performance. Similarly, suitable measures should be prescribed to avoid too many organizations functioning within the existing Command and Control Structure Environmental Protection Act.

The first generation of environmental management instruments like Water Act and Air Act have adopted 'concentration-based standards', as they were easy to monitor and find out violations, if any and defaulter can be penalised. However, as the cost of compliance was costlier than non-compliance, most of industries have adopted shortcuts in pollution control that has led to significant deterioration of resources. Second-generation instruments like Ecomark, ISI Certification have failed to take-off because of mismatch between costs and benefits and Indian Inc has stuck to its path of profit maximization and went on reaping the low-hanging fruits while ignoring the environmental externalities.

Third-generation instruments for environmental protection like NREP 2019 and their effective implementation require a perfect synchronization and coordination between not only the organizations, but also between various institutions as well. It is certainly a difficult task to achieve such integration as there is little coordination between the organization, but possible with sincere concerns. Over and above, the most important stakeholder is the consumer, and he/she is extremely price-sensitive. NREP, at least in the initial years, is bound to increase the costs and consequently, negative impact on market performance, ultimately may dampen the spirit of NERP 2019. Awareness aimed at the end-user and stringent complying conditions, encompassing every producer could be a few strategies that might help.

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COMMENTARY

A wild encounter to ensure a food secure 2050

Basabdatta Das, Samik Sengupta, Kashinath Bhattacharya and Swati Gupta Bhattacharya

A significant number of the world population suffers from the lack of food security and malnutrition due to constraints of financial instability as well as due to restrictions in crop yield intensification. Many wild plant resources are potential nutritional sources, but are not sustainable due to lack of scientific data or inadequate trade policies. Proper initiatives pertaining to ecology, conservation and government policies will bring wild edible plants into limelight.

Challenges of nutritional insecurity

The FAO has defined food security as the physical, social and economic access to sufficient, safe and nutritious food to meet the dietary needs for a healthy and active life. However, either due to food unavailability or nutrient deficiency, a significant number of the global population does not conform to this definition, and is thus 'food insecure'. A majority of this 'insecure' population is concentrated in Africa, Southeast Asia and South America. Incidentally, the United Nations has projected these areas for major population growth by 2050 (ref. 1). Deleterious impacts of climate change, water scarcity, habitat destruction, genetic erosion of various wild and indigenous crop breeds, and rising oil prices will be detrimental for intensive agriculture as is practised today, especially in these regions. To counter such challenges FAO[2], in its World Food Summit on Food Security (2009, Rome) urged for prompt increase in investments towards sustainable 'smart' agricultural system, which will be good for the farmer, the consumer and above all good for the earth.

Conservation agriculture, eco-agriculture, organic agriculture, integrated pest management, etc. are some of the sustainable procedures that are already in practice in various parts of the world. However, these methods have only been able to narrow the food security lacuna marginally. There is a constant demand–supply gap between consumers and pocket-friendly nutritious food due to the over dependence on commercially selected agricultural crops like rice, wheat, maize, sorghum, barley, potato, etc. These crops are unable to meet the dietary needs of the poor as well as rural population of developing countries, mainly due to the associated cost of procurement. Although the rich sections of society are able to buy commercial agricultural products, they often suffer from nutrient deficiency due to the narrow diversity of food components in their diet. Thus, food insecurity is an issue independent of the monetary strength and spending power of the consumers.

Answers from the wilderness

To overcome this bottleneck, specialized agencies have recommended the inclusion of new food sources from the repository of wild plants in a sustainable manner. The FAO has defined wild plants as 'plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human action'[3]. The geographical locations of nutritionally deprived countries also coincide with the most vivacious biodiversity hotspots where nature has unleashed her full bounty[4]. These areas also have rich tribal history and are goldmines of ancient traditional wisdom about wild edibles and medicinal plants. The tribal and other ethnic populations dwelling in close proximity of such ecosystems consume wild edible plants as part of their daily diet. In 2009, FAO estimated that about 1 billion people eat wild plant products regularly[5], and the forests are a source of livelihood for more or less 300 million people. Ethno-botanical studies of human evolutionary history have revealed that about 7000 wild plant species have been used as food and medicine[5]. Boa[6] reported that over 1069 species of fungi are being consumed worldwide. Rathore[7] reported that about 600 wild plants of India are edible. Ethno-botanists from various countries have made similar documentations about wild edible angiosperms, gymnosperms, pteridophytes, bryophytes, fungi, algae and lichens[8]. Tribal people worldwide regularly consume wild plants in the form of cereals, grains, starchy roots and tubers, legumes, nuts, vegetables, fruits, natural sweeteners, oilseeds, beverages, spices, stimulants and appetizers. Several studies have confirmed that these wild foods are rich in micronutrients, essential fatty acids, iron, zinc and calcium[9].

Bottlenecks of access

Various factors have been identified as hindrances towards the commercial promotion of wild edible plants. First, there is no differentiation in policy making about the protection and propagation of wild indigenous edible plants. These indispensable species are treated in the same category as non-timber forest products (NTFPs) and thus do not enjoy any special attention. In accordance to the CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) rule, trade in wild and endangered species is considered illegal in most countries. Small, clandestine transactions of wild products are made at remote village markets and fairs without proper accounting mechanisms[10]. As such, there is no standardized global estimate of the economic value of wild foods. Due to lack of appropriate scientific data, forecasting the effect of changing climate on the production and availability of wild food is almost impossible[11]. Commercial market-driven agricultural policies and irresponsible expansion of arable land by extensive deforestation have led to habitat destruction, thus reducing the availability of wild food species[11]. There is severe dearth of data regarding nutritional qualitative characters of wild edible plants. Some of the wild plant, e.g. wild yam, have anti-nutritional/poisonous properties. Unsustainable harvest coupled with lack of scientific documentation of species and lack of *in situ* conservation are steadily declining the wild food species and eroding biodiversity. The indigenous knowledge about local forest edibles and medicinal plants mainly resided with the tribal populations. The changing façade of livelihood practices, religious conversions and expansion of urban limits have compelled the younger generation of tribals to enter into mainstream society, thereby eroding the already non-conserved traditional knowledge.

Approach towards mass-friendly wild food

The United Nations has recommend that the scientific community and policy makers should develop an integrated approach to overcome the problems of wild edible plants. *In situ* and *ex situ* conservation of wild edible plants, followed by an extensive database containing taxonomic, eco-geographic and ethnic documentation in accordance with the intellectual property rights is immediately required. Detailed organoleptic studies, assessment of nutritional components, medicinal properties, and toxicity or allergenicity are to be assessed for identification of edible wild plants that can be included in daily diet. A number of international mechanisms, global and regional treaties, conventions and codes, with the agenda of incorporation of biodiversity in agriculture are operational. However, most of these contrivances are individual-centric initiatives and would be more fruitful upon increased collaboration. Agreements on protecting the land and water rights of rural communities and marginal farmers; land management policies to limit mono-cropping; pollution regulations to reduce agrochemical use; limiting subsidies favouring a particular crop; new market incentives to support the promotion of plant food biodiversity, and government incentives to farmers to cultivate new species are covenants which can be useful for the conservation and popularization of wild edible plants.

Conclusion

The erratic climate fluctuations in the Palaeolithic era prevented the human race from depending on selected plant species for food. It is after the Last Ice Age about 12,000 years ago that the climate stabilized, and humans began cultivating and selecting for the right kind of beneficial trait in edible plants. This process popularly termed as 'domestication' has given us predictable crops with high yields, better quality characters and stress resistance. However, it has also confined our diet to a handful of species

and has left our agriculture to the whims of the globally warming climate and the evolving potency of pathogens. At this exigent, the future of our food security should not only rely on post-apocalyptic seed banks at Svalbard, but also on the identification and propagation of wild edible plant species used by the ethnic people.

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India's second Biennial Update Report: five key takeaways

Shanal Pradhan and Gautam Goswami

India submitted its second Biennial Update Report (BUR II) to the UNFCCC on 31 December 2018, which builds upon the information presented in the Second National Communication (SNC). Being a non-Annex I party to the Convention, India like many other developing nations has to fulfil its reporting obligation of furnishing BURs every two years to intimate its climate mitigation efforts. Biennial reporting is aimed at highlighting trends in the national greenhouse gas inventory, mitigation actions, need for climate-friendly technologies, finance, capacity-building and lastly existing domestic Monitoring, Reporting and Verification (MRV) mechanisms. The comprehensiveness and depth of information present in BUR II, have increased considerably in comparison to its earlier version (BUR I). This paper suggests points relevant for improvizing on key aspects related to energy demands, MRV and the technology transfer process.

India submitted its first Biennial Update Report (BUR I) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016, a year ahead of China and again presented BUR II earlier than China. A major point to be accentuated here is that China in its first BUR had published national CO_2 emission inventories only for 1994, 2005 and 2012. This clearly thwarts the efforts and concept of embedding transparency in reporting, even when the country is responsible for 27.6% of the global CO_2 emissions. It also consumes more coal than the rest of the world combined[1]. In comparison, India has shown considerable poise in revealing emissions year-on-year basis right from 2000 to 2010 in its BUR I. Hence, it will be interesting to watch the emission discourse arising from China in its second BUR. Meanwhile, some clear-cut messages derived from India's BUR II need to be taken into cognizance.

Energy sector still remains the main culprit

The energy sector still remains the major emitter in the country, in fact, BUR II shows an increase to 73% from the 2010 emission of 71%. Whereas for agriculture, the greenhouse gas (GHG) emissions reduces from 18.3% in 2010 to 16% in 2014. Majority of the emissions are from electricity generation by use of fossil fuels, especially non-coking coal. Thus, a gradual upscale of clean coal technologies such as supercritical and ultra-supercritical technologies can help in cleansing the system along with renewable deployment. The energy and industry sectors are serious contenders that challenge the country's attempt to reduce emissions as they mostly contribute to CO_2 and HFCs, both GHGs which apparently remain in the atmosphere for longer periods. The methane rise from the industry sector as reported in BUR II is significant, at 0.178 Mt as compared to 0.023 Mt in 2010 (ref. 2).

Information lacking on finance required for technology uptake

One of the major prerequisites of BUR guidelines calls for facilitating or presenting information on finance,