inducing practices towards sustainable agriculture with clear targets and financial outlays. This includes a focus on the role of pasture lands, fisheries, animal husbandry (rather than the bias on crop husbandry that is present in the NAPCC) and seed banks governed by farmers' bodies as major thrust areas for adaptation. Or, when

---

2 Sustainable agriculture includes organic agriculture and is variously referred to as ecological agriculture or natural agriculture. It is characterized by agro-forestry, mixed cropping and crop rotation.

plans are made about access to information, the emphasis should not be just on information packages to farmers in a top-down manner about geo-spatial impacts of climate change, but also data on conventional vs. organic practices so that informed choices can be made by farmers.

- **Biotechnology**: On the use of biotechnology, especially genetic engineering, as part of the NAPCC (National Mission on Sustainable Agriculture), it is felt strongly that the government should focus on reducing the present subsidies to GHG-emitting practices like fertilizers rather than come up with GE seed varieties which are supposed to reduce GHGs. The proposed research like conversion of existing C3 plants to C4 plants for better adaptation using GE tools may not yield any results. Instead the focus should be on promoting crops like Millets which have C4 pathway and are more efficient in adapting to the climate vagaries. In fact, an assessment of the stress (in) tolerance of GE crops, high resource consumption and biosafety questions should be an important part of understanding the implications of Genetic Engineering as an agricultural technology in the era of climate change.

- **'Land to lab' programmatic interventions**: The NAPCC focuses too much on setting a research agenda for the NARS (National Agricultural Research System), following the old model of 'lab to land' research and not so much about programmes to be implemented immediately at the farmers' level. In the context of climate change and adaptation, there is hardly any time to be lost and farmers' need for resilient systems cannot wait for more research in the old paradigm to be taken up. The need is for solutions discovered from the farms, assessed and validated and spread to others, especially in terms of adaptation. There is a strong opinion that there is enough evidence of time-tested practices and experiences from the ground of certain sustainable agriculture principles and practices creating resilient farming systems. Further, civil society organizations also have enormous experience with creating effective people's institutions at the ground level which will allow for the delivery of programmes in an effective fashion. Therefore, the overwhelming need is for immediate programmatic interventions drawing on the strength of traditional knowledge and resources, farmers' innovations and experiences with the civil society.

  Alternative, horizontal extension systems with farmers' organizations at the centre are an important part of information-centred addressal of climate change.

  As part of the NAPCC, capacity building of agriculture scientists and extension workers on organic farming should be taken up so that they are equipped to take the message to farmers.

- **Traditional knowledge & resources**: The National Action Plan does not give adequate prominence to traditional resources and knowledge, which need to be made a cornerstone for interventions on sustainable agriculture. It was felt that popularization of traditional knowledge in addition to ever-evolving innovations in the fields of practicing organic farmers should be considered to be an important component of adaptation to climate change in agriculture. Such farmers should be identified and lessons learnt and disseminated through the extension system.

  There should be an emphasis on falling back on indigenous resources (seeds, animal breeds etc.), which have proven track record of adaptation to stress conditions. The Plan should also make Seeds, as replicable resources in the hands of farmers institutionalised the form of seed banks, as a major thrust and strategy for adaptation. As part of the NAPCC, there should be a mechanism evolved to track and monitor genetic erosion for all of the country due to climate change.

- **Centre-State relations**: State governments should be involved in consultations and planning right from the beginning – it is not enough that centrally-evolved plans are imposed upon them. In fact, it is ultimately the departments of agriculture and the extension and delivery mechanisms at the state level which will directly take everything to farmers and support them to bear the consequences of climate change. For instance, seed rolling plans need to be evolved by each state, with an emphasis on revival and restoration of open-pollinated, traditional and locally-adapted varieties.

- **'Public-People' Partnership**: Similarly, it was felt that civil society and its institutions should also be involved in planning and implementation related to the NAPCC. For instance, alternative, horizontal extension systems with farmers' organizations at the centre are an important part of information dissemination and learning for adaptation to climate change. The stress should be on public-people partnership in the Plan. There should be recognition that only market-driven technologies are not the answer in the era of climate change. There is a need for renewed thrust on public research in partnership with communities.

- **Risk management**: When it comes to Risk Management, it should be acknowledged first that the existing risk management strategies and mechanisms have failed farmers badly. There is a need for complete recasting of the existing models and mechanisms. We need new mechanisms to assess damage and loss and better ways to deliver support - including weather insurance, livestock insurance and effective crop insurance.

- **Clear convergence**: The Plan should clearly spell out how it converges with other plans and missions both within the NAPCC as well as in other agencies like the Planning Commission.

- **Social safety nets**: As part of adaptation strategies, strong social security nets should be put in place for the rural households, including with a provision of minimal incomes, pension, insurance etc., with special emphasis on the agriculture workers.

A Blueprint FROM CIVIL SOCIETY TO ESTABLISH & PROMOTE SUSTAINABLE AGRICULTURE For Food Security & IN THE ERA OF CLIMATE CHANGE

Sustainable Agriculture (ecological farming/ organic farming/LEISA/Non Pesticidal Management/SRI etc) approaches are now acknowledged for the wide set of ecological and economic benefits that accrue to the practitioners as well as consumers of agricultural products. These approaches which are based on low external inputs are also low energy intensive and less polluting hence mitigate and help in adapting to the climate change. However, the promotion of sustainable agriculture on a large scale is often confronted about its potential as well as its practical limitations. In the last five years two large scale initiatives, NPM scalingup (Community Managed Sustainable Agriculture-CMSA) in Andhra Pradesh[3] and SRI promotion in states of Tripura[4], Orissa and Tamil Nadu have brought in new learnings and broken the earlier apprehensions on scaling up such practices and their relevance on a large scale.

These successful experiences had three elements in common. First, all have made use of locally adapted resource conserving technologies. Second, in all there has been coordinated action by groups or communities at local level. Third, there have been supportive external (or non-local) government and/or non-governmental institutions working in partnership with farmers. Almost every one of the successes has been achieved despite existing policy environments which still strongly favor 'modern and established' approaches (technology and support systems) to agricultural development. Now the challenge is to create a policy environment to scaleup across the nation. This needs a newer approach in terms of capacity building, horizontal learning, newer institutional systems and newer forms of financial support to be put in place.

The programmatic support to agriculture today favour only high external input based agriculture. As a result, none of the mainstream programs provide any support for promotion of these models. This needs the recasting of program guidelines or initiating newer program to provide support to more sustainable models in agriculture which can be easily accessible to small and marginal farmers. The mission on sustainable agriculture can initiate a programmatic support to scale up sustainable agriculture with the objectives to

- reduce the risks and vulnerabilities with uncertain weather conditions and degraded and limited natural resources in these regions, by adopting suitable cropping patterns and production practices
- diversify the assets and income sources to sustain the livelihoods by integrating livestock and horticulture into agriculture and promoting on-farm and off-farm employment opportunities,
- conserve and efficiently use the available natural resources like soil and water, and promote biomass generation,
- organise farmers into institutions which can help them to have better planning, greater control over their production, help to access resources and support, improve food security and move up in the value chain,
- build livelihood security systems to cope up with the natural disasters like drought, floods and other climate uncertainties

1. **Sustainable agriculture:** Sustainable Agriculture can be defined as an integrated farming system which is based on locally adapted cropping patterns and local resource (natural resources and natural processes) use based on local knowledge, skills and innovations.

The capacity of a farming system to adapt to changing climate and weather conditions is based on its natural resource endowment and associated economic, social, cultural and conditions. The viability of these elements also constitutes the basis for sustainable agriculture, understood as agricultural production that: ensures adequacy of food production; does not harm the resource base; is economically viable; and enhances quality of life. Many climate and weather risk management strategies fit squarely into sustainable agriculture practices and can, therefore, be promoted with several of the programs and policies targeting environmentally responsible production.

Strategies to be adopted

a. *Changes cropping patterns and cropping systems to suit the local resource and weather conditions. Multiple/mixed cropping, intercropping systems with legume components etc.*
b. *Ecological farming practices which can maximise the local resource use. Many of these practices are based on indigenous knowledge and focus on building soil biological productivity. Non Pesticidal Management, Organic Soil Management, Community Seed Banks, System of Rice Intensification, soil moisture management etc have already proven to be useful.*
c. *Locally adopted crop varieties specially in saline and flood prone areas, drought prone areas, making suitable selections adopting Participatory Plant Breeding and Participatory Varietal Selection.*
d. *Developing suitable farming systems integrating agriculture, horticulture and livestock.*

2. **Farmers' Institutions:** Organized communities have proven to be more effective in planning and managing their resources and livelihoods, lobbying for a policy change and securing their entitlements. Appropriate

institutional systems for each of the purposes need be established.

Strategy to be adopted –

a. *The farmers would be organised into common interest groups federated into producer collectives. Existing institutions like Women SHGs etc would be used to initially anchoring the program.*
b. *These institutions would take the roles of planning, mobilising resources, organising production, and take up post harvest management and marketing activities.*
c. *The producer collectives will improve the collective bargaining power of the farmers, will internalize market activities like bulking, primary and secondary processing which improve the village economy.*

3). Food and livelihood Security: Shift to sustainable agriculture is often seen as a compromise on food security. This is mainly because food is understood as only wheat and rice, few pulses, oilseeds and vegetables. The food basket can be increased if we can expand the scope to include millets, coarse cereals, dryland fruits, uncultivated greens etc which can also bring in nutrition security. Data from National Centre for Organic Farming (NCOF), ICRISAT and CMSA have proven that crop productivity can also be maintained with organic/ecological farming. Going beyond the current food security systems like PDS and mid-day meal schemes, systems need to be established to improve livelihood security in terms of sustaining food production in the village, improving income generation opportunities to the small farmers and agriculture labor is important in the rural areas especially in rainfed regions. The frequent monsoon failures results in droughts and support systems needs to be build to help the farm families and livestock to tide over.

a. *Building house hold food security systems by adopting suitable cropping patterns*
b. *Village level management systems for alternative models like grain banks would be appropriate and attempted.*
c. *Suitable off-farm and non-farm employment opportunities would be identified and promoted.*

4) Financial Support Systems: Currently all the financial support systems to agriculture are given only for external inputs. We need to create proper support systems for farm internalized inputs, community based infrastructure, knowledge and skill building and sharing etc.

a. Direct Subsidies to farmers rather than input subsidies
b. Integrating NREGA with sustainable agriculture so that each farmer gets 100 labor days for farming can provide ample scope in this direction.
c. Explore tools like Direct Income Support which exist in many developed/ developing countries need to be explored as decent living income cannot be explored only through pricing mechanism.

5) Partnerships: At the district level we need build partnerships between various governmental and non governmental agencies to implement the program. At the national level we need to build an alliance of Public sector research organisations, extension agencies, departments dealing with rural livelihoods and NGOs which are working on sustainable agriculture/organic/ natural/ecological farming.

CONCLUSIONS

The following is the firm view, therefore, of civil society groups endorsing this position paper that:

- Indian farming is at a cross-roads and climate change is one more factor adding to the existing agrarian and agriculture crisis in the country, that requires a decisive direction shift at the policy level;
- Fundamental changes have to come from the acknowledgement and realization that unilateral, top-down, prescriptive "knowledge generation and transmission"

models of agriculture development adopted in the country so far have in fact resulted in an ecological, economic and social crisis in the farming sector of the country within 40 years of adoption and that climate change is one more imperative for drastic change to address the situation.

- Climate change is already a reality for Indian farmers and that conventional models of agricultural research and extension will fail to address the need of the hour unless some fundamental recasting is done. The immediate need for interventionist action precludes traditional models of research and support systems and requires alternative but urgent programmatic interventions, led by farmers' institutions and their local resources, knowledge and innovations.
- Existing mainstream models of farming are GHG-inducing and are not conducive to adaptation either given their high external-input dependency – models which increase the risk of vulnerable farmers.
- Sustainable agriculture, on the other hand, holds immense mitigation and adaptation potential, specifically in the context of climate change even as it improves rural livelihoods and addresses the ecological crisis in Indian farming (genetic erosion, land degradation, water depletion and contamination etc.)
- The fertilizer thread mill has not only affected the soils and farmers but has become a major burden on the national exchequer. The Fertiliser subsidy has reached all time high of Rs. 1,19,772 cr (Ministry of Chemicals and Fertilisers, 2008) in 2008-09 which is 650 % rise in the last four years. Whereas sustainable agricultural practices are self sustaining and will not only improve the sustainable production and address the food security but also address the nutritional security by providing nutritionally rich safe food.
- As the International Assessment of Agricultural Science & Technology for Development (IAASTD) concluded, business as usual is not an option any more. In fact, this paper concludes that there are no options in front of the Indian government and Indian farmers but to establish, promote and adopt sustainable agriculture for all of India.

---

[1] *In Andhra Pradesh the Community Managed Sustainable Agriculture Program in collaboration of Society for Elimination of Rural Poverty, CSA and Federations of Women Self Help Groups and NGOs now supported under Rastriya Krishi Vikas Yojana. During Kharif 2007, more than 3,50,000 farmers from 1800 villages in eighteen districts of the state are practicing NPM in more than 2.80 lakh ha in various crops. Sixteen of these districts are part of the 32 districts with serious agrarian crisis identified by the Government of India. The savings (on chemical pesticides) in costs of cultivation on pest management ranged from Rs. 600 to 6000 per ha without affecting the yields.*

[2] *Tripura state government achieved 30,000 ha area (16 % of paddy area) under SRI during 2007-08. Between 2002-05 the farmers adopting SRI went up from 44-880 and to 70,000 farmers in 2007. Yields from Aman (Kharif 2006) under SRI from the 17 agricultural subdivisions works out to 3,519 kg/ ha, five-year average without SRI ending 2005 working out to be 2,618 Kg/ha indicating a 34% increase.*

Centre for Sustainable Agriculture
12-13-445, Street No. 1, Tarnaka, Secunderabad - 500 017, India.
Ph:+91-40-27014302/7735, Fax:+91-40-27002018
Email: csa@csa-india.org Website: http://www.csa-india.org