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ECOSYSTEM OF DROUGHT

Understanding Ecosystem of Drought Vulnerability to Improve Drought Resilience of Small Farmer Agro-ecosystem.

As drought this year touches lives of a quarter of the population of India (in 255,923 villages in 254 districts in 10 states)[1] and debates over drought preparedness and development priorities by the Centre and states are contested in the media and questioned by the Courts (viz. the row over IPL match in Maharashtra), this paper attempts a better understanding of the changing 'drought ecosystems' of poor farmers in India and explore whether 'living with drought' is possible drawing lessons from the regional adaptive traditions and by questioning the mainstream agricultural trends.

Drought: A Fact and Reality

A hydro-meteorological manifestation[2], drought is a natural phenomenon, as natural as the climate and its variability. In a country like India, when rainfed agriculture is the dominant food production system and land use, drought remains an inherent accompanier of the farmer, society and the economy[3]. Irrigated agriculture is no different, as most of the irrigation systems being surface water-based with links to precipitation.

In the context of climate change, as rainfall is predicted to be more variable in India and dry regions becoming drier, extreme and intense drought events with higher frequencies[4] are expected. Whether it would be a meteorological drought, a hydrological drought and agricultural drought, this would depend upon causation shifting from rainfall deficiencies through run off deficiencies to the availability of water for crops in the growing season[5].

Making of a Drought: The Human Influence

While drought remains a natural 'phenomenon' and technically an event, what makes it a 'disaster' or matter of concern, is a combination of factors, which are often man-made. Not denying the fact that there are extreme and perennial droughts, impacts of which may be disconnected from anthropological connection, the fact remains that 'droughts' are often man-made. Severe droughts, being experienced of late, can no longer be seen as purely natural hazards, because human activities play a role. Understanding and managing drought require acceptance of human influence as integral to drought is natural climate variability. (Van Loon et al, 2016)[6]

Understanding Drought: Proposing a Multidimensional Framework Lens

Premised on an acceptance that drought would remain a companion of Indian Agriculture in this profoundly human-influenced era, the Anthropocene[7], this paper, attempts to explore, if its impact can be minimized on agriculture, food production, rural India and more importantly on the millions of small and marginal farmers, who are most affected by it, through a better multidimensional understanding.

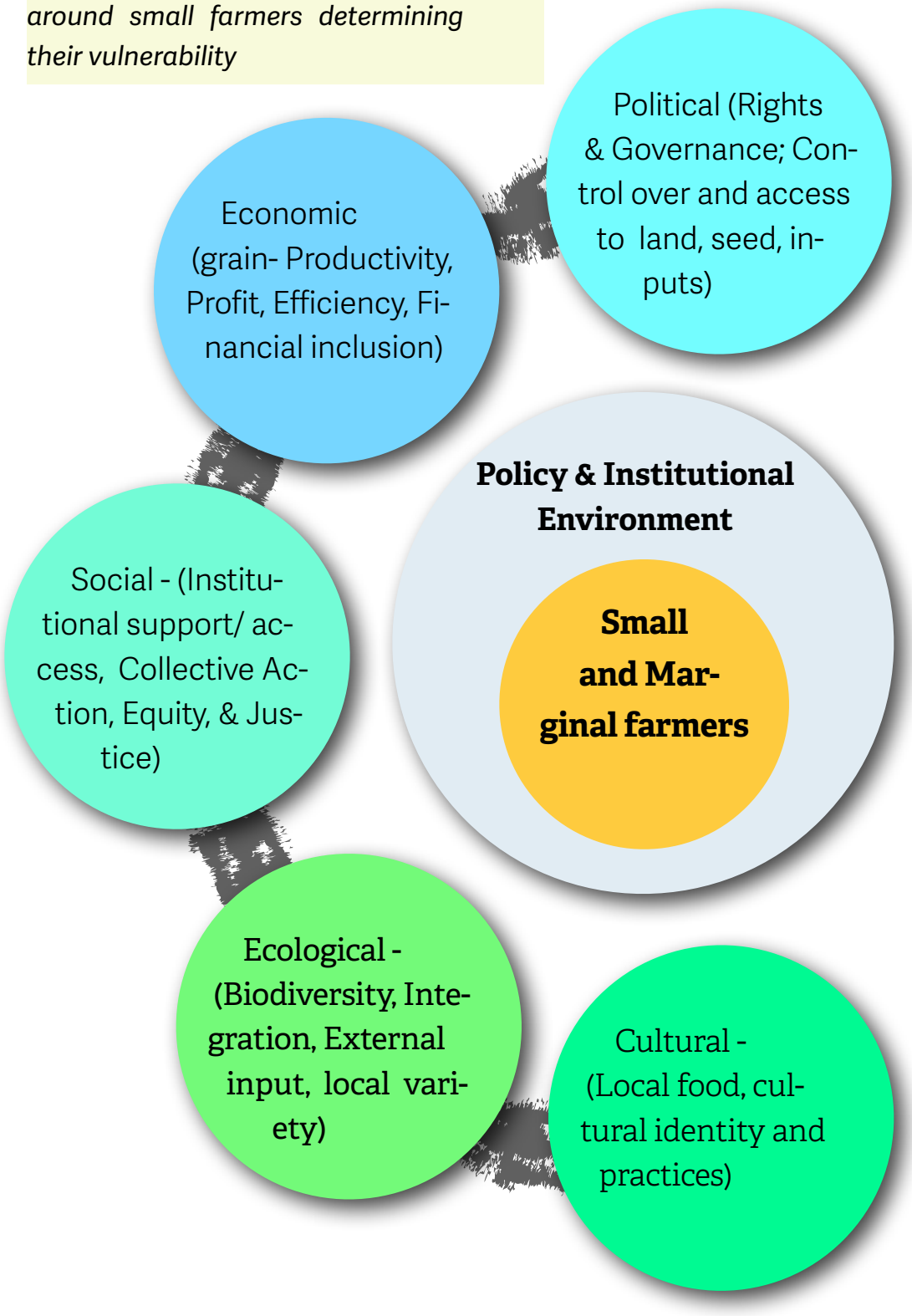
Keeping in forefront the millions of farmers who bear the burnt, this paper adopts a human-angle to propose a comprehensive 'Ecosystem Framework' to understand and analyze the drought vulnerabilities of poor, especially the small and marginal farmers in the Indian context. More particularly, it seeks to examine, whether such vulnerabilities have accentuated of late in the liberalized anthropocene, as a result of the development pathway that has been adopted in general[8] and its influence on the agriculture sector in particular around policy, research, extension and market.

Ecosystem of drought vulnerability framed here, attempts to understand the small farmer's environment in holistic, multidisciplinary perspectives to analyze how the social, economical and ecological environment around it has changed of late along with the political and cultural mileu and whether the changes have induced higher vulnerabilities? As drought could most usefully be

characterized by its impact on the poor farming community and their ecosystem/landscape, this framework argues that the ecosystem of drought framework can probably help in a better appreciation of the quantum of its impact.

It is assumed, such a multi-dimensional diagnostic tool would help drought-stakeholders better appreciate the vulnerabilities and accordingly act to address the issues structurally, on a long-term perspectives and strengthen drought preparedness and adaptation, while also responding to post-drought measures.

Figure 1: Ecosystem of Drought around small farmers determining their vulnerability



From Living with Drought to Dying of Drought

Drought has been accompanying agriculture since its inception and farmers have been ingenuously adapting to climatic variability, through manipulation of biodiversity, natural resources management and agronomical practices. Traditional system of cropping and crop management, have evolved around local agro ecological strengths and limitations. While not romanticizing with past and tradition, an attempt is made to see whether there were reasonable element and logical practices adopted in the past to cope with drought and whether the changes brought in at a faster pace over last years, have made us more vulnerable.

Aggression of market and growth led agriculture-research in anthropocene, to defeat nature by imposing and manipulating agriculture systems through crop-choice, input and technology has often brought in negative externalities for small and marginal farmers, by either marginalizing them or weakening them, making them vulnerable in both ways.

An attempt has been made to analyze and contrast the developmental paradigms and agricultural practices across the five ecosystem-dimensions to provide a holistic appreciation of drought impact and vulnerability. Considering the scope of the paper, limited aspects and examples under each dimension are dealt with, primarily to help in wearing this different lens. By no means the examples, references and anecdotes dealt below, must be treated as comprehensive and exhaustive

unpacking of typologies/elements under each dimensions.

It is required to be also appreciated that the comparison of the paradigms, primarily aims at drawing lessons for better drought preparedness, adaptation and mitigation and by no means aims at derogating the present practices. Present development paradigms have also multidimensional elements viz. decentralized local governance, access to IT-enabled services, scope of insurance, growing preference towards cultural and natural food etc., which no doubt, enhance the ability to live with droughts.

Ecological Trends: Losing Local Ecosystem Resilience with Increased External Dependence

Changes around the way food used to be sourced and grown; biodiversity used to be nurtured and relied upon; land and soil used to be husbanded; water used to be managed and more importantly, the way communities used to accept, respect and adapt to nature and natural limitations and geo-climatic variations, have affected the resilience of ecosystems with implications on adaptability and vulnerabilities of the small farmers.

Sourcing food from non-agricultural (uncultivated systems viz. forest, wetland, pastures etc.) along with agricultural ecosystems, an ecosystem approach to food consumption, used to allow rural and tribal communities to address year round food and nutrition requirements as well as disaster and seasonal induced shortfall of agricultural foods. Since the productivity of trees is often more resilient to adverse weather conditions than that of annual crops, forest foods often provide a "safety net" during periods of other food shortages caused by crop failure, as well as making important contributions during seasonal crop production gaps (Blackie et al., 2014; Keller et al., 2006; Shackleton and Shackleton, 2004).

Farmers in the rainfed tracts and in tougher agro-ecosystems (viz. mountainous, upland, arid etc.) had evolved their choice of crops and varieties as well as spatial and temporal crop-mix in response to vagaries of monsoonal rain and other physical limitations. In response to climatic and physical risks, they had also oriented their dietary intake and diversity to ensure food and nutritional security.

Adaptive elements to climate change like diversification, low external input/energy use, weather forecasting/adjusting, traditional natural resources management (moisture, nutrition and pest management), cropping practices (mixed/inter/relay cropping, crop rotation etc.) collective food and seed storage and distribution etc. are inherent to small farmer agriculture. The practices of such adaptation are more pronounced in marginal and remote ecosystems and there are research evidences, which demonstrate their potential in augmenting local food and nutritional security.

The food production in these farms has undergone tremendous changes over last few years with respect to crops, varieties, cropping patterns and crop management, in response to external market, research and extension stimuli. Most of these changes have occurred without taking into cognizance the potentials of traditional farming systems, which had evolved over years of interaction with local resources limitations, in terms of their adaptation and cultural linkages. The new technologies which crept into these rainfed small farms have not always been always designed for smallholder situations and are often ill equipped to withstand increasing intensities of disaster. As a result, the vulnerability of the small and marginal farmers is increasing with increased external dependence and expectations and reduced internal control and adaptation.

Agriculture developmental approach focused on breeding, use of agro-chemicals, irrigation-based high input technologies around few selected food crops has been quite successful in meeting national food security and in augmenting income of many farmers. However, it has also resulted in narrowing of crop and varietal diversity evolved to adapt local geo-climatic variations, deteriorated soil health and water holding capacity, negative changes in water regimes (viz. ground water depletion and salt accumulation), making the farming contexts more vulnerable to droughts.

Social Trends Around Small Farmers: Reducing Scope for Local Collective Action & Control

Changes around the way water, seed, food and feed used to be stocked/conserved/ harvested and shared by the communities, transformation of the gender role in agriculture and reducing scope of collective actions around farming have impacts on the safety nets which protect communities from disaster situations.

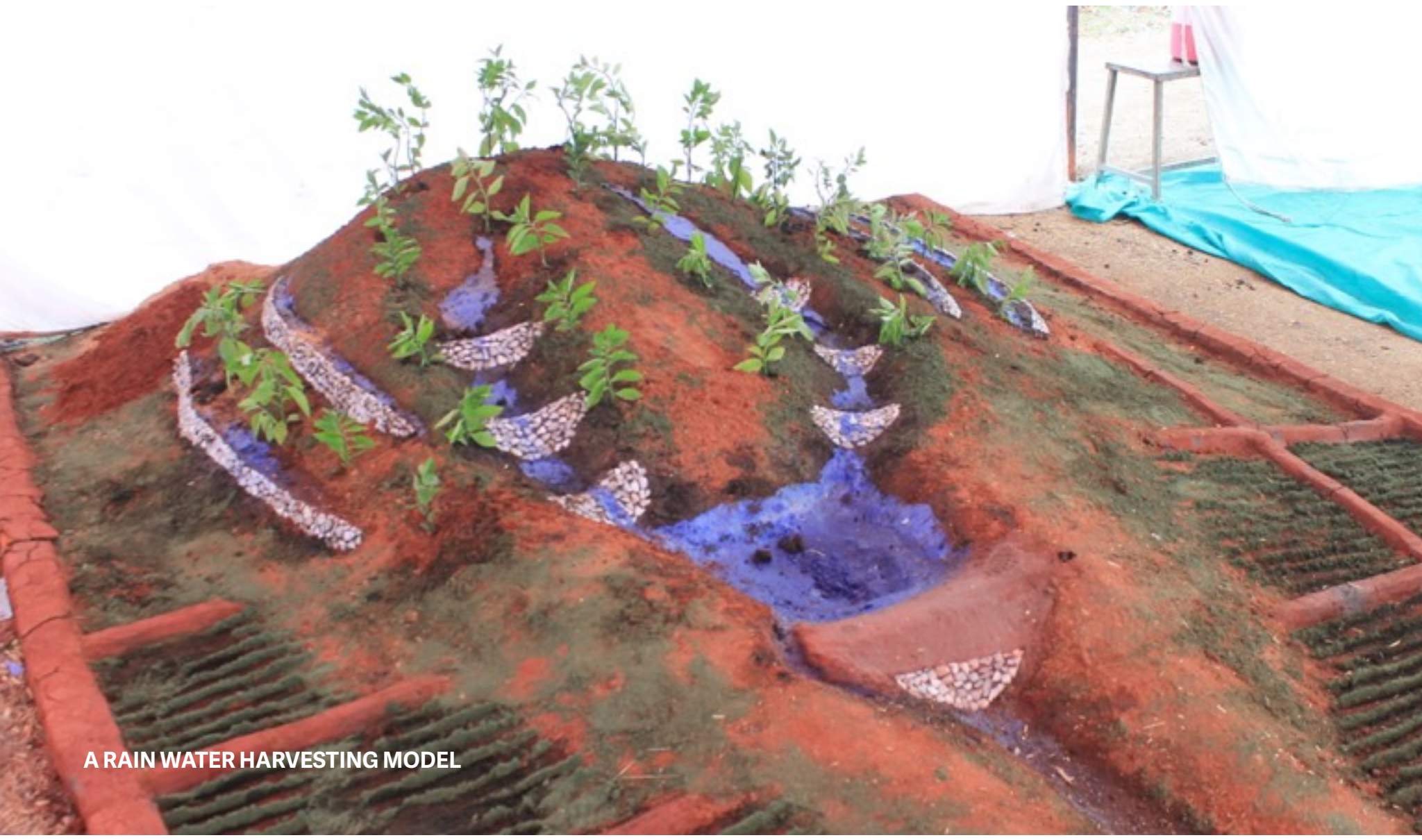
The shared and adaptive water management and governance systems, particularly in water-scare and deficit ecosystems, evolved with discipline, restrain and internal-control and augmentation in water use, have eroded and of late replaced with external dependence, exploitative free-rider use and lack of local initiatives to conserve and harvest water. Efforts around participatory watershed development and water-harvesting initiatives, have shown results, but have remained largely externally induced and fund-driven, with instances of elite capture and negative externalities marginalizing poor, landless and tribals.

There are informal seed supplies and distributions systems, which comprised of farmer managed seed production and management systems based on indigenous knowledge and local diffusion mechanisms. These systems include methods such as retaining seeds on-farm from previous harvest to plant the following season and farmer-to-farmer seed exchange networks. There has been little or no emphasis on the informal seed supply sector[9].

Despite evidence that gender-informed approaches are needed to bolster women's roles, productivity and farm-resilience, they are not yet a mainstay in the agriculture sector. Women's involvement in agro-biodiversity preservation, livestock care, genetic improvement, food and seed storage and processing are no longer promoted or practiced, except in some areas where feminization of agriculture is taking place due to male migration. It is a fact that, women play a critical role in helping family fight and adapt to drought, by food foraging, sharing saved resources, taking care of family while also contributing with wage labour.

Instances of collective action in adapting to drought by small and marginal farmers and rural communities in vulnerable ecosystem are traditional realities, which has not been emphasized much in mainstream drought management characterized by relief by external institutions. This is still happening to a great extent, while different forms of collective action like micro-credit groups, self help groups (SHG), Farmers' Field School (FFS), area/user groups (in watershed projects), Farmers' Interest Group (FIG), Farmers' club, farmers' cooperative, producer companies etc. are being able to achieve the desired development objective with mainstream and alternate development mechanism support.

These collective action initiatives, apart from involvement of farmers has the potential to also bring in other stakeholders like researchers, development specialists, extension workers, corporate and social entrepreneurs to a collaborative platform for working towards a set objective. While most of the existing initiatives[10] are meant to connect small farmers with market through promotion



A RAIN WATER HARVESTING MODEL

of commercial/enterprising agriculture, collective actions in the direction of adaptive food security are limited to institutions around production (like farmers' field school, area/user groups etc.) and distribution (e.g. seed/grain banks).

Economic Trend: Increased Efficiency & Productivity at the cost of enhanced Vulnerability

With Green Revolution Technology, the costs of cultivation and risks of crop failure are so high that often the small farmers cannot recover even the money spent. Between 1990-91 and 1995-96 in India, chemical fertilizer costs increased by 113%, and pesticides by 90%, whereas the wholesale price of wheat went up only by 58%[11]. Sharp rise in international cereal prices of late (2007-08) had also a profound impact on the food security and increased vulnerabilities of the poor in South Asian countries[12].

Increased focus on economic efficiency and productivity enhancement of food and cash crops, at the cost of feed reduction[13], diversity loss, soil and water degradation, had lead to food-surplus and commercialized agriculture –economy with substantial compromise on resilience. A mechanistic paradigm of industrial agriculture converts diversity to monocultures by focusing on external inputs of chemicals as well as on uniform monoculture commodities as outputs. Chemical-intensive monocultures produce less food per acre than biodiverse, ecological farms when all outputs are taken into account. (Shiva, 2016)

Most of these economic gains of present-agriculture sector are being calculated discounting environmental and social cost they come with and future vulnerability they are inherently linked to. While this approach leads to achievement of overall national food security and appreciable agriculture growth, issues of equity and sustainability of farm production, local food and nutritional secu-

rity often get compromised. In spite of this, growth and development, quite ironically, Indian economy, still succumbs during a poor monsoon, which shows the weakness in the present agricultural paradigm and the vulnerability it exposes the millions of poor farmers to.

Cultural Trend: Searching local identity in a globalized market

Traditional cultural practices and food systems have evolved in adaptation to the regional ecosystems and are positively related and mutually supportive. Biodiversity, food diversity, and cultural diversity go hand in hand. Tribals in the heartland of India evolved two hundred thousand rice varieties from one wild grass: the Oryza sativa. (Shiva, 2016) [14]

Our culture is linked to and has evolved around agriculture and therefore a culturally relevant agriculture and agriculture contexted around local culture is fundamental for food security, sustainable livelihoods and wellbeing. Many traditional societies have been found to adapt to food and water scarcity during drought by relying on local alternate systems, including forest food and cultural water endowments.

However, development interventions, as well as global trends of expansion of industrialized agriculture, monocultures, and the market economy have negative and, in some cases, devastating impacts on the traditional food systems, subsistence-based economies and agroecological systems upon which Indigenous Peoples depend for survival [15].

Political Trends: Losing Local Control

An increased and intensified patronage of green-revolution areas and farmers, also lead to lesser focus on rainfed areas and small farmers. With funding for agriculture research, shifting from public to private research, interest has grown in biotechnology. This change is reportedly disadvantageous to small farmers because private research companies lack incentives to address small farmers' concerns (Pingali and Traxler, 2002). An analysis of establishments and outcomes of agriculture research in India reveals lack of public-research and extension support to these rainfed small farms in the areas of their crops (viz. millets, tubers, vegetables etc.), agro biodiversity (viz. indigenous varieties and landraces of paddy) and cropping practices. The brown revolution aimed at increasing productivity of dryland areas in India, was always treated as being subservient to the big brother Green Revolution and Irrigation promotion. The result can be seen in the extension of the Green revolution to Eastern India (BGREI), even after the documented limitations of the same in Punjab.

Out of 138.35 million of operational holdings in India, with an average size of 1.15 hectares, 85 per cent are in marginal and small farm categories of less than 2 hectares. As per India's Agriculture Minister [16] "These small farms, though operating only on 44 per cent of land under cultivation, are the main providers of food and nutritional security to the nation, but have limited access to technology, inputs, credit, capital and markets," The fact that, most of the small and marginal farmers are concealed sharecroppers and tenants, with unrecorded rights, their access to formal credit, insurance and compensation continue to be denied increasing their vulnerabilities. Lack of a formal contract also disincentivises the tenants to invest in farmland resilience, while it also restricts accessing the support price market. The land record management system with archaic and un-updated record, also handicap farmers from accessing support services. Small and marginal farmers also bear the burnt of land acquisition, land-use change, loss of commons to the maximum.

Curtailed access to forest and common food systems, in the wake of their increased privatization, has reduced the availability of natural and wider food baskets on which communities are dependent on, compelling them to depend more and more on purchased foods to meet their minimum survival needs. During drought, these communities get affected most, with loss of their field crops and with limited ability to purchase costlier food.

Conclusion

Limited voice and gradual marginalization of small farms have not been able to influence the decision makers, researchers and extension agents about the need for appreciation of the small farm ecosystem in entirety. Instead of appreciating their eco-friendly, biodiverse food production and sourcing systems which has low-foot print/ net handprint and high energy efficiency, present policy paradigm terms them as inefficient farmers, who must be pushed out of agriculture to contribute to urban and industrial development. While lack of appreciation and promotion of their 'ecosystem' make them harder hit by droughts, impact of drought make them further sunk into the vicious downward spiral of poverty and get them expelled as cheap labour to serve the mainstream development paradigm. They lose the battle either way.

There is a compelling need to have a relook at the present paradigm of agriculture development and its implication on small farmers, in the context of increasing drought vulnerabilities, through multidimensional human-angle lens like this 'Ecosystem' framework. Further delay may be too costly; we may lose the opportunity to save the small farmers and small-farm agriculture, with all its ecological, social, cultural, economic and political advantage.

REFERENCES: [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12]

[13] As a result of changed straw to grain ratio and increased replacement of coarse cereals in arid ecosystems

[14] Shiva V (2016) Who Really Feeds the World?: The Failures of Agribusiness and the Promise of Agroecology, North Atlantic Books, Pages 208

[15] [16]