Revitalizing Rainfed Agriculture of Andhra Pradesh

Executive Summary

The growth prospects of agriculture in Andhra Pradesh largely revolve around vibrancy of rainfed agriculture since the latter accounts for over half of the net cropped area. The rainfed area is heavily concentrated in seven districts and saddled with innumerable constraints. The impact of climate change is more visible in regard to occurrence of extreme events, yield gaps of major crops and deteriorating environment. The land and water management issues are key to the revival of agriculture. The Agricultural Commission has recommended a set farm practices/ production systems, value addition measures, institutional interventions and capacity building measures to cope up with the challenges and to revitalizing rainfed agriculture and protecting farmers’ interests.

Current Scenario

In the State of Andhra Pradesh, around 56 per cent of the net sown area is under rain-fed agriculture. Classifying a district as rain-fed if less than 30 per cent of its net sown area is not under dependable irrigation Classifying a district as rain-fed if less than 30 per cent of its net sown area is not under dependable irrigation. The rainfed area constitutes the arid and semi-arid districts of the state viz., Anatapur, Chittoor, Kadapa, Kurnool and Prakasam, and sub-humid districts i.e. Visakhapatnam and Vizianagaram. Droughts occur more frequently in arid, dry and semi-arid districts. Anatapur, Kadapa and Prakasam account for 80 per cent of the rainfed area. The dry districts suffer not only from low irrigation but also from a small proportion of dependable irrigated area. Open/bore-wells are the main sources of irrigation in the semi-arid districts of Anatapur (76.3%), Chittoor (84.7%), Kadapa (73.3%), Kurnool (46.5%), and Prakasam (43.4%) but tank irrigation is more in
prominent in Vizianagaram district (47.8%).

The farmers of this rainfed area are more vulnerable due to low and fluctuating incomes. Poverty is heavily concentrated (32%) in these areas; sizeable proportion of them is chronically poor. The higher share of wage income in total household income relative to income from cultivation and limited non-farm employment / income opportunities highlights the livelihood insecurity of farmers.

**Rain Fall**

Climate change effects are more pronounced in the frequency and intensity of extreme events in these areas. The erratic pattern and changes in quantity of rainfall and number of rainy days have led to greater uncertainty and production risks. The five arid and semi arid districts experience low and erratic rainfall. Further, there is significant spatial variation in the contribution of SW and NE monsoons to the total annual rainfall. The annual average rainfall varies from 553 mm in Anantapur to 1231 mm in Vizianagaram (Figure 1). One of the major reasons for the noticeable increase in rainfall during the low rainfall/ off-season months in recent years is sporadic heavy rainstorms. The rainfall data since 1901 suggests that their intensity and frequency have increased over the years. Nearly 10 to 40 per cent of the rainfall drains as run-off from the fields depending upon the land slope.

![Figure 1: Annual Mean Precipitation from (1981-2002) in Andhra Pradesh](source: Directorate of Economics and Statistics, Govt. of Andhra Pradesh)

Most of the rainfall occurs during the southwest monsoon and the number of rainy days is very low at 39 days in the arid and dry semi-arid districts—Anantapur, Chittoor, Kadapa and Kurnool. Potential evapo-transpiration (PET) is much higher than the rainfall in these districts, except in Chittoor; as a result these districts face extreme moisture deficit.

**Droughts**

All the four Rayalaseema districts and Prakasam district are drought prone. The frequency of droughts has increased during the last 20 years when some part of the State had experienced a drought in as many as 15 years. The worst period was when the State suf-...
fered from five years of continuous droughts between 1999-2000 and 2004-05. Almost the entire State experienced drought continuously during 2001-02 and 2002-03. One in every three years used to be a drought year. During the last 20 years, all the mandals of Anantapur district were declared as drought affected in 10 years. In a couple of years, 94 per cent and 89 per cent of mandals in the State were declared drought affected and on an average, 38 per cent of mandals in the State were affected by drought every year. It varied from 19 per cent in the two Godavari districts to 56 per cent in Kadapa and 59 per cent in Anantapur. The drought coping mechanism has weakened over the years due

Status of Natural Resources

Of the 645 non-urban mandals of the state, 129 mandals have been found to be extremely (natural) resource deprived and these are mostly in Anantapur (51), Kurnool (30), Kadapa (24), Prakasam (18) and Chittoor (3) (Figure 4). Further, among the 129 very high resource deprived mandals, the share of Rayalaseema and Prakasam districts is 64.3 percent. 78 out of 287 mandals in these five districts are resource deprived. All the mandals of Anantpur are either extremely or highly deprived in regard to natural resource base while Vizianagaram and Visakhapatnam are better placed. These data indicate the vulnerability of rainfed agriculture.

Of the total 645 non-urban mandals of the state, 129 mandals have been found to be extremely (natural) resource deprived and these are mostly in Anantapur (51), Kurnool (30), Kadapa (24), Prakasam (18) and Chittoor (3) (Figure 2). Further, among the 129 very high resource deprived mandals, the share of Rayalaseema and Prakasam districts is 64.3 percent. 78 out of 287 mandals in these five districts are resource deprived. All the mandals of Anantpur are either extremely or highly deprived in regard to natural resource base while Vizianagaram and Visakhapatnam are better placed. These data indicate the vulnerability of rainfed agriculture.

Of the total 664 mandals in Andhra Pradesh, 105 have reached the “unsafe” stage of groundwater development; of these 105 mandals, 47 are in the “semi-critical” and 12 are in the “critical” category, and 46 mandals are in the “over-exploited” category. All these unsafe mandals are concentrated in four districts—namely Anantapur and Chittoor (69%); Kadapa and Prakasam (31%). Kurnool, a semi-arid district, as well as Visakhapatnam and Vizianagaram have no unsafe mandals, due to relatively better canal irrigation in Kurnool and higher rainfall in the latter two districts.

Soil Degradation

State receives eighty per cent of its total rainfall in less than 100 days and less than 100 hours making its management a difficult proposition. Land degradation is rampant and the high rainfall intensity induces the erosion of the fertile top soil. The erratic rainfall, high doses of chemical use in agriculture, low forest cover, poor investments in land and other resources and unscientific agricultural practices have led to severe soil degradation in Rayalaseema. About 50 Million tonnes of surface soil is lost every year. Environ-
mental degradation is taking place at an accelerated pace and the management of land and water resources has emerged as the main task in these districts.

**Cropping System**

Most of the rain-fed districts have light soil and a majority of them have crop growth period of less than 25 weeks which indicates that only a single crop can be grown in these districts. Prakasam has a sizable proportion of heavy soil and length of crop growth period longer than 25 weeks, while Anantapur has the lowest length of crop growth period. Hence, double cropping is possible in Prakasam. Pulses and oilseeds are the major crops in the rain-fed; Groundnut is the predominant crop in the dry areas of Anantapur and Chittoor; chickpea in Kurnool and Prakasam. The percentage of cropped area under rain-fed crops has increased over time for cotton and maize at the cost of groundnut and sunflower.

![Figure 2: Mandals according to Degree of Resource Deprivation in Andhra Pradesh*](image)

*Only 645 Rural Mandals have been considered.*

**Source:** CESS Study, 2016

**Yield Gaps**

The rain-fed districts have different characteristics which influence their production decisions and productivity. In comparison to the State average, many rain-fed districts of Andhra Pradesh show a severe yield gap of 13.3 per cent to 69.6 per cent in red gram, 11.8 per cent to 47.5 per cent in maize, 19 per cent to 44 per cent in cotton and 1 per cent to 32 per cent in bengal gram. In north coastal Andhra, despite its being placed well in terms of natural resources, crop yields are low due to meager investments and inadequate modern inputs use. High productivity in Prakasam, an agriculturally backward district, may not be sustainable due to the presence of extremely natural resources deprived mandals. It also has the highest yield for sunflower among the 13 districts of Andhra Pradesh. In Chittoor and Vizianagaram, the yields of a few crops are better. Many rain-fed districts have higher yields of sunflower than the State average. Some progressive farmers of
Chittoor district have achieved very high yield levels for maize, pulses, groundnut, sunflower, and cotton. Such practices should be scientifically assessed and replicated in other regions. Many factors such as soil fertility and management practices, knowledge levels of farmers, climate variability, credit, extension services and technology are the reasons for the yield gaps in rain-fed districts.

Market Imperfections

Rainfed farmers have been witnessing problems and risks in both production and supply chain. The oilseed growers have been adversely affected by WTO regulations while farmers of perishable crops experience frequent price crashes. The contract farming and market interventions have made limited progress in this region. A number of commercial crops grown in the rainfed area are not covered under minimum support price scheme and neither floor price scheme has been implemented. The Agricultural Market Committees established for market regulation and development made little progress and farmers have been losing confidence in these committees. Farmers of these regions are also put to disadvantage due lack of grading facilities. Price information inadequacies and asymmetries have denied price discovery by the farmers. Failure of the state in promoting private markets and creating competitive conditions has led to market imperfections and rainfed farmers do not have adequate space in decision making in the agricultural marketing systems.

Coping Mechanisms Adopted

The major crops grown are cotton, groundnut, sunflower and pulses which exhibit a high degree of production volatility. The traditional systems of intercropping such as Sorghum + Pigeon pea, Pearl millet + Pigeon pea and Groundnut + Pigeon pea and growing of short duration and contingency crops are being opted by progressive farmers to minimize the risk of total crop failure in some of these areas.

The State and NGOs have undertaken several initiatives to mitigate the adverse effects of rain-fed agriculture and stabilize farm incomes even while correcting for ecological imbalances. These include: Participatory Ground Water management (PGM), Community Managed Sustainable Agriculture (CMSA), Tree Based Agriculture (TBA), the WADI model of cultivation in hilly areas and Integrated Watershed Management Projects (IWMP). Participatory Groundwater Management (PGM) aims to ensure that the annual groundwater withdrawal in a hydrological unit (HU) does not exceed its annual groundwater recharge and implemented as a community based intervention in seven drought prone districts of undivided Andhra Pradesh during 1995-2003. Farmers are trained and encouraged to apply hydrological science for sustainable management of their groundwater resources, with an emphasis on reducing the demand for water for agriculture through numerous options such as changes in the cropping pattern, water use efficiency and soil moisture management.

Community Managed Sustainable Agriculture (CMSA), an initiative of SERP in 2004, is a multi-objective intervention to address
the genuine concerns of farmers in rain-fed areas regarding food and livelihood securities through the promotion of non-pesticide and organic agriculture and horticulture.

Integrated Watershed Management Project (IWMP) has been implemented since 2008 in drought prone areas of the state to restore ecological balance by harnessing, conserving and improving degraded natural resources such as the soil, vegetative cover and water. It also lays emphasis on convergence, community participation and livelihood alternatives. During 2009-10 to 2014-15, about 432 projects were taken up benefitting 1.81 million hectares at the cost of Rs 517.73 crore in (13 districts) Andhra Pradesh.

Strategies for Revitalising Rainfed Agriculture

The successful practices, CMSA, INM (Integrated nutrient Management), PGM and IPM (Integrated Pest Management) are promising and need to be scaled up. It is imperative that there should be location and farm-size specific interventions to manage risk and to protect natural resources. Some of the challenges include scaling up of the successful practices to larger areas, sustainability of community participation, institutional vibrancy in coordination of supporting organizations and nurturing partnerships, management of community resources and infrastructure. Better extension services and adequate knowledge can help the farmers to take better production decisions and increase crop yields and farm income.

Priority should be accorded to the extremely natural resource deprived mandals in the rain-fed districts in development planning.

Managing Water and Land Resources

Efforts to reform groundwater use, rainwater harvesting and soil conservation are inadequate. The rain-fed arid and semi-arid regions are experiencing severe pressure on groundwater resources. Subsidies and market penetration had resulted in the installation of bore-wells in excessive numbers in the rain-fed areas for realizing a quick profit. The situation has become so alarming, particularly in hard rock areas, that each bore-well may not be able to support an adequate area of land to be economical. The problem is further exacerbated by the increased receding of the groundwater level. The cropping systems have changed and water management has moved from the community (e.g. tank) to individuals (e.g. wells). Studies suggest that the power subsidy is largely usurped by the large farmers. Even after the shift to orchards (individual) and plantations by large and absentee landlords, the draft on groundwater has not come down.

PGM has to be introduced in a phased manner; the over-exploited situation needs the immediate attention of the government. Those in the critical and semi-critical situation also need attention, since there is a threat of these mandals reaching the level of over-exploitation in the near future. Well/bore-well irrigation systems should be considered as a part of the rain-fed ecosystem. Water from these sources should be limited to low water intensive crops or to grow high value crops.
through pressurized systems (drip, microsprinkler). Rice, if it is to be grown under the rain-fed ecosystem, should be grown only in the kharif season with the System of Rice Intensification (SRI) cultivation to meet domestic needs.

The twin problems of land degradation and variability in rainfall can be mitigated through the harvest of the run-off at the micro (field) and macro levels (watershed). The rainwater can be stored in various structures such as farm ponds, percolation dams, check dams, rock fill dams and loose boulder structures. It is beneficial to hold rainwater in situ so that the water is stored in the soil column to meet the water requirements in the intermittent rainless days during the monsoon. Some of the ways to enhance rainwater percolation into the soil is to have conservation measures of various types to contain the rainwater like: summer rainwater harvesting, summer/off season ploughing, contour farming, deep tillage, zing-terracing and mulching. Rainwater harvesting at the individual level of a farm holding is free from all socio-politico-cultural obligations but is constrained by high initial investment.

Tanks, an important common pool resource is being neglected and is being lost mainly on account of encroachments. The repair and maintenance of the tanks must be done through participatory interaction between users and funding agencies. The user communities such as Water Users Association (WUA) must be empowered with legal rights on maintaining and distribution as well.

**Soil Conservation**

Vegetation is the best moderator in soil conservation. Contour bunds along with waste weirs are adequate for low rainfall (less than 600 mm) regions and in light soils, whereas graded bunds are necessary for the other rainfall zones and in less permeable soils. Growing fodder legumes/grasses on the bunds is one important way of protecting the bunds. Vegetative barriers with dual purpose local species of vetiver must be encouraged wherever possible. They are best established when combined with small earthen bunds. Keeping the waterway covered in grass and gully plugging should be an integral part in the watershed development.

**Production System**

There has been a rapid decline of agro-biodiversity particularly in rain-fed agriculture. Mono-cropping has affected bio-diversity with the advent of commercial agriculture, especially in rain-fed areas. Groundnut and cotton are continuously grown in the rainy season in Rayalaseema. More recently maize is taking over in non-traditional areas, more so in the rice fallows. The excess application of phosphates to the groundnut crop has led to phosphorus induced zinc deficiency in Anantapur. Newer tree species are taking over in tree based cropping systems. A similar change is visible in livestock, particularly in bovines. There are fewer species of milch animals. The loss of biodiversity affects the small and marginal farmers more since agro-biodiversity used to be their safety net. Many small and marginal farmers continue to maintain biodiversity in crops (mixed cropping). They also have traditional livestock-based activities as a source of livelihood. In-
tegrating multiple components and species into the farming system would make it vibrant and sustainable. In the rain-fed areas, mixed cropping as well as mixed farming help in mitigating the effects of drought and provide sustainable livelihood to many of the farmers.

Tree growing or the system of agro-forestry by integrating trees along with crop and livestock systems has declined over the years for many reasons. Growth of multi-purpose tree species act as a moderator in erosion control, carbon sequestering and as a synergistic tool in tree-crop-livestock production systems. Among the various agro-forestry models, agri-horticulture is highly suitable for the Rayalaseema region, both for arable and non-arable lands with limited water for irrigation. A separate system has to be created using a network of piped water supply on payment mode and islands of Special Horticulture Zones (SHZs) should be developed on the pattern of SEZ (special economic zones). In these zones, paddy and other water intensive crops need to be discouraged and special emphasis should be given to perennial fruit plants with forward and backward linkages.

During the last few decades, crop shifts have been taking place in the rainfed regions of the state ie horticultural crops in Rayalaseema and plantations crops such as coffee in north coastal Andhra. There is ample scope to promote farmer producer companies around these crops to augment incomes of farmers besides engaging the educated unemployed youth gainfully. The cluster based approach is more suitable to make these producer companies more sustainable.

The Seed Village Scheme is another initiative in this direction to empower farmers in selected/suitable areas to upgrade the quality of saved farm seed and/or to produce foundation and certified seed for distributing to other farmers at an affordable cost in time.

Organizing the resource poor farmers into SHGs and federations is a pre-requisite for enhancing their bargaining power and also for accessing factor inputs as well as knowledge inputs. The proposed APSAFE should play an active role in checking the malpractices both in input and product markets. The farmer SHG federations can collectively work for the convergence of programmes like State Horticulture Mission, MGNREGS and Integrated Watershed Development for addressing their land and water related issues. The IWMP model of agricultural development is better suited to the State for the optimal utilization of water and other resources.

Village/Gram Panchayat resource based agriculture development plans need to be prepared involving farmers, NGOs and professional experts in a participatory mode using frontier technologies. Such a decentralized approach with the participation of stakeholders has been successfully attempted in Kerala under People’s Campaign and village development plans were prepared and debated for setting priorities at the GP level. The State should emulate this approach.

(Based on the Report of the Commission on Inclusive and Sustainable Agricultural Development of Andhra Pradesh)