IN FOCUS

The Paris Climate Change Conference and Sustainable Agriculture

M. S. Swaminathan* with Arivudainambi Appadurai†

Abstract: Climate change can be a mega-catastrophe if we do not take action now, both in the areas of adaptation and mitigation. An uncommon opportunity now exists for converting a potential calamity like climate change into a tool for achieving the goal of sustainable agriculture.

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Beyond Paris

The Paris Agreement essentially restores the status quo with reference to the implementation of the provisions of the 1992 United Nations Framework Convention on Climate Change (UNFCCC). I am glad that there is a commitment to limit temperature rise to 1.5°C. Even this increase will lead to the loss of 6 to 7 million tonnes of wheat in the Punjab-Haryana area, though countries in the Northern latitudes will benefit. I am happy that the principle of common but differentiated responsibilities has been reiterated.

What is now urgently needed is the redoubling of our efforts in the area of both adaptation and mitigation. With respect to adaptation, this involves shifting our emphasis to the per day productivity of crops rather than per crop productivity.[1] There is also need for greater attention to reduce ammonia volatisation by replacing normal urea with neem-coated urea. Our food security can be safeguarded by promoting the establishment of a biogas plant, a water harvesting pond, and planting nitrogen-fixing trees in every farm. To honour our commitment in the area of shifting to renewable energy and a low carbon pathway of economic development, there is need to pay

* M. S. Swaminathan Research Foundation, founder@mssrf.res.in
† Strategy Head, Climate Resilience Practice, World Resources Institute, India

[1] By per day productivity of crops I mean the yield per day. For example, we have varieties of wheat which may yield 5000 kg per hectare in 200 days. There are also some varieties that can give the same yield in 150 days; this is because of their ability to transfer the photosynthate to grain formation more efficiently.

intensive attention to the research and development (R&D) aspects of solar, nuclear, wind, biogas, and biomass energy. This is also the pathway to sustainable agriculture, which constitutes the second of the Sustainable Development Goals (SDGs), which will replace, from next year, the Millennium Development Goals (MDGs).

Energy and food security are two major concerns in relation to the Paris Agreement. What are the methods of redeeming our commitment in the area of reducing the consumption of coal and petroleum products? Renewable energy is obviously the answer. Nuclear energy is environmentally benign but has to gain adequate public understanding and support. There are also problems relating to nuclear waste disposal. This will call for launching a nuclear literacy movement and at the same time establishing citizen-scientist partnership committees around major nuclear power plants such as Kudankulam and Kalpakkam. With reference to other forms of energy that do not contribute to greenhouse gases, the greatest emphasis is now being placed on solar energy. In addition to centralised forms of solar energy generation, there is a need to promote decentralised home-based solar energy and water-harvesting structures.

In addition to the adoption of a low carbon pathway in the field of energy generation, safeguarding food security requires prompt attention. This will call for climate-smart agricultural techniques. In particular, new methods of supplying nutrients should be developed and promoted. The methane emissions from cattle should be harnessed in the form of biogas plants. For capitalising on biomass, we need institutional arrangements like the Rice Biopark that we are establishing at Nay Pi Taw in Myanmar. In such bioparks, rice straw, hull, and husk can be converted into energy sources. We will be able to honour the commitments made at Paris only if we have more intensive research on all aspects of nuclear, solar, biomass, biogas, hydel, and wind energy.

One area discussed in Paris was the commitment to a green climate fund on the part of developed countries. So far this has been talked about but concrete action is not yet forthcoming. If funds become available, they can be used both for adaptation and mitigation. Adaptation will require considerable extension efforts and timely climate information. Drought, flood, and good weather codes will have to be developed and adopted. Mobile telephones provide an opportunity for the transmission of such information. Our experience shows that this is particularly effective in coastal areas for the purpose of providing timely information to small-scale fishermen on the likely height of waves at different distances from the shoreline. They can also be informed about the potential location of fish shoals. Such fisher-friendly technology is now being adopted in coastal Tamil Nadu and Andhra Pradesh and is being extended to Kerala.

In coastal areas, special anticipatory measures should be taken to empower coastal communities to face the challenge of the rise in sea level. Ninety-seven per cent of

the world's water is seawater and there are opportunities for seawater or biosaline agriculture. There is also a need to refine the methods of growing crops below sea level as is being done in the Kuttanad area of Kerala, which has been designated by the Food and Agriculture Organisation (FAO) of the United Nations as a Globally Important Agriculture Heritage Site (GIAHS). The Government of Kerala is establishing an International Research and Training Centre for Below Sea Level Farming in Kuttanad. This training centre will be of great value not only to areas like the Sunderbans in India but also to neighbouring countries such as the Maldives and Sri Lanka. Seawater can also be used for agriculture through halophytes or salt-tolerant varieties of plants. In order to conserve halophyte genetic material, the M. S. Swaminathan Research Foundation (MSSRF) has established a Genetic Garden of Halophytes at Vedaranyam in Tamil Nadu. Biosaline farming can take the shape of sylvi-aquafarms involving the cultivation of economically valuable tree species and the raising of fish through mariculture techniques.

Climate change can be a mega-catastrophe if we do not take action now, both in the areas of adaptation and mitigation. Anticipatory preparation for potential changes in temperature, precipitation, and sea level can help introduce new technologies in farming. The technological transformation of small scale agriculture and fisheries can be a beneficial outcome. In the future it will be difficult to import foodgrain at affordable prices. An uncommon opportunity now exists for converting a potential calamity like climate change into a tool for achieving the goal of sustainable agriculture.

Achieving a Yield Revolution in Major Food Crops

On the occasion of the 50th anniversary of our Republic, President K. R. Narayanan identified two areas as representing the most significant national achievements between 1950 and 2000. These were strengthening the commitment to a democratic system of governance through elected panchayati raj institutions and other local bodies. Gender justice has been incorporated in grass roots democratic institutions, first by reserving 33 per cent and later 50 per cent of all seats for women. The second area highlighted by President Narayanan was the achievement of the green revolution, which lead to self-sufficiency in our food requirements. In the early 1960s, I had said that a revolution in the yield potential of major food crops like wheat and rice was an idea whose time had come. A research strategy involving changes in plant architecture and physiological rhythm was then initiated. In order to achieve this, we had initially to import seeds of semi-dwarf varieties of wheat from Gonjiro Inazuka in Japan and Dr Norman Borlaug in Mexico. These varieties were capable of responding to good soil fertility and water management.

The idea of achieving a yield revolution through a revolution in plant type was put into practice intensively during the period 1963-8. As a result our farmers produced more wheat in 1964-8 than had been possible over the preceding four thousand years. This is why William Gaud from the United States coined the term "Green Revolution,"

to indicate that we can, by means of green plants, achieve higher production through the productivity pathway.

In the case of rice as well, we started the yield revolution with Indica-Japonica crosses. Soon this gave way to the use of semi-dwarf varieties of rice obtained from Taiwan and from the International Rice Research Institute in the Philippines. Thus, new opportunities were created in the 1960s for breaking yield ceilings in wheat and rice and thereby increasing productivity per units of land and water. The significance of a productivity approach to agricultural self-reliance will be clear from the fact that the world requires 50 per cent more rice in 2030 than in 2004 with approximately 30 per cent less arable land than today. Mainstreaming ecology in technology development and dissemination is the road to sustainable agriculture.

The progress made by our country in food production, thanks to the green revolution symphony, which comprised farmers, scientists, and policy makers, has probably no parallel in the world. Our independence had the great Bengal Famine as its backdrop. We have now introduced a Food Security Act that confers the legal right to food to nearly 75 per cent of our population. We have thus moved from famine to conferring the right to food with home-grown food.

There is, however, no time to relax. The monsoon and the market are two of the major determinants of a farmer's well being. Monsoon behaviour is becoming erratic because of events associated with global warming. Similarly, market volatility often denies farmers the right price at the right time and place. How do we rescue the interest of our farmers from the vagaries of the monsoon and the market? This is the current challenge to scientists and policy makers.

2015 has been designated the International Year of the Soil. 2016 is the International Year of Pulses. 2016 also marks the beginning of the UN Sustainable Development Decade. Sustainable development goal no. 2 calls on the world to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture." I had indicated as early as 1968 that the indiscriminate use of fertilizers and pesticides and over-exploitation of groundwater as well as the loss of biodiversity will lead to disastrous results. The following was my statement at the Indian Science Congress held at Varanasi in January, 1968:

> Intensive cultivation of land without conservation of soil fertility and soil structure would lead ultimately to the springing up of deserts. Irrigation without arrangements for drainage would result in soils getting alkaline or saline. Indiscriminate use of pesticides, fungicides, and herbicides could cause adverse changes in biological balance as well as lead to an increase in the incidence of cancer and other diseases through the toxic residues present in the grains or other edible parts. Unscientific tapping of underground water would lead to the rapid exhaustion of this wonderful capital resource left to us through ages of natural farming. The rapid replacement of numerous locally adapted varieties with one or two high yielding strains in large contiguous areas would result

> in the spread of serious diseases capable of wiping out entire crops, as happened prior during the Irish potato famine of 1845 and the Bengal rice famine of 1942. Therefore, the initiation of exploitative agriculture without a proper understanding of the various consequences of every one of the changes introduced into traditional agriculture and without first building up a proper scientific and training base to sustain it may only lead us into an era of agricultural disaster in the long run, rather than to an era of agricultural prosperity.

I therefore called for an "evergreen revolution" that would lead to increases in productivity in perpetuity without associated ecological harm. While addressing India's Parliament, President Obama spoke of the importance of evergreen revolution in the following words:

> Together, we can strengthen agriculture. Cooperation between Indian and American researchers and scientists sparked the Green Revolution. Today, India is a leader in using technology to empower farmers, like those I met yesterday who get free updates on market and weather conditions on their cell phones. And the United States is a leader in agricultural productivity and research. Now, as farmers and rural areas face the effects of climate change and drought, we'll work together to spark a second, more sustainable Evergreen Revolution.

The transition from the green to evergreen revolution is the need of the hour. It will involve new science such as the production and application of biological software to such areas of sustainable agriculture as biofertilizers, biopesticides, vermiculture, drip irrigation, and soil health enhancement. In every administative block we should establish a soil health monitoring and enhancement centre that can help farmers maintain high yields in perpetuity.

World Trade and National Food Security

The World Trade Organisation (WTO) is an inter-governmental body to promote free and fair trade. In developing principles for assessing what is fair and what is unfair in trade, a global view is normally taken. This is where the problem arises. Agriculture is essentially a commercial occupation in developed countries, where hardly 5 per cent of the population depends on agriculture for its livelihood. On the other hand, in many developing countries, including our own, agriculture is the principal occupation of a majority of rural families, who depend upon crop and animal husbandry, fisheries, forestry, and agro-processing for their livelihoods and for household food security. In such regions, farm size is small and the marketable surplus is low. As a result, farm families require social protection. It is wrong to designate the limited support given to them as subsidy. It would be appropriate to refer to the assistance given as support to sustainable farming.

Most international agencies describe India as the country with the largest number of hungry people in the world. Both agrarian prosperity and national food security

depend on the economics of farming. We have now come to the stage of creating a legal right to food through the National Food Security Act 2013. As mentioned earlier, our country has evolved from a "ship-to-mouth existence" to a right-to-food commitment. To fulfil this commitment, we have to give concurrent attention to production, procurement, and public distribution.

The difference between agriculture as a commercial occupation and agriculture as a means of abolishing hunger and malnutrition must clearly be understood by those who participated in the 10th ministerial meeting of WTO held in Nairobi in December, 2015. The industrialised countries should understand and acknowledge the human dimensions of trade in foodgrain. Developed countries have safeguarded the extensive financial support they are giving to their farmers through the green box provision. It is high time that there is also a Livelihood Security Box that can help countries adopt farm support policies that can help them achieve the zero-hunger challenge launched by the UN Secretary General.

Implications of the Paris Agreement

The following are some goals for which the Conference of Parties expressed support:

- *Agreement to restrict raise of temperature below 2℃ and, to the extent possible, to 1.5℃.* There is now a bit of hope for developing countries that climate change will be addressed and that a low carbon world is achievable. Short- and long-term targets to decarbonise are now enshrined in law, countries have made individual commitments, there is more awareness of the problem, and governments have all agreed to act. Over time, countries have agreed to "peak" their emissions in return for better access to technology.
- *The notion of common but differentiated responsibilities (CBDR).* This has been expanded to include the term "in the light of different national circumstances." The acknowledgement of the historical emissions by developed countries can be seen as a positive sign for the people fighting for climate justice.
- *Intended Nationally Determined Contributions (INDCs).* About 185 countries have submitted their INDCs, indicating their plans to reduce emissions over the next 20 years. These plans are made public and hence there is an expectation that governments will be more accountable and responsible in implementing action plans.
- *A big push for renewables.* This push is accompanied by the possibility of enhancing the share of renewables manifold in the coming years. Several mega commitments were made in this context.
- *Financial transfers.* Vulnerable countries are to get US $100 billion a year from 2020 from developed countries, with a provision to scale up this commitment on a regular basis. Richer developing countries like China and Singapore will also contribute to these transfers.

Discomforting Features of the Agreement

- Although the Paris agreement is, overall, legally binding, much of the detail is not. Countries will not be forced to do more than they want, nor will there be any redress if they do not achieve their targets.
- The big push for "green economy" is skewed towards big business communities, with a possibility of bypassing small holders.
- Money earmarked for regular development activities may be diverted for climate change assistance.
- Though there is a recognition of problems of loss and damage, the decision not to link this to liability and compensation is a setback for many small island nations.
- The legal responsibility of richer countries to help developing countries to adapt to climate change, a key component of the Kyoto Agreement, is altered; that responsibility is now voluntary and to be shared between developed and developing countries.
- There is ambiguity about the generation of the financial resources that will be used to fund developing countries.

Implications for Mitigation-Related Actions

India may need to provide more elaborate details of its mitigation targets including, *inter alia*, details on the scope and coverage of greenhouse gases (GHGs) and quantifiable information of India's reference point, such as the emission intensity of GDP in 2005 in future nationally determined contributions (NDCs). In accordance with Article 4 of the Agreement, starting from 2020, India will have to communicate its NDCs every five years, and successive NDCs must represent a progression. In addition, the Article notes that all NDCs "shall be recorded in a public registry maintained by the (UNFCCC) secretariat." The NDCs are to be framed in the context of "common but differentiated responsibilities and respective capabilities, in the light of different national circumstances." Developed country Parties have been asked to continue with economy-wide absolute emission reduction targets, while developing country Parties can enhance "their mitigation efforts, and are encouraged to move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances."

Implications for Adaptation-Related Actions

Para 45 under Adaptation, Section III (Decisions to Give Effect to the Agreement) requests Parties to "strengthen regional cooperation on adaptation where appropriate and, where necessary, establish regional centres and networks, in particular in developing countries, taking into account decision 1/CP.16, paragraph 13." This might be beneficial in the long run from the perspective of fostering South-South Cooperation to improve climate change resilience and to achieve a cohesive stance

during global negotiations. India can act as a leader for the developing world by strengthening South-South collaboration through regional dialogue and initiatives on climate mitigation, adaptation, finance, technology transfer, and capacity-building. This may contribute significantly to India's economic development as well. *India can leverage the newly established Paris Committee on Capacity Building that aims at "fostering global, regional, national and sub-national cooperation" to enhance South-South cooperation.*

Article 7 Para 5 of the Agreement calls all parties to initiate adaptation action that are

> country-driven, gender-responsive, participatory and fully transparent, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.

In this context, India's upcoming National Adaptation Plan 1 should provide guidance to national, regional, and State-level plans to enable

- actionable adaptation strategies that address potential vulnerabilities arising from climate change for communities, ecosystems, and the overall economy;
- integration of state-of-the-art adaptation technologies with indigenous knowledge; and
- integration of climate change adaptation in socioeconomic and environmental policies.

Implications for Forestry-Based Mitigation and Adaptation Actions

Article 6, Para 1 of the Agreement recognises that countries may

> choose to pursue voluntary cooperation in the implementation of their nationally determined contributions to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity.

Para 2 of the same Article allows countries to engage in voluntary internationally transferred mitigation outcomes (ITMO) to help meet their Nationally Determined Contributions (NDCs) while ensuring avoidance of double counting. The details of this mechanism are yet to be developed, but it is envisaged to be those projects that score high on environmental integrity, transparency, and robust accounting principles, and so forestry projects can easily qualify. India can consider showcasing its forestry-related Nationally Appropriate Mitigation Action (NAMA), which is under development, as a viable candidate for ITMO. As per Article 6, Para 8 (b), India can use non-market-based mechanisms to allow the participation of the public and private sectors in implementing forestry-based activities.

COP 21 also saw a rise in financial commitments towards REDD+ globally. Germany, Norway, and the United Kingdom pledged collectively to support REDD+ programmes to the tune of USD 5 billion in total for six years starting 2015, and reaching USD 1 billion per year by 2020. Norway has pledged to double its USD 258 million contribution to the Green Climate Fund (GCF) provided that GCF can finance verified emissions reductions in deforestation and forest degradation.

Monitoring, Reporting, and Verification (MRV)

India will have to provide a national greenhouse gas (GHG) emission inventory, report on progress achieved on its INDC (Intended Nationally Determined Contribution), and provide information related to climate change impacts and adaptation as appropriate. In addition, India, being a developing country, will have to provide information on financial, technology transfer, and capacity-building support needed and received by the country as per Article 13 Para 10. The periodicity of this reporting will be "no less frequently than on a biennial basis" as per Para 91 under Transparency of Action and Support, Section III (Decisions to Give Effect to the Agreement). The framework also calls for a Technical Expert Review of the information submitted by each Party. However, this process will differ depending on national circumstances and it will "pay particular attention to the respective national capabilities and circumstances of developing country parties."

Para 85 under Transparency of Action and Support, Section III (Decisions To Give Effect To The Agreement) notes that a Capacity-Building Initiative for Transparency has been established under the Agreement in order

> to build institutional and technical capacity, both pre- and post-2020. This initiative will support developing country Parties, upon request, in meeting enhanced transparency requirements as defined in Article 13 of the Agreement in a timely manner.

The Global Environment Facility (GEF) has been mandated to support the establishment and operation of this initiative as a priority.

Climate change can be a mega-catastrophe if we do not initiate anticipatory action to checkmate the impact of a rise in temperature, sea level, and water scarcity (drought) or surplus (flood). On the other hand, there are solutions to potential challenges. For example, rice can come to the rescue of food security, since rice grows under a wide range of latitudes and altitudes. A cadre of climate risk managers needs to be built from among men and women members of local bodies. Methods of safeguarding food, water, and livelihood security should be priority areas for research and propagation.