UNLOCKING THE POTENTIAL OF RAIN-FED AREAS FOR THE FOOD SECURITY: AVAILABLE OPTINS – LESSONS FROM ANDHRA PRADESH (INDIA)

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I. INTRODUCTION

Rain-fed areas, which support a large proportion of the poor and their livelihoods, have been neglected. Consequently, there is a severe threat to the food security of the poor. Rainfed agriculture constitutes 80% of global agriculture and plays a crucial role in achieving food security (Droogers et al., 2001). The importance of rainfed agriculture varies regionally but produces most food for poor communities in developing countries. In sub-Saharan Africa more than 95% of the farmed land is rainfed, while the corresponding figures for Latin America are almost 90%, South Asia about 60%, East Asia 65% and 75% for the Near East and North Africa (FAOSTAT, 2005).

The potential for food production in the rain-fed areas has not yet been fully realised. This paper argues that large investments are needed, which in turn necessitates pro-active policy support for development of rain-fed areas and ensuring food security. This is highly significant as protecting and developing rain-fed areas are means to addressing the needs of the most marginalised. It highlights the experiences of Andhra Pradesh (a state in Southern India) in rain-fed development and shows how important the watershed development, community-based tank management and sustainable agriculture initiatives are for growth and sustainability of rainfed agriculture. It concludes with a demand for policy support towards addressing the needs and priorities of rain-fed areas with an emphasis on rights and entitlements of farmers such as accessing food.

II. PONTENTIALS OF RAINFED AREAS

With the green revolution technology, a large gap has been created between dry land and wet land agriculture on the one hand, and dry land and wet land crops on the other. As the productivity in the irrigated areas is stagnated because of adverse impacts of green revolution technology, the future food security lies with rainfed agriculture (Molden et al. 2001). However, rain-fed areas have been neglected for long due to lack of policy support. Despite the historic bias in favour of irrigated agriculture, rainfed agriculture continues to be an important part of the agricultural production.

¹ This paper is prepared by FANSA [a South Asian Network of civil society organizations and a member of Freshwater Action Network (FAN); www.fansasia.net] for the Conference’s session on “Nexus Cafe: Ideas-Innovations-Interaction”, 16 November 2011. It was written by Ms. Sudha (goparajusudha@gmail.com) and Mr.NLN Reddy (nlirmari@gmail.com), with the support of Murali and other colleagues across FANSA.
Growing agricultural crisis in the last two decades, which manifested in farmers’ suicides and food insecurity, has forced policy makers to rethink about rain-fed areas. Planners are increasingly looking towards rainfed or unirrigated agriculture to help meet the rising demands for food projected over the next several decades. Yield gap analyses carried out by Comprehensive Assessment for major rainfed crops in semi-arid regions reveal large yield gaps, with farmers’ yields being a factor of two to four times lower than achievable yields for major rainfed crops. Given such potential, yields could easily be doubled in rainfed areas of Asia provided the adoption of available improved soil, water, crop and pest management options on farmers’ fields is enhanced (Rockström and Falkenmark, 2000). In other words, the large potential for rain-fed agriculture in many areas of the world can be veritably realised if the technical and socioeconomic constraints are overcome. Towards this end, the following issues and problems of rainfed areas need to be addressed:

An insight into the inventories of natural resources in rainfed regions shows a grim picture of water scarcity, fragile environments, drought and land degradation due to soil erosion by wind and water, low rainwater use efficiency (35–45%), high population pressure, poverty, low investments in water use efficiency (WUE) measures, poor infrastructure and inappropriate policies (Rockström et al., 2007). Small and marginal farmers, who own such lands in rain-fed areas, have kept land fallow owing to lack of investments and policy support.

Rainfed areas are prone to severe land degradation due to poor land use. Over a period of time, continuing agricultural production, particularly in marginal and fragile lands, results in degradation of the natural resource base, with increasing impact on water resources. There is also reduction in land productivity capacity due to wind and water erosion of soil, loss of soil humus, depletion of soil nutrients, secondary salinization, diminution and deterioration of vegetation cover as well as loss of biodiversity is referred to as land degradation (Bossio et al., 2007).

There is a many fold increase in water and energy consumption in agriculture. Rain-fed agriculture used to consume less energy and water. However, with changes in food production systems from gravity based surface water irrigation (no energy) to more ground water dependency (i.e., bore well irrigation) energy consumption has increased. In the changed circumstances, communities lost control on water management. Water, a common resource has now increasingly become private resource (Davaluri V and K. Srinivsa, 2000).

Over the years, the farmers sunk bore wells indiscriminately in search of water. With the depletion of ground water, bore wells were sunk deeper year after year, which has negative impact on ground water. The depletion of ground water has thus increased pressure on water and energy. The rainfall variability also affects cropping systems in rain-fed areas. There is an increased incidence of crop failures in recent years due to delayed or untimely rains.

The excessive emphasis on commercial agriculture and consequent conversion of the food crops into cash crops has changed the face of dry-land agriculture. In the process, diversified cropping systems got disrupted leading to less availability of food locally. With increased input costs, the commercial crops have forced farmers to invest a lot thereby incurring consequent losses. The situation is worsened because of lack of any support (institutional, financial, etc) from the government as well as due to market volatility. This pushes farmers to take extreme steps. For example, unable to cope with losses, the cotton farmers in many of

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2 Land degradation represents a diminished ability of ecosystems or landscapes to support the functions or services required for sustaining livelihoods. A global assessment of the extent and form of land degradation showed that 57% of the total area of drylands occurring in two major Asian countries, namely China (178.9 million ha) and India (108.6 million ha), are degraded (UNEP, 1997).
parts of India, more so in Telangana region of Andhra Pradesh, have committed suicides (SAGE 2011)

Drought and land degradation are interlinked in a cause and effect relationship, and the two combined are the main causes of poverty in farm households. This negative nexus between drought, poverty and land degradation needs to be broken to meet the Millennium Development Goals (MDGs) of halving the number of food-insecure poor by 2015.

### III. OPTIONS FOR REVITALISING RAINFED AREAS

There is thus, a need to avail options for stimulating agricultural growth for food production and reducing poverty and environmental degradation in rainfed areas. The experience in India, and elsewhere, suggests that it is possible to increase the cropped area and yields from rain-fed agriculture through watershed development, revitalising small water bodies and sustainable agriculture. Together, these interventions can help us realise full potential of rain-fed areas thereby leading to satisfying a substantial part of the food demand. Following is expatiation on the above tenets based on our experiences in Andhra Pradesh, a southern state in India.

#### A. WATERSHED APPROACH

Watershed programmes have been implemented since 1990s in rain-fed areas to conserve soil and water, use natural resources productively and improve natural resource-based livelihoods. It lays emphasis on ecological restoration and on strengthening rural livelihoods. Watershed is a hydrological unit and can be defined as an area from which the run-off drains and flows through a common point in the drainage system.

Due to human interventions for agricultural purposes, changed ecology and management practices have had negative effects on the well-equilibrated natural watersheds (Reddy, N.L. N, and Sarah 2003). There is thus a reduction in water availability resulting in threatening land productivity and rural livelihoods. In view of the above, the watershed approach has graduated from natural resource conservation to productivity enhancement and sustainable rural livelihoods. In a way, the watershed approach not only focuses on improving land, water, vegetation and livestock, but also on the people whose livelihoods depend on these resources. The key components of watershed development thus include (IIED and Development Alliance, 2001):

- Carrying out area treatment (e.g., contour/farm bunds and farm ponds) and drainage-line treatment (e.g., check dams, percolation tanks) measures to conserve soil and moisture and to harvest run-off water, respectively. All these measures help to recharge groundwater.

- Enhancing productivity in agriculture, livestock and forestry sector; and also supplementing income activities.

- Improving livelihoods of poorest of the poor, with emphasis on women, landless and disadvantaged groups.

Sustaining development and protecting the environment – these are the two-pronged achievements of the watersheds. The effectiveness of improved watershed technologies was evident in reducing run-off volume, peak runoff rate, soil loss and improving groundwater

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3 Natural resource management on ridge to valley basis is an important aspect of the sustainable rural livelihood strategy.
recharge. Watershed interventions have also contributed towards improving natural resources, productivity of land, water and livestock, as well as enriching rural livelihoods.

The studies conducted by International Crop Research Institute for Semi-Arid Tropics (ICRISAT) show that the average village income from agriculture, livestock and non-farming sources were much higher compared to the neighbouring non-watershed village income.

Increasing crop productivity – this is a common objective in all the watershed programmes, and the enhanced crop productivity is achieved after the implementation of soil and water conservation practices along with appropriate crop and nutrient management. For example, the implementation of improved crop management technology in the watersheds of Andhra Pradesh increased the maize yield by two and a half times and sorghum yield by three folds (Wani et al., 2006a).

Improving water availability – in the watersheds this was attributed to efficient management of rainwater and in-situ conservation, establishment of Water Harvesting structures (WHS) and improved groundwater levels. Findings in most of the watershed sites reveal that open wells located near WHS have significantly higher water levels compared with those away from the WHS. In the various watersheds of India the treated area registered a groundwater level rise of 7.3 m. The various WHS resulted in an additional groundwater recharge per year of approximately 428,000 m$^3$ on average. With this improvement in groundwater availability, the supply of clean drinking water was guaranteed (Wani et al., 2006b).

Supplemental irrigation – this can play a very important role in reducing the risk of crop failures and in optimizing the productivity in the Semi-Arid Tropics (SAT). In these regions, there is good potential for delivering excess rainwater to storage structures or groundwater, because even under improved systems there is loss of 12–30% of the rainfall as run-off. Striking results were recorded from supplemental irrigation on crop yields.

Besides improvement in the status of resources and adoption of better management practices, the communities in watershed villages are well organized and in a position to make informed decisions. Building on social capital made the huge difference in addressing rural poverty of watershed communities. Watershed interventions have also created enabling conditions for nurturing adaptive capabilities of rural communities to climate variability. The watershed management practices certainly added to existing drought proofing practices and improved rural livelihoods to some extent.

B. REVITALISING TRADITIONAL WATER BODIES

Food production is directly related to water availability. The communities in the rain-fed areas face water scarcity due to variability of water availability. There is not enough water to meet people’s needs, as rising water demands persist from one season to the next throughout the year. There is broad consensus on the need to improve water management and to invest in water for food as these are critical to meeting the MDGs. There is a large potential for increasing food production through small-scale water harvesting systems that provide partial irrigation when water is most needed by the crops.

Traditionally tanks used to play an important role in the development of agriculture and rural livelihoods in semi-arid regions. They also played significant role in protecting local resources.

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4 A tank is a small water storage structure created by constructing earthen bund across a shallow valley to hold the rainfall runoff from its catchment area. Tanks may be either isolated or in cascades.
environment and sustaining water resources\textsuperscript{5} through ground-water recharge and harvesting surface water.

The fundamental reason behind environmental resource degradation is dilution or disintegration of the community’s stakes and erosion of grassroots level mechanisms to protect and enhance these stakes (Jodha, 1998). The genuine and effective restoration of community stakes is facing several constraints from the state and the local communities (Narain, 2003). Due to burgeoning problems of water scarcity and erosion of livelihood support systems, tank restoration emerged as essential development intervention.

Therefore actions around rehabilitation and management of tank should take into consideration needs of different users instead of limiting to command farmers. For example, the defunct tank in MattiGuttapalli (Andhra Pradesh, India) was converted into percolation tank after integrated treatment of tank and its resource base. The catchment area (consisting of a hillock) was treated under watershed programme. The removal of obstructions in the catchment helped in flow of rain water into the tank. Tank structure improved with bund strengthening, desilting, repairing sluice and removing encroachment in tank beds. Tank was converted into percolation tank after attending to above works (Reddy et al, 2006).

Who benefited from the above process? Integrated tank development in the tank served the interests of multiple livelihoods such as agriculture in command area, fishing and livestock. The availability of water all through the year largely facilitated access to drinking water and recharge of bore wells in the command and influence zones. Silt application improved soil fertility in dry land area. And there is regular fishery activity in the tank; and enhanced dairy activity in the village.

C. SUSTAINABLE AGRICULTURE

Another aspect that is vital to the development of rainfed agriculture is enhancing productivity. Sustainable agriculture can reduce uncertainty in rain-fed agriculture due to fluctuations in rainfall and its distribution. It can also improve relative productivity in rainfed lands affecting the livelihoods of the poor and marginalised farmers. And it involves giving priority to location specific interventions (and based on community knowledge) on soil fertility management, agronomic practices and production technologies as well as promotion of sustainable food cultures. Ultimately, the gains made through watershed interventions are to be consolidated through sustainable agriculture, which can bring-in improvements in the total factor productivity\textsuperscript{6} one of the necessary elements in making rainfed farming viable.

It is thus extremely important to design and implement policies and programmes for enhancing productivity of rain-fed agriculture and building the resilience to climate, in order to capitalise on the investments made in watershed and surface water harvesting. In other words, watershed development, revitalising traditional water bodies and sustainable agriculture needs to be considered holistically. (There will be a greater impact of these initiatives for ecological sustenance when sustainable agriculture rides on watershed and surface water.) In formulating these policies, there is a lot to learn from the civil society engagement for past three decades on innovation and scaling up of various elements of rainfed sustainable agriculture. In this context, three elements of sustainable agriculture

\textsuperscript{6} Factor productivity has to be redefined to include contribution made to the food, fodder, nutrition and ecological security. There is a greater potential for achieving this by giving more emphasis to sustainable agriculture which is centred on environment friendly practices, use of non-chemical fertilizers and pesticides and food production cycle.
which have been rediscovered from the traditional wisdom and age-old practices are to be accorded highest priority:

Community collective knowledge: The knowledge of farming has been externalised in the modern agriculture. The farm-based knowledge on soil, seed and other crop management practices has been internal to farming community, which was made redundant by the market driven agriculture. The agriculture has become more external input based and market driven both in terms of knowledge and inputs such as seed, fertilisers and pesticides (DDS 2008). It is possible to meet the disaggregated needs of rainfed agriculture only through use of knowledge and collective wisdom of community; and through proper investments to understand and integrate these knowledge systems with mainstream policies.

For example, Deccan Development Society (DDS) in Andhra Pradesh (India) has revived various traditional agricultural practices relevant to semi-arid regions. DDS has organised Dalit women farmers, documented traditional practices and supported them in appropriate use of local knowledge. In doing so, it has also built various support systems and enabling processes. These include exclusive Krishi Vigyan Kendra (KVK) on Millets (research and extension), celebrating crop festivals and organising carnival, alternative public distribution systems in villages and community based marketing. The learning from this experience is that the process of reviving traditional knowledge systems and food cultures should go together for conquering the hunger. And, therefore, the agricultural research should be re-oriented (and democratised) to give proper place to community knowledge.

Diversified Cropping: One of the basic principles of sustainable agriculture is ‘No to mono cropping’. It is possible to achieve crop diversification through mixed crops and crop rotation. And such a system is more suitable as each crop in the mixed crops draws nutrients from different soil strata and complements each other in fulfilling nutrients requirements, while working as a risk reduction mechanism in case of monsoon failure. The crop diversity helps in making available variety of foods, which are a part of local diet and fodder for livestock. These practices ensure crop diversity and thereby bio-diversity, which in turn helps in climate change mitigation and adaptation (PCCC 2009). For example, DDS has not only revived different traditional crops (in Medak district, Andhra Pradesh), but also involved the farmers to grow mixed crops. DDS has applied to AP bio-diversity council for recognition of the selected farms where nearly 30 varieties of crops are grown as crop-biodiversity heritage sites. And the process for getting approval is in progress.

Less external input agriculture: The sustainability of agriculture depends on input costs (both in financial terms and environmental impact). It is, therefore, important to reduce dependency on external inputs in soil fertility management7, seed and pest management. The practices such as compost usage, tank silt application, bio fertilizers and green manure will help in better soil fertility management and local self-reliance. Similarly, promotion of the seed banks and Non-pesticide management /Integrated Pesticide Management helps in seed sovereignty and farmers self-reliance in pest management respectively. All these will also help in increasing profitability of a crop8. Thus, these should be integral components of sustainable agriculture. In recognition of this, NGOs as well as governments have started focusing on these practices.

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7 Crop rotation and mixed cropping helps in retaining the soil fertility. There is a need to use farm yard manure, compost, vermi compost, tank silt application and green manure.
8 Bio fertilizers and botanical pesticides make the agriculture sustainable as they are available within the village and comes from the farm with no costs.
All the practices of sustainable agriculture may not be adopted in one go, given the changed practices of agriculture (dependence on external inputs, and cash economy). Adopting at least one method reduces stress on energy and ecology. The farmers of Punukula, a village in Khammam district of Andhra Pradesh used to grow cotton with heavy chemical fertilizers and pesticides. The farmers in the area turned to bio pesticides like Neem (Azadirachta indica) and garlic clove sprays in response to years of crop failures and saddened by incidence of farmers’ suicides⁹ (Down To Earth, 2004; www.indiatoggether.org, 2005).

Sustainable agriculture is all about changing the mindsets of the people and policy makers. It is defined by the Center for Integrated Agriculture as farming systems and government policies that develop long-term positive impacts on agricultural profitability; environmental quality, food sufficiency, quality and affordability as well as promoting rural family and community vitality. The lessons from sustainable agriculture are as follows;

- Building on the local best practices of farmers in rainfed farming, both indigenous and exogenous, by documenting, standardizing and disseminating information.
- Designing and implementing context-specific, multiple and interrelated interventions across sub-sectors like agriculture, livestock and horticulture through land development, organic matter build up, crop production enhancement and livestock development.
- Developing and offering a package of social security products such as deficit rainfall insurance, crop insurance, livestock insurance and human insurance to mitigate the risks and vulnerabilities of rainfed farmers.
- Build the capacity of farmers in the areas of proven rainfed farming technologies, leadership development, and change in attitude of farmers towards rainfed farming to lead to significant changes.

D. THE RIGHTS-BASED PARADIGM

The issue of rainfed area development is all about rights of the rainfed farmers and their entitlements for food, water and energy. Investments are needed in research, infrastructure, extension and creating support systems. In other words, discussions on rights of rain-fed areas need to address the rights of the people along with their geographical and geophysical dispositions. Specific investments should be apportioned for these areas’ development. The disaggregated needs of different groups, in particular small holders’ rights are to be addressed. One such example is Dalit-specific watershed for the treatment of lands of scheduled castes (a deprived and resource poor social group). Above all, policies aimed at ensuring rights will have to include specific needs of rain-fed areas. For instance, there is a campaign going in India about including millets in public distribution under food security measures, particularly in the context of proposed food security bill (DDS 2010).

IV. POLICY RECOMMENDATIONS

The rain-fed areas, which support a large proportion of the poor and their livelihoods, have been neglected. As a result, there is a severe threat to the food security of the poor. The potential for food production in the rain-fed areas has not yet been fully realised. For realising the food security there is a need for a pro-active policy support from government on

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⁹ After five years of effort (1999 to 2003) to rid farmers completely of pesticides, today the villagers do not use chemical pesticides at all - they are inspiring other farmers in their district and elsewhere to go the same way and improve their livelihoods. The Panchayat has passed a resolution that they would remain pesticide-free.
rain-fed agriculture. Based on the above discourses, we would like to recommend the following policy interventions:

- Rain-fed agriculture can meet substantial part of food demand provided proper investments and interventions are made. Sustained investments need to be made for revitalising rain-fed agriculture.

- A new paradigm for rainfed agriculture to promote soil fertility/organic matter, crop diversification, local input based agriculture (local seed systems, NPM), protective irrigation, and local value addition and marketing initiatives.

- Policies aimed at ensuring rights should give due space to the needs and potentials of rain-fed areas. Acknowledge the role of rain-fed agriculture in food production; and include dryland produces (Millets) in food security programs.

- Investment in organic agricultural practices by integrating crop and livestock systems. Include measures for livestock population growth.

- Policy for a holistic development of rainfed areas which enables of watershed development, community based tank management and sustainable agriculture as a prime movers of growth and sustainability of the rainfed agriculture as well as food security.

- Promoting commercial crops has devastating impact on soils and farming communities in rainfed areas. Discourage commercial only attitude in rain-fed as a policy; and encourage food crops and diversified cropping systems. Right to food to be realised with proper investments in dryland.

- Abolishing the artificial divide between dryland and irrigated systems with its bias towards irrigation management.
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