A Study of Indigenous Agricultural Practices among the Tribals of Andhra Pradesh and Telangana

The Trajectory of Transition and Impacts on Livelihoods and Food Security

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We wish to also thank the ITDA and Agriculture Department officials, who gave us vital information for this study.

Abstract

The face of modern agriculture has changed from what the world perceived as the answer to address the issue of food security; it is not headed in the expected direction – the climate is changing, we are combating a drinking-water crisis, and our "revolutionary" food-production practices have become unsustainable. Modern agriculture was seen with an absolutely new different perspective that overlooked the traditional indigenous agricultural practices which were time-tested and had evolved in the farmer's laboratories in fields. Traditional indigenous agriculture is a repository of knowledge and a product of the adaptation of farming practices to the local environment that needs to dovetail with the innovations and practices of modern agriculture.

The **"Study of Indigenous Agricultural Practices among the Tribals of Andhra Pradesh and Telangana – the Trajectory of Transition and Impacts on Livelihoods and Food Security"** was primarily undertaken to document and recognize the sustainable indigenous agriculture knowledge and practices of the tribals located in the Eastern Ghats of Srikakulam and Visakhapatnam in Andhra Pradesh and in Adilabad in Telangana. It is a qualitative and quantitative study, where data were gathered through interviews, direct observation, focus group discussions and questionnaires, and analyzed.

The study brings to light and compares the traditional with the current agriculture systems, how unique and innovative they were and how, over a period of time, the practices changed and its impact on mankind, environment, food and hunger.

It has also raised pertinent questions on sustainability and the increased vulnerability of small and marginal tribal farmers to climate change.

Several types of indigenous knowledge and decision-making that are useful for development have been documented in this study, which in future will facilitate policy makers, development agencies, and communities to take a lead role in promoting use of indigenous knowledge in modern agricultural practices to sustain agriculture to address the needs of mankind in a sustained manner.

CONTENTS

Chapter 1

Introduction

1.1 Background

Traditional agriculture is believed to have been sustainable. This inspires conservationists to analyze and, if possible, benefit from the proficiency of indigenous knowledge; at least what remains of it or can still be remembered by local people. The reason for such a search is clear: world population is steadily increasing; poverty is growing and natural resources are degrading (Barkin, 1995).

The Green Revolution technologies, which partly solved the problem of food needs, appear to be too expensive, as the costs of technology transfer, soil erosion and loss of plant genetic materials that were resistant to diseases are high (Davis and Ebbe, 1993). Traditional agriculture, as it was originally applied, can neither be fully resumed nor would be accepted by increasing world population. It is, however, useful to preserve and mobilize local knowledge, which reflects the expertise in and understanding of the environmental aspects gained over thousands of years. About eight percent of the Indian population belongs to a category listed as Scheduled Tribes, enumerated in the Schedule to Article 342 of the Constitution of India. Tribal people have been seen to be strongly associated with the forests, hills and remote areas, practicing a unique lifestyle, having a unique set of cultural and religious beliefs. For millennia, tribal communities have lived in forests and survived on hunting and gathering of uncultivated forest food for sustenance. The tribal economy is a subsistence economy, which is primarily agro-forestry based. While agriculture is the major source of livelihoods for land-owning families, collection of minor forest products, herbs and non-timber products are major sources of income for the marginalized and landless tribal families. However, with growing population and resource pressure, the region is now witnessing a rise in livelihoods based on settled farming. Central Indian tribal homelands, comprising roughly 100 districts and running across the belly of the country, are home to roughly 55 million tribal people, i.e., more than 70 percent of India's tribal population. Notwithstanding the rich vegetation and good rainfall, this belt is home to one of the largest concentrations of rural poverty in the world.

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Tribals in developing societies have evolved location-specific local knowledge gained through close interaction within natural and physical environments and cultural adaptation, which are now recognized to be more eco-friendly and sustainable. Until the 1980s, these tribal farmers were considered laggards; however with increased awareness and scientific research it has been made possible to recognize such farmers as innovators based on their unique indigenous practices in the field of sustainable agriculture. But it has also been observed with the intervention of market economy and flawed short-sighted government policies and programs over a period of time, the rich traditional indigenous practice of sustainable agriculture have eroded.

The study "A Study of Indigenous Agricultural Practices among the Tribals of Andhra Pradesh and Telangana – the Trajectory of Transition and Impacts on Livelihoods and Food Security" was conducted in purposively selected tribal villages of Srikakulam and Visakhapatnam districts in Andhra Pradesh, and Adilabad district in the state of Telangana, India. The study was undertaken to document the traditional indigenous knowledge of sustainable agricultural practices and the trajectory of transition and its impact on livelihoods and food security.

1.2 Literature Review

For a long time, the tribals have been the focus of study for social scientists; Indian tribes have been studied by scholars of different disciplines and from different points of view. This literature review discusses important research findings in this regard and highlights the limitations and opportunities of the practice and system.

Various research studies reviewed from the published literature have been classified into

- Review of literature on indigenous agricultural practices among the tribals in India
- Tribal agriculture in transition / conservation / issues
- Ethnographic studies of tribes in Andhra Pradesh and Telangana

Review of literature on indigenous agricultural practices among the tribal in India

Kumar and Reddy (2004) conducted a study among the Pradan tribe in Adilabad district. The paper presents some empirical data which highlights the community's indigenous agricultural knowledge and the changes over time. The study states that the community in the past had evolved and adopted several mechanisms for land, soil and crop management including natural pest-management. But with time and external influence, the practices have changed, firstly the shift from sustenance-agriculture practices to input intensive agriculture (use of pesticide and fertilizer), secondly the shift from a primarily food-based system of cropping to commercial cash crops. Hence, the study concludes by recommending that instead of encouraging the farmers to adopt input-intensive agriculture the state

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departments must advocate the organic cultivation of crops. While understanding the changes in agricultural practices over the time, various external/interrelated factors like migration, changes in livelihood, etc. have been overlooked.

Sarvesh and Singh (2010) have given the scientific rationale of traditional agricultural practices followed by the tribal farmers of Uttar Pradesh. Although the discussed TAK (Traditional Agricultural Knowledge) is available in the tribal setting, not much is in practice and of priority. Further, Singh, Sinha and Kudada identified 25 indigenous cultivation processes, where 10 were used for soil management, three for weed management, two as plant protection measures, six for management of seeds and five for post-harvest techniques. The study, however, ignored the indigenous agriculture technology for farming. The literature gives a detailed description of traditional agricultural wisdom for forecasting the weather, with scientific rationale, but the document could not correlate it with climate resilience or coping mechanism practices of the tribal farmers.

Naranswamy's paper (2004) discusses traditional pest control techniques and innovative pest control devices used by tribals in the Nilgiri hills of Tamil Nadu. It is known as tribal Pest Management System and addresses crop pests, grain pests, pest-trapping and -repelling devices. Tribal people have been using plant-based products, crop residue and animal products for pest management.

Shankar (2015) states that the decreasing access to forest resources by tribal communities due to land alienation is a major factor for the changing

agricultural scenario among the tribals. He attempts to highlight that tribal women play a vital role in agricultural practices and have been instrumental in safeguarding the indigenous practices and passing them on to the next generation. Although the different traditional practices followed by tribal women have been explained elaborately, the study does not give detailed information/evidence on how the indigenous knowledge was conserved and passed on to the next generation. The indigenous knowledge practiced by tribal women was on the following subjects:

- Restoration of traditional seeds
- Preparation of natural/bio pesticides

Singh and Sureja have laid emphasis on the wisdom and perceptions of the Gond and Baiga tribal communities in Madhya Pradesh .The practices developed by them are for conservation of agricultural resources and their survival in a rainfed agro-ecosystem. The system of conservation and coping mechanism during drought is based on trial and error, hence no conclusive practice has been documented. The indigenous practices followed by the community are as follows:

- Classification of soil on account of topography, texture, stickiness and crop compatibility
- Indigenous cropping systems:
  - Red gram cultivation with rice – Seeds of red gram are sown on bunds as a check against soil erosion
  - Utera cropping system – Broadcasting the next crop seed 15 days before the harvesting of the primary crop, for effective utilization of available soil moisture (kharif season)
  - Bardi Cropping – Multifarious diversified crops in local surroundings of home and kitchen garden
- Creating micro-environments: Artificial trenches are made, where wetness/soil moisture is maintained through seepage of water from hilly areas in rainy season, which helps in crop growth
- Soil and water management
- Summer ploughing
- Mulching
- Dividing the land into small plots
- Contour ploughing
- Growing grasses along the borders of the farm plots

Ramakrishna (2004) in his study gave detailed information about the Apatanis tribe from Arunanchal Pradesh, who explored specific crop biodiversity (rice varieties) to capture nutrient differentials in the soil and optimize production from the agro-ecosystem. Their elaborate water management and nutrient recycling strategies represent a highly complex form of traditional ecological knowledge and technology linkages.

Inventory and Documentation of Tribal GIAHS in India, Schumacher Center (2000), in its report identified the biodiversity-linked traditional ecological knowledge for soil fertility management pertaining to North-eastern India. The TAK among the tribals of the North-east is as follows:

- Tribal societies, i.e., Garo, Khasi, Apatani, Jantia, etc. in North-eastern India grow plant-nutrient-efficient crop species on the top of the slopes and less efficient species along the bottom to match with the soil fertility gradient on a steep slope.
- With shortening of the shifting-agriculture cycle, the farmers tend to emphasize more on tuber and vegetable crops, as compared to cereals.
- Operating under a mixed cropping system, where the species are sown at the same time soon after the first rain during the monsoon, the farmer harvests crops sequentially as and when the crop matures over a period of a few months. After harvesting, economically useful components, which decompose rapidly, are recycled in the agricultural plots.
- Weed biomass pulled out of plots are put back into the system for similar reasons; about 20 percent biomass of weeds are left *in situ* without being

pulled out ,which serves as an important nutrient and conservation practice on a hill slope, which otherwise could be lost through erosion/leaching processes.

- Earthworms form an important component of many traditional agricultural systems.
- Under the Tropical Soil Biology and Fertility (TSBF) program, *in situ* management of earthworms for sustainable management of soil fertility, with reduced input of inorganic fertilizers in tea gardens of southern India. This technology is now patented by the investigators.
- Socially selected and/or valued species of traditional agricultural systems and those from natural systems often have ecological significance; these keystone species often play a key role in nutrient enrichment of the soil; such species help in redeveloped land use systems with community participation.
- Traditional eco-technologies, such as water harvesting systems and their use have been shown to alter soil biological processes and thus improve soil fertility.

The FAO's *Inventory and Documentation of Tribal GIAHS in India* (2010) identifies the three-tier agriculture system of Seethampeta and Srikakulam, where the hills are divided into different land-use classes based on the elevation, slope and ecological considerations, as an important agricultural heritage site. In this system the uplands are retained as forests, the mid-elevation lands are used for slash-and-burn agriculture, and in the plains, the tribal farmers grow the more economically viable varieties of crops.

Tribal agriculture in transition / conservation / issues in tribal agriculture

The problems of agriculture in the tribal areas as they emerged from the study of Ramaiah (1981), are: (i) The small size of agricultural holdings; (ii) Absence of irrigation facilities; (iii) Use of primitive techniques of cultivation; (iv) Absence of use of improved seeds and fertilizers and, as a result of the above, low productivity and meager net returns; and (v) Heavy debts and high rates of interest on loans.

Majumder (1987) noticed that the Garos (a hill tribal group) have now become, to some extent, part of the modernized world society. In technological development, they took a great leap from shifting cultivation to plough cultivation, but it was a pre-modernization attainment and till now they have been

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refusing to accept any more advanced technology in agriculture, though attempts have been made through various governmental agencies to modernize their agriculture.

Sangle and Kulkarni have attempted to study the extent of technological gap in tribal farming and to determine the extent which the factors like situational, personal, and socio-psychological aspects and communication can help in the prediction of technological gap on tribal farms.

Howbora, Banti Gogoi (1987), in their comparative analysis, distinctly brought out the difference in

methods and techniques among the tribal and non-tribal farming practices, but the study is limited to making an assessment of the effect of different agricultural practices on agricultural performance.

Ahmed and Shamim (2011) concluded that indigenous peoples' traditional knowledge could be important sources for developing new technologies in future, which would be economically viable, socially acceptable and ecologically sound.

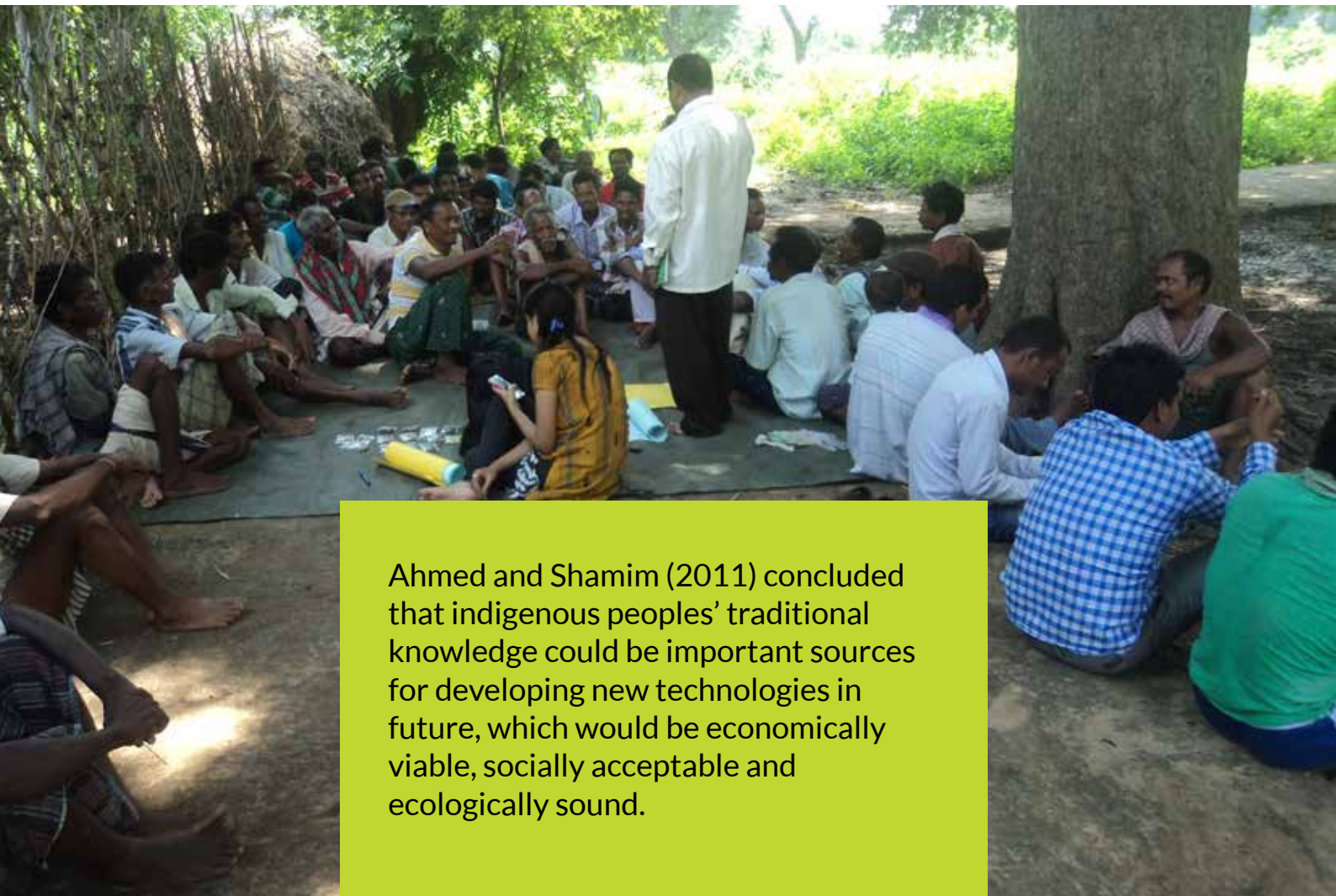
The tribals are in a transition phase from a forest-centered lifestyle to a rural, settled cultivation lifestyle, but the production from agriculture is not commensurate with the food requirements, while the scope for supplementation by way of intake of natural foods is diminishing due to depletion of the forests. The tribals are caught in a situation where on one hand they are losing command over the natural resources and on the other are unable to take command over the new resources at their disposal.

Ethnographic studies

Adhikary (1985) observed that since a long time ago, the Santhals have been pursuing plough cultivation and living within the broad framework of the agrarian economic structure of village India in close association with the caste-based Hindu society. Devendra Thakur (1986) made an elaborate study of the Santhals in Bihar. The study highlights their socio-economic conditions. It has also documented to what extent they were responsive towards the projects and programs undertaken during the different developmental plans.

Authorities on Indian archaeology like Sankalia (1962) and anthropologists like Haimendorf (1962) considered the Savara one of the indigenous tribes of prehistoric India. He has given in his book the origin, social and economic status of the Savara community. Sitapati and Munro believed that these people fled from their original habitat because of the onslaught by Aryans and settled initially along the basin of Vamsadhara River. Later they were invaded by the Hindus from the east and this forced them to flee to the hills and forests. They presently inhabit Orissa, Andhra Pradesh, and Madhya Pradesh. In Andhra Pradesh they occupy a continuous belt in the hills of Vizianagaram and Srikakulam districts bordering Orissa state. The distinct feature of all the Savara settlements is their location on hill slopes.

Padal, Raju and Chandrasekhar have studied the Kondadora, literally meaning "leaders of the hills", who are found chiefly in the hills of Visakhapatnam,



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Vizianagaram, Srikakulam and East and West Godavari districts of Andhra Pradesh. They are known for their robust physique, simplicity, and love for their land, forest, ecology and its entire set up. They are basically shifting cultivators. But they have now adapted to settled cultivation.

Christoph Von Furer-Harnendart (1988) has discussed the pattern and causes of disintegration of the traditional tribal system and their attitude towards the developmental programs of the government. Taking the example of two tribes, Apatanis of Arunachal Pradesh and Gonds of Andhra Pradesh, he found that the two tribes stand at opposite ends of the spectrum today. While Apatanis were clearly set on an upward path, the Gonds were threatened by an apparently irreversible decline in their fortunes. He claims that Apatani tribe of Arunachal Pradesh, numbering about 15,000, achieved development and integration without losing their identity because of the protection given by the Government of India.

P. Sudhakara Reddy (1995) in his comprehensive study discusses the processes and problems of displacement, rehabilitation and socio-cultural changes that occurred among the displaced Scheduled Tribe, the Yanadis of the Shriharikota Island in Andhra Pradesh, where the rocket-launching station was established by the Indian Space Research Organisation (ISRO), Government of India. The author also tries to portray the traditional social and cultural fabric and adaptation of the Yanadi islanders prior to their displacement, which serves as the basis for understanding the continuity and change in the environment, society and culture. He analyses the rehabilitation programs and the resultant factors and the forces behind the system of forced migration, and the adaptation of the Yanadis to the new environment outside the rehabilitation centers. He also describes the pattern and processes of continuity and change on the socio-cultural set up of the Yanadi Islanders.

Prakash and Suryanarayana Raju report on the ethnographic profile of Yerukala, a tribe living in the plains of West Godavari district of Andhra Pradesh. This paper is based on the data collected through various ethnographic techniques in some villages of Narasapuram *mandal*. The social status of the tribe is very low in rural areas. However, they claim superior status over Scheduled Castes. It is a patriarchal society and possesses a few sub-tribes and several exogamous patrilineages. Uncle-niece marriages and cross-cousin marriages are highly preferred. Child marriages are not unusual and monogamy is common. It is a patriarchal society and patrilocal residence is the norm. People are non-vegetarians. Most of the Yerukula people are illiterate. Occupationally, these people have a history of being involved in criminal activities such as burgling and dacoity. However, many of the Yerukulas have changed their occupation. The religion of the Yerukula is animistic and the influence of Hinduism and Christianity is noticed. This paper also reports various ceremonies and rituals associated with various life-cycle events namely, birth, naming, menarche, marriage, divorce and death.

Tribals in developing societies are now being recognized to be more eco-friendly and sustainable. Indigenous knowledge is threatened from two sources:
(1) Loss of the indigenous people's territorial boundary through their displacement by government projects or through commercial utilization of natural resources. This makes it impossible for many indigenous communities to sustain their knowledge.
(2) The introduction of the modern practices of agriculture and medicine.

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To examine the importance of such traditional knowledge of tribals and their role in sustainable agriculture, the study was conducted among the tribal communities in the districts of Srikakulam and Visakhapatnam in the state of Andhra Pradesh

and in Adilabad district of Telangana state. The aim of the study is to document traditional agricultural practices so as to protect the traditional sustainable agricultural practices from disappearing. Documenting the indigenous knowledge through such studies will highlight conservation and management practices that sustained the tribal communities over centuries that can be adopted for improving sustainable agricultural practices in the present times.

1.3 Objectives of the Study

The main objectives of the study were as follows:

- To study and document the traditional agricultural practices and the transition of change among major tribes of Adilabad, Visakhapatnam and Srikakulam
- To relate as to how and to what extent the traditional practices were climate resilient and served as coping mechanism against climate change
- To study the dynamics of food security and nutrition in terms of cultivated (farm-based) and uncultivated (forest-based) food, and the role of women

1.4 Limitations of the Study

Considering the complexity of the study, to capture the traditional agricultural practices mostly through recall techniques limited to an extent the scope for an exhaustive pool of qualitative data.

The data collection, FGDs and interviews were conducted for the study between the months of July to November (prime *kharif* season). Due to the preoccupations of the tribal communities in their agriculture farms, the study team had to collect the exhaustive data within a limited time window.

The study had its limitations, as it did not dwell in depth on the economic impact of the change in practices.

The subjectivity of the study may have some preconceived biases by the data-collection team / researchers.

Chapter 2

Methodology

2.1 Universe of the Study

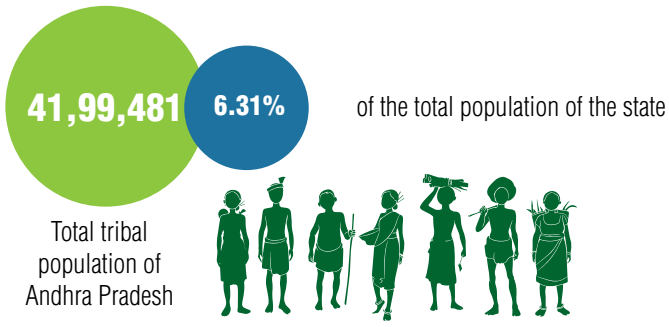
Currently 33 different tribes reside in the states of Andhra Pradesh and Telangana. According to Census 2011, the total tribal population of the then united Andhra Pradesh was 41,99,481, comprising 6.31 percent of the total population of the state. The tribes within the state are spread over the plain as well as the hill areas. The Scheduled areas or Agency areas extend over 30,030.77 square kilometers, constituting 10.91 percent of the total geographical area of the state. All the 33 tribes present a striking diversity marked by heterogeneous ethnic composition, diverse historical traditions and social and cultural levels. Of these 33 tribes, the Yanadis, Yerukala and Sugali are the populous tribes in the plain areas, while the Gond and Koya are the populous tribes in the Scheduled Areas and Kondh is the most primitive tribe in the state, thus representing the different social, cultural and economical levels of the tribes living within the state of Andhra Pradesh and Telangana. Eight tribes, namely the Gonds, Kolams, Naikpods, Savara, Kapu Savara, Jatapu, Kondadora, Kondh and a small percentage of others have been chosen for the present study as they are the major tribes in the Agency areas of Utnoor in Telangana and Seethempeta and Paderu in Andhra Pradesh state, where CPF is working with the tribals in 72 villages.

2.2 Sample Area

The study has been conducted in the CPF operational villages located in the Agency areas of Srikakulam and Vishakhapatnam districts of Andhra Pradesh and Adilabad district of Telangana.

2.3 Sample Size

A total of 534 households were surveyed from 35 villages, which represent 13 percent of the total households and 50 percent of the total villages of the CPF operational area in the districts. The households and the villages were selected through random sampling. The details are in Table 1.



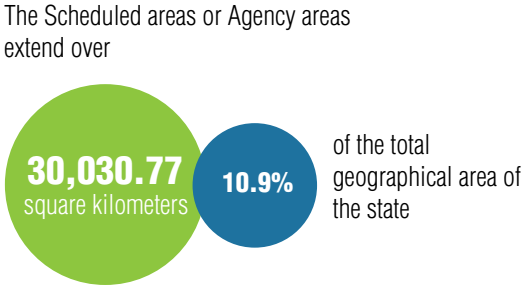


Table 1: List of sample villages

District	No. of Villages	Name of Village	Community	Sample Households
Srikakulam	7	Ambalagandi	Jatapu	14
		Kottakota		17
		Kusumuru		23
		Lokonda	Kapu Savara	17
		Mamidijola		15
		Seedhi		19
		Titukupaiguda	Savara	26
Total	**7**			**131**
Visakhapatnam	**7**	**Gorrelagondi**	**Kondadora**	**16**
		R. Kothavuru	Nukadora	18
		Kandulapalem		46
		Isukalagondi		10
		Panasapalli	Kammara, Goud	35
		Chavidimamidi	Kondh	9
		Thotagunnala		10
Total	**7**			**144**
Utnoor	**12**	**Balanpur**	**Gond**	**12**
		Bheemuguda	Kolam	5
		Umapathikunta		12
		Ramnagar		12
		Kolamguda		10
		Morripet		7
		Jendaguda		6
		Kamaiyapet		26
		Pitlaguda	Naikpod	16
		Ramlingapet		8
		Ellaguda		14
Total	**12**			**130**
Narnoor	**9**	**Khandow**	**Gond**	**12**
		Rampur	Kolam	15
		Kattaguda		9
		Sedwai		10
		Chittaguda		16
		Mathurathanda	Mathura	16
		Anduguda	Andh	10
		Admiyan	Gond, Pradan	24
		Khandow BT	Lambada	18
Total	**9**			**131**
Grand Total	**35**			**534**

2.4 The Sources of Data

The study is based on primary data collected by both qualitative and quantitative techniques. The qualitative data was collected through Focused Group Discussion (FGD) and PRA. In all, 30 FGDs were conducted, 10 FGDs each with old tribal farmers, young tribal farmers and women, to ensure that all age groups are well represented and the study captures their perspective. On an average, one FGD group had 12–15 members as participants, who gave details about the origin of cultivation amongst their community, key practices in land preparation, sowing, harvesting, maintenance of seed and grain banks, uses of tools, the role of women, dependency on uncultivated food from the forest, etc.

The quantitative data was collected through a structured household questionnaire which was collected from different age groups, including both men and women, to ascertain the transition in practices and also, in a way, substantiate the findings of the FGDs.

The total population of Scheduled Tribes in India is 843.26 lakh and constitutes 8.20 percent of the total population as per the 2001 Census report. Given below is a brief description of the tribes covered under this study.

Savara

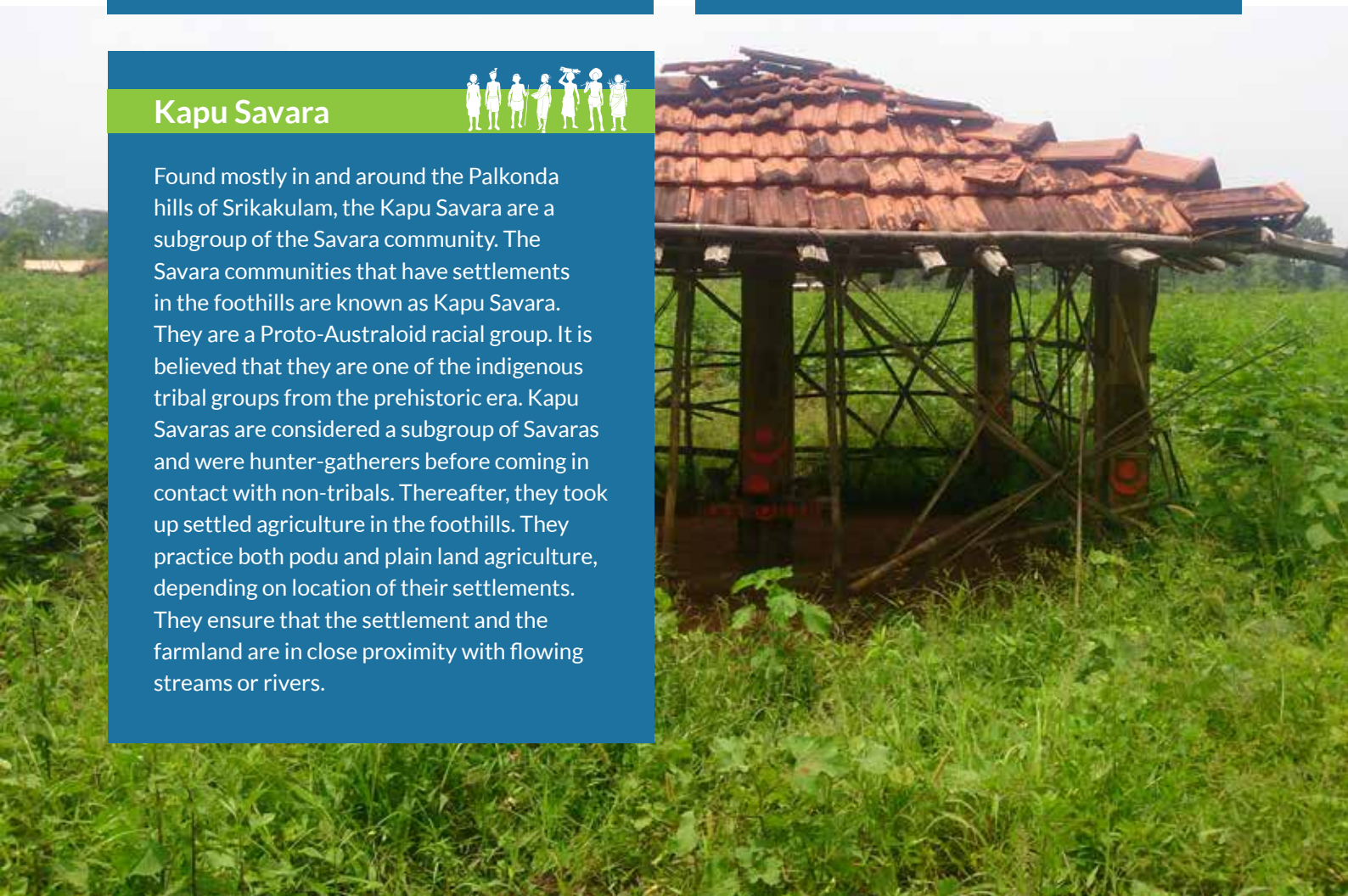
The Savara, numbering about 4.92 lakh, are one of the most populous tribes of the country. The Savara are one of the most primitive tribes of Andhra Pradesh. They are mainly found in the picturesque Palakonda hill ranges (part of Eastern Ghats) of Srikakulam and Vizianagaram districts. They belong to Proto-Australoid racial stock. On the basis of physical features the Savara habitat can be divided into two distinct zones: (1) the hill settlements and (2) the foothill settlements. In Sanskrit, Savara or Sabara means a mountaineer. It is believed that Savaras were one of the indigenous tribes of pre-historic India adept in manufacturing painted pottery and even copper tools and weapons. The traditional social unit is the extended family, including both males and females descended from a common male ancestor. Their source of livelihood is based on the location of the settlement. For generations the main sources of livelihood for the Savara were shifting cultivation on hill slopes and the collection of forest produce.

Jatapu

The Jatapu tribes are an acculturated section of the Khond tribe. They chiefly reside in the dense hill slopes and valleys in the Aency areas of Srikakulam and Vizianagaram districts. Shifting cultivation or podu cultivation was one of the ancient methods of cultivation practiced among the Jatapu community , especially in the areas of forest and mountain tracts and were experts in it. . They use to grow millets like ragi, sama and korra, oil seeds like niger and castor, and pulses like red gram in podu fields. They were adept at hunting and fishing as well. They are well-versed in handicrafts like basket- and mat-weaving, oil extraction, etc. They celebrate festivals called Hira parbi (seed charming), Maha parbi (new mango fruit eating), Kumlla parbi (consuming maize and pumpkin products), etc. The Jatapus' economy is largely influenced by the habitat they inhabit and the level of knowledge accumulated about the natural resources and skills by using these resources.

Kapu Savara

Found mostly in and around the Palkonda hills of Srikakulam, the Kapu Savara are a subgroup of the Savara community. The Savara communities that have settlements in the foothills are known as Kapu Savara. They are a Proto-Australoid racial group. It is believed that they are one of the indigenous tribal groups from the prehistoric era. Kapu Savaras are considered a subgroup of Savaras and were hunter-gatherers before coming in contact with non-tribals. Thereafter, they took up settled agriculture in the foothills. They practice both podu and plain land agriculture, depending on location of their settlements. They ensure that the settlement and the farmland are in close proximity with flowing streams or rivers.



Kondadora

The Kondadora, literally meaning “leaders of the hills”, are found chiefly in the hills of Visakhapatnam, Vizianagaram, Srikakulam and East and West Godavari districts of Andhra Pradesh. The total population of this tribe in the state is 1,41,089. They are known for their robust physique, simplicity, and love for their land, forest, ecology and its entire set up (Haimendorf, 1982). The Konda Dora tribe is divided into a number of clans such as Korra, Killo, Swabi, Ontalu, Kimud, Pangi, Paralek, Mandelek, Bidaka, Somelunger, Surrek, Goolorigune, Olijukula, etc. They call themselves Pandava Doras or Pandava Rajas. They believe that they are the descendants of the Pandavas of the Mahabharata. The Konda-Dora language, which is also known as Kubi, is closely related to the Kui language of the Khond, and has borrowed vocabulary from Odia and Telugu. Many Konda-Dora speak Telugu as well as or instead of their native language. They are basically shifting cultivators. But they have adapted to settled cultivation. They collect and sell non-timber forest produce (Minor Forest Produce).

Khond

Khonds, an ethnic group of India, are one of the Particularly Vulnerable Tribal Groups (PVTGs) of Andhra Pradesh with a population of 86,010 in the state. They are believed to be from the Proto-Australoid ethnic group. Traditionally hunter-gatherers, their main divisions are the Kutia, or hill Khonds, and the plain-dwelling Khonds; the landowners among them are known as Raj Khonds. Their native language is Kui, a Dravidian language written with the Oriya script. The Kondh are adept land dwellers exhibiting greater adaptability to the forest environment. They witness a way of life relatively unchanged through centuries. They have a subsistence economy based on foraging, hunting and gathering but they now primarily depend on subsistence agriculture, i.e., shifting cultivation or podu. They have practiced podu farming for generations and do not remember it as a new practice The Kondh are excellent fruit farmers. Forest fruit trees like mango and jackfruit are also found in huge numbers, which fulfill the major dietary chunk.

Gond

The Gond are also known as the Raj Gond. The term was widely used in the 1950s, but has now become almost obsolete, probably because of the political eclipse of the Gond Rajas. They are spread over the states of Madhya Pradesh, eastern Maharashtra, Chhattisgarh, Uttar Pradesh, Telangana, Andhra Pradesh and Western Odisha. With over ten million people, they are the largest tribe in Central India. The Gondi language is closely related to Telugu, belonging to the Dravidian family of languages. Originally they must have been nomadic hunters and food gatherers and later also took to shifting cultivation. Shifting cultivation is not merely one type of agriculture but a complex cultural form, a way of life. It requires no draft animals and allows the cultivators more leisure time for work in the forest, hunting, fishing, and the collection of forest produce.

Kolams

Kolams are a designated Scheduled Tribe in the Indian states of Telangana, Chhattisgarh, Madhya Pradesh and Maharashtra. They belong to the Particularly Vulnerable Tribal Group (PVTG). They live in exclusive settlements in forests and mountainous tracts. Their population, according to the 2011 Census, is 44,805. The Kolam tribals are forest dependent and sustain themselves on hunting, forest produce and have also taken to farming. The Kolam people have Dravidian features. They speak their own dialect, called Kolami, but also speak Telugu and some of them also speak Marathi. They have a patriarchal society with a male member being the head of the family.

Naikpods

The wooded hills and secluded valleys of Adilabad district, which were the habitat of the Kolams, also served some groups of Naikpods as a refuge area, where until the 1940s they practiced slash-and-burn cultivation with hoe and digging stick. The Naikpods lived in hill settlements. Naikpods are also located in the districts of Karimnagar and Warangal in the state of Telangana. Naikpods originally had a language of their own, which closely resembles Kolami, but today only a few small groups of Naikpods in the western part of Adilabad District and the adjoining taluks of Maharashtra still know this ancient tongue. The majority of the tribe speaks Telugu as their only language. Traditionally, the Naikpods lived in the forest and were basically food gatherers and hunters and their sustenance depended on it. As food collectors, they ate wild roots, Caryota pith, mango kernels, etc., which were available within the forest.

Chapter 3

Findings and Observations

Chapter Three gives details, analysis and findings of the traditional agricultural practices and the changes that have taken place over a period of time, amongst the tribes located in Visakhapatnam and Srikakulam districts of Andhra Pradesh and Adilabad district in the state of Telangana. The results, discussions and analysis have been undertaken on relevant issues as part of the study and presented in this chapter.

3.1 Agricultural Background of the Tribal Communities

The study also undertook to find the traditional agricultural practices that each of the tribes followed – their genesis and evolution. This information has been collected through first-hand group discussions and recall techniques.

GONDS

The Gond tribes were originally forest dependent and were food collectors and hunters. Traditionally they did not have knowledge of cultivation. As reported some 40–50 years back, tribal men and women from the family cleared forest for cultivation, which they had learnt from the communities that were located near the forest. The transition was not easy, as they faced the wrath of the Forest Department, which would raid the land cleared and taken by tribals for farming. During the raids the tribals would run away and later come back again to cultivate. Forest was cleared for agriculture farming according to the capacity of each household.

NAIKPODS

Originally the Naikpods were a forest-dependent community and for their sustenance ate gums, tubers, fruits, etc. and hunted animals. Agriculture was started some 50–60 years back. They learnt the art of farming from the communities living on the plains outside the forest periphery, where they worked as farm laborers. They gradually became inclined to undertake agricultural farming for their food needs and sustenance. They came to the plain lands from the forest and cleared land for agriculture. The tribes did not have any internal management system for the extent of land to be taken for each family for agriculture farming. It basically depended on their capacity to farm.

KOLAMS

The Kolam tribes were originally forest dependent and lived in forests and sustained themselves on hunting and collection of food – tubers, mushrooms, flowers (*mahua*), nuts, gums, etc. Some of the tribals worked as farm laborers in the fields of farmers who were located in the villages outside the forest. Some 50 years back, some tribals, after serving the agricultural farmers as farm laborers for 10–15 years, decided to take up agricultural farming to sustain themselves.

From total dependency on the forest for their food and sustenance they moved towards agricultural farming as well. The husband and wife and other members in the family cleared a section of forest. Despite intimidation and resistance from the Forest Department, the tribals continued farming. They were jailed in Utnoor for defiance, their bulls were taken, but it did not deter them. The confrontation between the Forest Department and the tribals finally stopped some ten years back.

JATAPU

Traditionally The Jatapus way of agriculture is *podu* cultivation, which is a Neolithic practice of shifting, slash-and-burn agriculture farming .The villages are located in the forest foothills and the tribal farmers practiced farming of millets, lentils, oil seeds and pulses for livelihood and sustenance in their *podu* farms and also depended on the forest for their uncultivated food requirements. The tribals had a deep sense of natural resource management, and in order to keep a balance between the need for sustenance and the environment, the village head decided the extent of land each family could undertake for farming, based on the size of the family. The farms were located on the forested hillsides of the Eastern Ghats. The land was burnt before shifting to other patch of land to ensure that the ash acted as a fertilizer; the land regenerated and was fertile again for farming after three years. After the implementation of the FRA 2006 , *podu* cultivation is not in much practice.

SAVARA

The community traditionally has been practicing *podu* farming for generations. They practiced shifting agriculture with slash-and-burn farming. They burn the fields every three years and move to another field for farming. They traditionally moved between two plots of land for farming. The traditional knowledge of farming was handed down to them from their parents and grandparents in the fields. Each family in the village practiced *podu* farming in the forest hills and the village elders and leaders decided the extent of land to be undertaken for cultivation by each family. On an average a family of four to five adult members could take 2–2.5 acres of land for cultivation. No one violated this rule. The *podu* farm land got recognised under FRA as IFR land for most of the farmers and now shifting cultivation has become illegal, except in designated FRA lands.

KAPU SAVARA

Kapu Savara communities live in forests in the foothills and used to subsist on shifting agriculture, food gathering and collection of minor forest products. They practiced slash-and-burn agriculture to clear and make their farmland fertile and move to a new plot after three years. They practiced *podu* farming on the forest hill slopes. In plain lands they cultivate paddy, which they have learnt from neighboring villages which fall in the state of Odisha.

KODU

The Kodus are one of the PVTGs of Andhra Pradesh. They practiced shifting agriculture but not slash-and-burn farming. This tribal community sustains itself on agricultural farming and gathering of uncultivated forest food and collection of minor forest produce. Traditionally they practice three-level farming, which is a practice unique to the tribals of this region. Three-level farming is based on the gradient, quality of soil and water availability. *Podu* cultivation is the first level, the second level of farm fields are called *garu* which has step farming and uses land that is less fertile, and the lowest land, located in the foothills or plain land, is called *pallam*, which is used for wetland farming. They passed the traditional knowledge of farming from their parents and grandparents to the next generation. Self-imposed rules are enforced by these tribals to maintain equilibrium between nature and their needs. The Kodu PVTG households often relocate voluntarily from their original habitation, if their population increases and they feel that this would put pressure on the natural resources, which would not be able to sustain them. Secondly, like some of the other tribes, the extent of *podu* land that was undertaken by each family was based on the family size.

KONDADORA

The Kondadoras were traditionally shifting cultivators; they would leave the current patch of land and clear the next patch of land for higher yield after every two to three years but over a period of time have adapted to settled cultivation for their sustenance. Apart from agricultural farming, they gathered uncultivated food from the forest and also collected minor forest produce for their sustenance. Like the Kondh, the Kondadora also practiced three-level farming based on the gradient of the hill forest land – *podu, garu and pallam*.

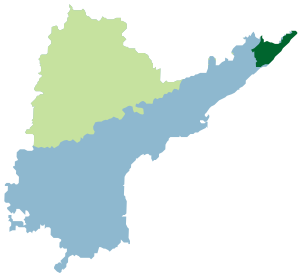
The top two levels were undertaken for mixed cropping, where the seeds were broadcast, and for the third level a small nursery bed was prepared within the same patch of land and later the seedlings were transplanted in the fields. In the top two levels mostly millets, pulses, vegetables and flowers were grown. The extent of land undertaken for cultivation was decided by the community as per the family size and their capacities for farming. On an average they cultivated one to three acres of land. Like other tribals, they practiced extensive crop diversity in their agricultural farm lands. This three-level farming system is still exisiting now in settled cultivation.

Kapu Savara communities live in forests in the foothills and used to subsist on shifting agriculture, food gathering and collection of minor forest products. They practiced slash-and-burn agriculture to clear and make their farmland fertile and move to a new plot after three years. They practiced podu farming on the forest hill slopes.

3.2 Agriculture Farming Practice, Cropping Pattern, Variety of Crops Grown

Each geographical location has significant differences in farming practice in terms of the gradient of the slope, availability of space for agriculture, water and soil type. The farming practices and techniques unique to the study locations and tribes have been described below.

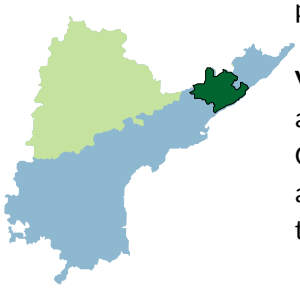
3.2.1: Locations and Practices



Srikakulam: The district lies in the Eastern Ghats of India and mostly consists of hilly areas with dense forest. They have two types of farmlands, plain land and *podu* land. Traditionally The sites covered by well-developed forest growth of land were taken for *podu* cultivation – shifting cultivation. Vegetation served them as an index of the fertility of the site. The thicker the forest vegetation of an area, the more years it could be kept under cultivation and the larger its yields. But at the same time, the hillocks which included too many huge hardwood trees, which would require too much labor to cut, were avoided. Land that was too rocky or too steep was also excluded. Slash-and-burn farming was in practice, as the ash of the burnt trees made the land fertile. In *podu* land they cultivated millets, lentils and oil seeds.

In the foothills are the plain lands, which are primarily wetlands. The land usually lies near a running stream or *nala* and is very fertile. They cultivated paddy and vegetables in the plain land.

The *podu* or shifting cultivation is not much in practice in the current scenario. The *podu* land got recognition under FRA and the area under shifting cultivation is fixed. As per law the farmer cannot move to a new patch of land. The *podu* lands are currently under cashew plantation.



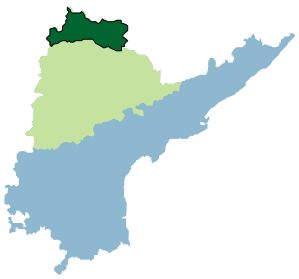
Visakhapatnam: It also lies in the Eastern Ghats and has hilly areas available for farming. The three-level forest-farm model of sustenance was practiced by the tribals in Visakhapatnam based on land gradient. This model ensured food availability and demonstrated optimum utilization of land resource for sustenance.

The fertile fields located on the top of the hills in the forest are called *podu* fields. *Podu* farming is an indigenous agricultural practice, where the tribals practiced slash-and-burn-and-shifting agriculture. The tribals undertook farming for three to four years on a plot of land; after that they would select a new farm location. No land-development works were undertaken before sowing the seeds as the land was considered fertile. In the *podu* land the tribals undertook mixed crop farming with a minimum of eight or nine crops at a time that comprised of millets, lentils and some oil seeds. The *podu* farming was rainfed and this practice was passed from generation to generation.

The second level of farm fields, located in the semi-fertile or degraded middle hills with steep slopes, was called *garu*. There is severe soil erosion due to the heavy rain water run-off, making the land less fertile for farming. In *garu* land the tribals undertook step farming and land development works, where they ploughed the land using bullocks and also tilled the land. They used cow-dung manure to improve soil fertility and also built soil and stone bunds on the periphery of the steps to arrest soil and water erosion. Mud channels were built in *garu* land to irrigate the fields. In *garu* land the tribals usually grew one or two varieties of crops like *ragi*, little millet , oil seed (*ulassallu*), dry paddy, turmeric or maize.

The third level of fields is called *pallam* or *pallamu*, which is located in the foothills of the forest and is basically wetland farming. The land is ploughed and tilled, and mostly paddy and vegetables are grown in these farms.

The traditional practices are still intact in the current period.



Adilabad: Traditionally they have plain forest land for cultivation and follow shifting cultivation. They keep changing the patch of land every two to three years. The farmlands have dry, arid, black and loamy soil, which is best suited for growing millets and pulses

3.2.2 Variety of Crops Grown

Traditional tribal agriculture was based on diverse crop varieties, which provided food security to households and maintained ecological soil and water balance.

The study found that there was a rich diversification of crops of different types in the area, with traditional indigenous varieties of food crops and cash crops. Millets and pulses were a staple of the food the tribals ate. Overall, the study found that in past there were 11 different types of millets, with 17 varieties; 8 types of pulses with 16 varieties; 2 varieties of paddy; and vegetables, oilseeds, etc. On an average 10–15 varieties of crops were sown at the same time in the fields.

Figure 1 below shows that Visakhapatnam was the richest district in terms of crop varieties, i.e., the farmers used to cultivate six different food crops – millets, cereals, pulses, oil seeds, vegetables and others. It was a storehouse of 11 varieties of millets, 8 varieties of pulses, 2 cereals, 3 oilseeds, vegetables and cash crops like turmeric and ginger, whereas in comparison Srikakulam and Adilabad had fewer varieties of millets, pulses and oil seeds.

The study compared the traditional vs current food-grain diversity (Figure.2). As per the data collected it has been found that there is a phenomenal drop in crop diversity, but under the category of 'Others' the crop diversity has increased, where food crops have decreased or replaced with cash crops as in Srikakulam with cashew and in Adilabad with cotton.

Figure 1: Comparison of types of crops grown traditionally in three district

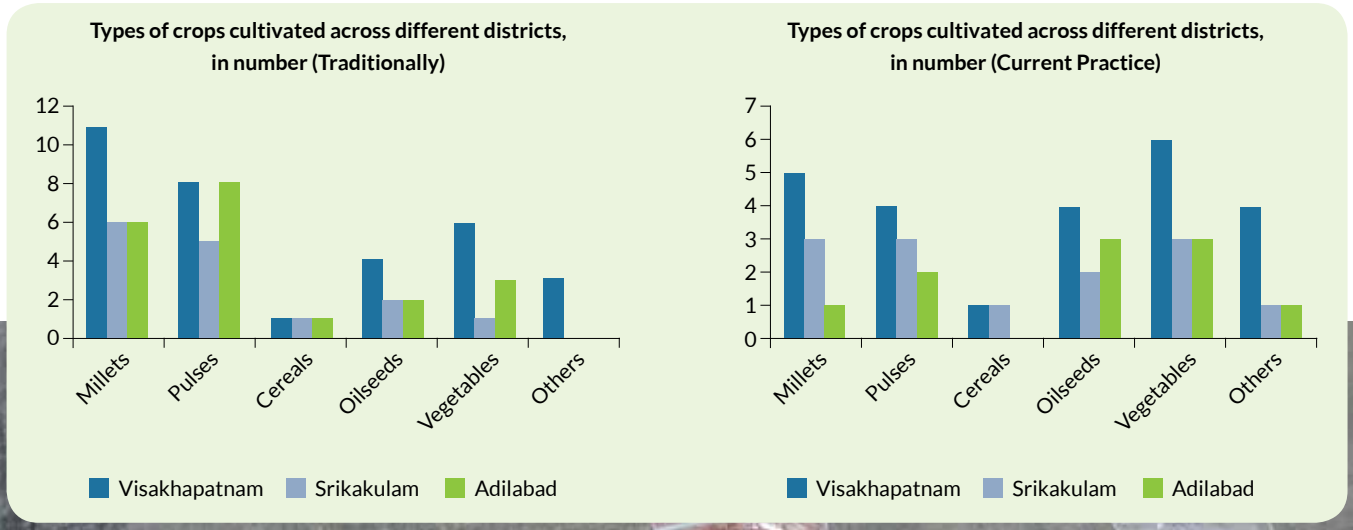


Figure 2: Comparison of types of crops grown currently in three districts

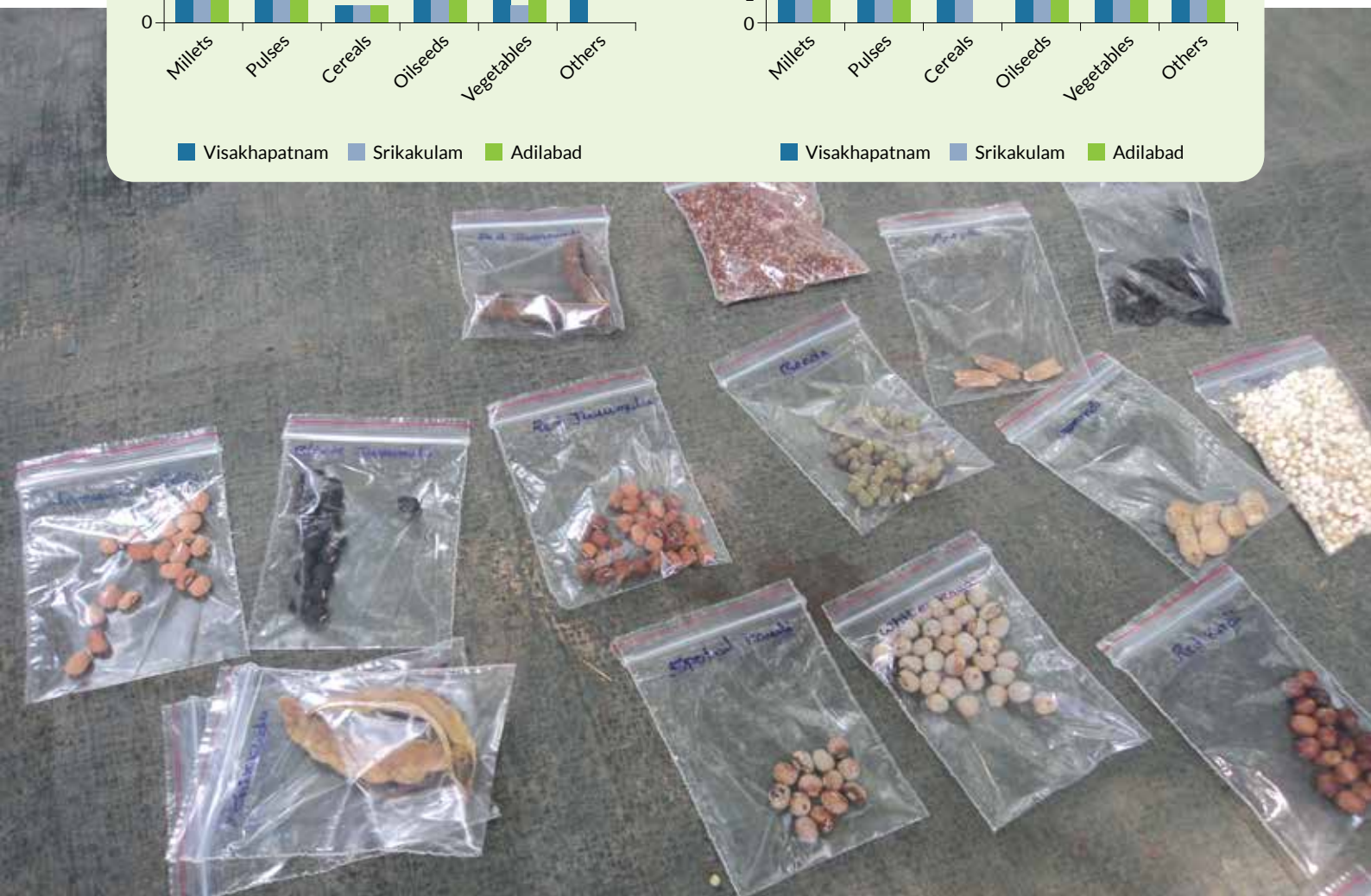


Figure 3: Comparison of past and present crops cultivated in three districts

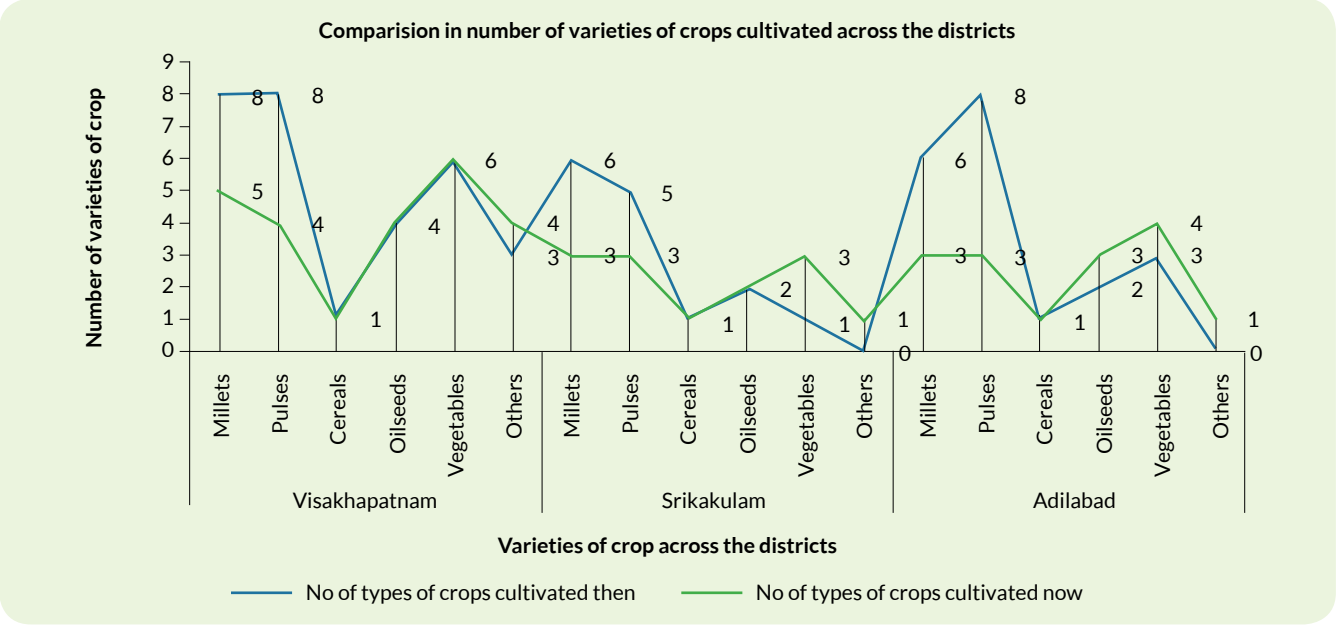


Figure 3 above gives a comparative analysis on the varieties of crops cultivated traditionally against the current situation. The graph shows that there is an approximately 50-percent fall in cultivation of millets and pulses across the districts, whereas there is insignificant variation in cultivation of cereals, oilseeds and vegetables; some new varieties of cash crops have entered under "Others".

As there is reduction in cultivation of millets and pulses in the current generation, there is a potential threat of the seed varieties getting extinct. Currently in Visakapatnam the seed and crop diversity is comparitively greater than in Srikakulam and Adilabad. Adilabad has gradually lost on this traditional knowledge and practice.

As per the study findings, traditionally there were 8 types of millets with 15 varieties, which has now reduced to 5 types with 5 varieties (Figure 4).

Simillarly in Figure 3 it is seen that there were seven types of pulses with 13 varieties, which has reduced to three types with six varieties.

With the fall in cultivation of traditional varieties and the introduction and propagation of cash crops and mono crops in the agriculture system, there has been a paradigm shift in the cropping pattern.

Figure 4: Comparison of availability of millet varieties, past and present

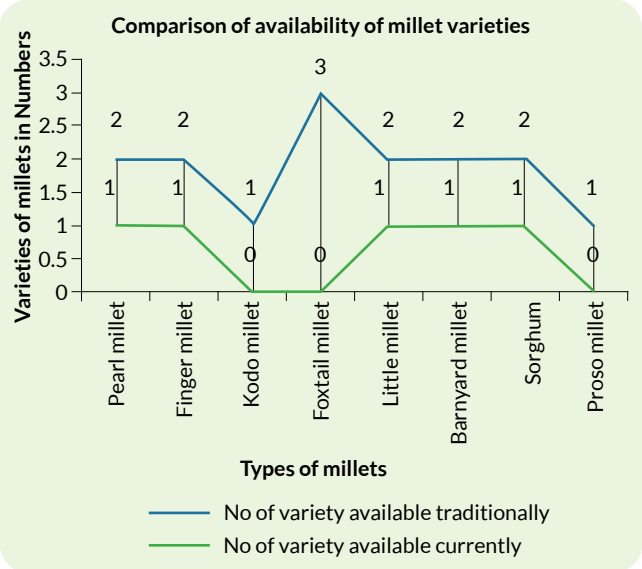


Figure 5: Comparison of availability of varieties of pulses, past and present

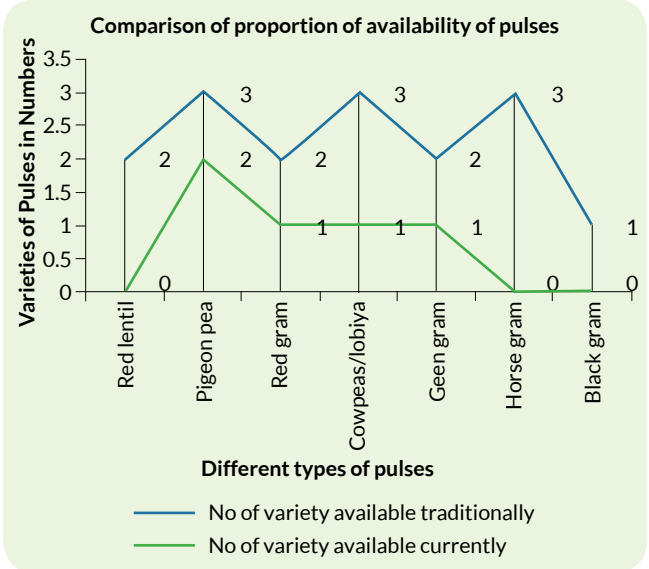


Figure 6: Land under food crops, across time in different districts

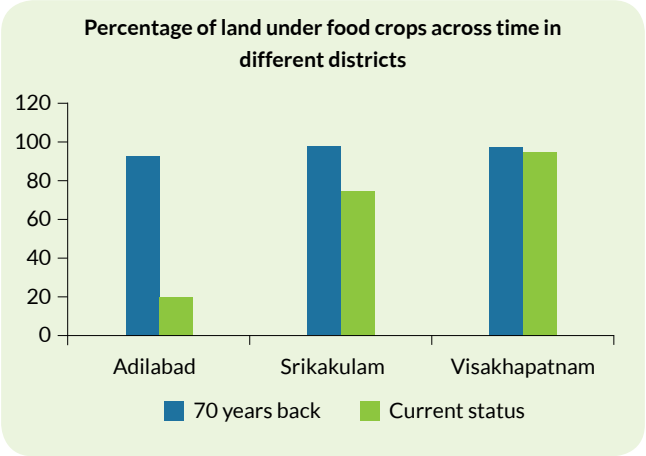
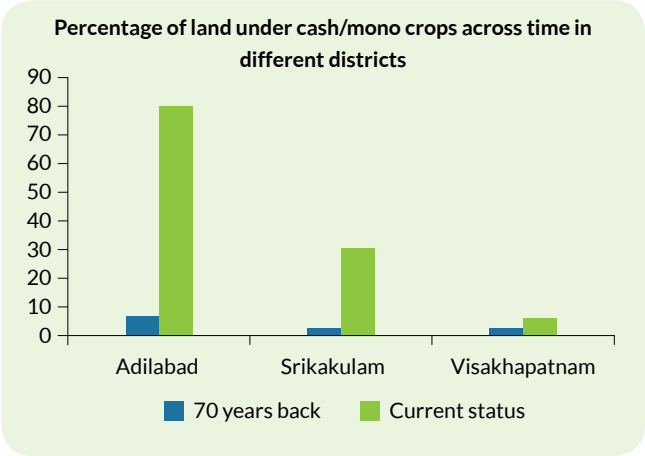


Figure 7: Land under cash/mono crops across time in different district



Traditionally, almost the entire cultivable land was under food crops, whereas currently, apart from Visakhapatnam, in the other districts (Srikakulam and Adilabad) there is a considerable shift in land usage from food-crop cultivation to cash-crop cultivation. Thirty percent of cultivable land in Srikakulam and 80 percent in Adilabad is under cash-crop cultivation.

Considering the availability of market for the produce, subsidies from government, and promotion of high-yield-variety seeds, 90 percent of young respondents expressed their reluctance to use the old varieties of seeds. According to them, the old varieties do not give much yield and are much more labor intensive and the processing of traditional grains is also labor intensive, especially of millets as they are coarse millets. In this era of modern science and technology, with the advance of mechanization, which has made agricultural activities less labor oriented, and the higher profits with cash and mono crops, the current generation is less interested in cultivating food crops.

Intensive monocropping and cash crops are threatening with extinction the traditional seed varieties and the traditional knowledge of cultivating them.

- The extensive use of chemical fertilizers and pesticides in Adilabad for cash/mono crops and in Srikakulam for paddy farming poses an environmental risk of soil degradation, water contamination and high input costs and low profitability in the future.
- The crop diversity that traditionally existed and has shrunk by almost 50 percent in terms of millets and pulses, has created an imbalance in food intake and nutrition.
- The traditional rich crop diversification also ensured food security, in case of extreme climatic adversities – drought, floods, etc. The mixed cropping pattern ensured that despite climate adversities, food crops were available to the tribals, which provided them sustenance and made them self reliant.

Millets need very little water for their production and require just around 25 percent of average rainfall. Millets often grow on skeletal soils that are less than 15 cm deep. They do not demand rich soils for their survival and growth; hence, for the vast dryland areas, they are a boon. Grown under traditional methods, no millet attracts any pest. Thus, they are of great advantage to the agricultural environment and are amazing in their nutrition content.

The decrease in crop variety and increased food imbalance (carbohydrate, protein and fats) has increased the risk of malnutrition. If there is any

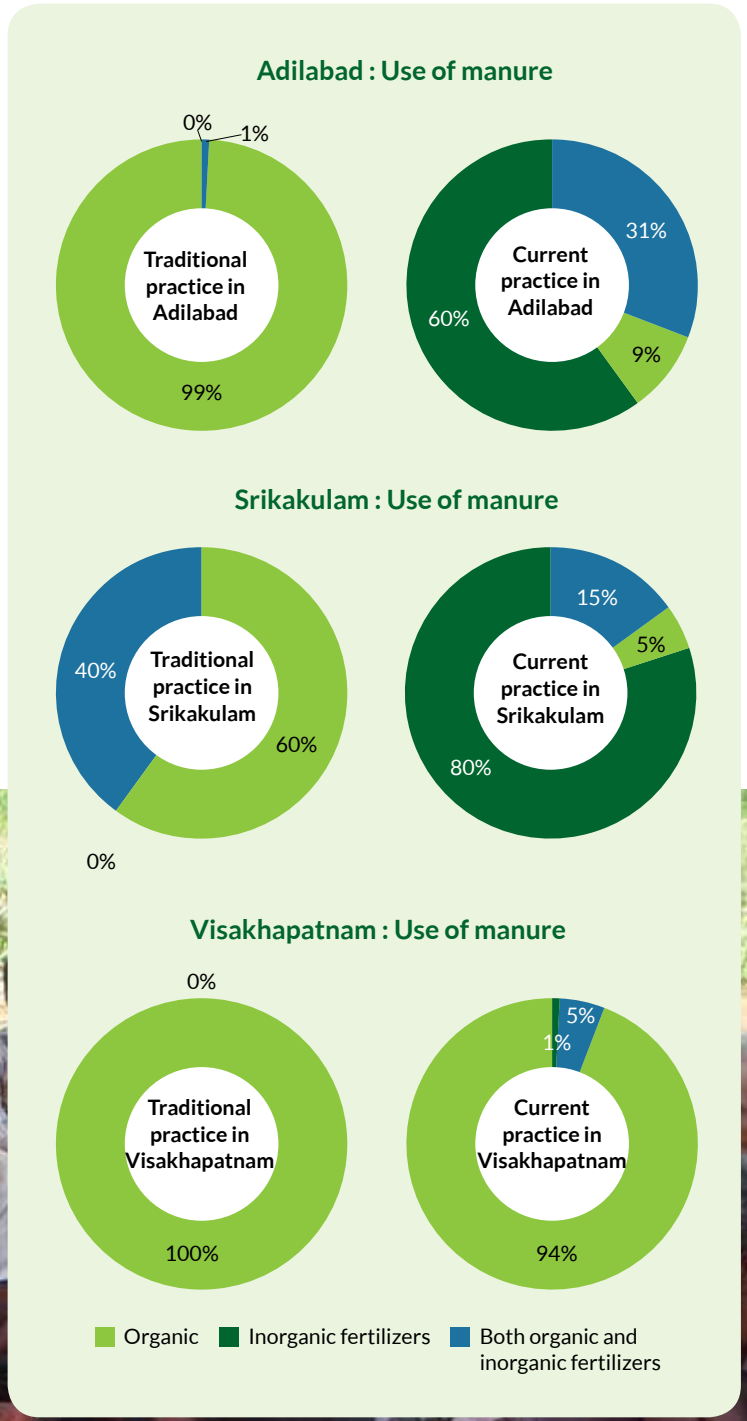
In this era of modern science and technology, with the advance of mechanization, which has made agricultural activities less labor oriented, and the higher profits with cash and mono crops, the current generation is less interested in cultivating food crops.

cropping system that can withstand these challenges, survive and flourish, it is the millet. While wheat and rice might provide only food security, millets produce multiple securities (food, fodder, health, nutrition, livelihood and ecological).

3.2.3 Manure

Traditionally, all farmers from the three districts (Adilabad, Visakhapatnam and Srikakulam) used natural organic matter – farmyard manure, cow dung, fodder, cow urine, and compost – as manure fertilisers. Farmers collected locally available resources from their own cattle, kitchen waste and village-level pits. Figure 8 below shows that traditionally (according to folk memory) 99 percent, 60 percent and 100 percent of farmers used organic manure in Adilabad, Srikakulam and Vishakhapatanam respectively, but now the practice has changed drastically. In Adilabad it has fallen to 9 percent , in Srikakulam to 5 percent, but in Vishakhapatnam 94 percent of framers still use organic manure.

Figure 8: Use of manure in different districts, then and now



In Adilabad and Srikakulam, because of the extensive cash-crop cultivation, there is increase in use of inorganic fertilizers for cotton, paddy and cashew cultivation, whereas they still use organic manure for the food crops cultivated in the *podu* land.

The tribals of Visakhapatnam have been able insulate themselves from adopting cash crops, chemical farming, etc. This was only possible since the government schemes and programs could not reach the tribals due to poor accessasibilty. As narrated by the Agricultural Department of Visakhapatnam, with the advent of the Green Revolution, the department tried to introduce chemical fertilizers and HYV seeds to them but it was difficult from them to reach out to the interior areas; as a result, the tribal are still following traditional modes of agriculture. The Forest Department also tried to encourage coffee plantations among the tribes on their IFR lands, but were not successful in this endeavor. The reasons attributed are the same as above.

3.2.4 Sowing Patterns

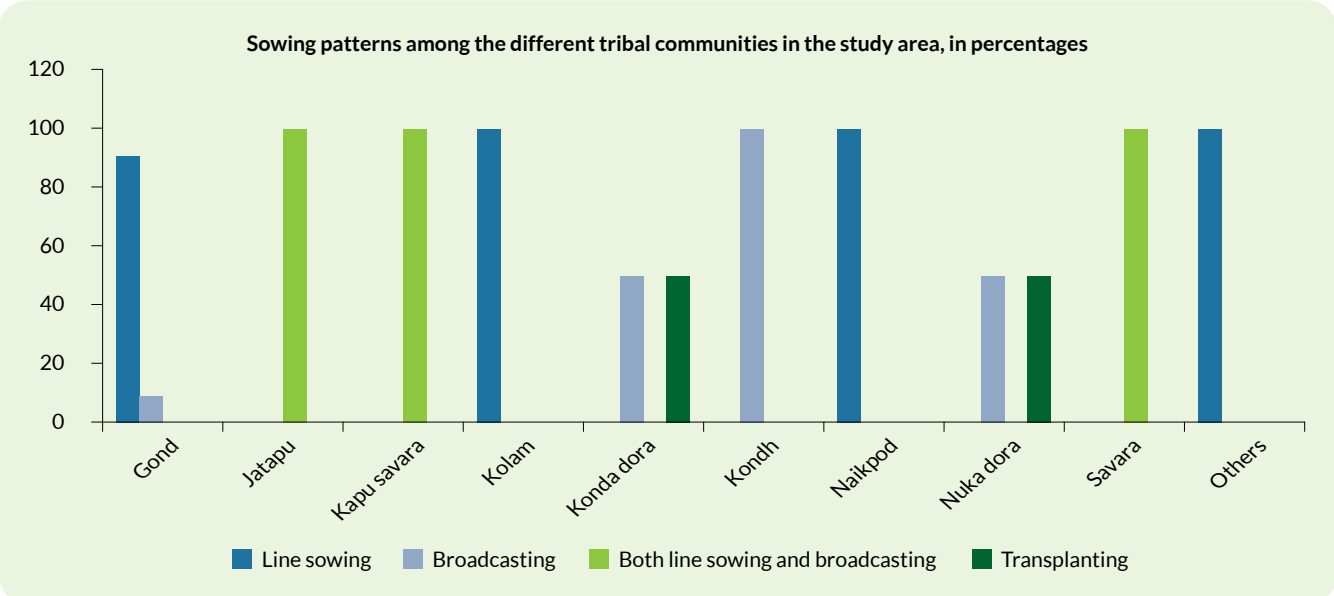
The study found that almost all of the tribes practiced both line sowing and broadcasting techniques and the technique was unique to each seed, which has not changed over time.

Figure 9 below shows that 90 percent of Gonds and 100 percent of Kolams and Naikpods practice line-sowing techniques for pulses and lentils. In comparison, 100 percent of Kondhs practice broadcasting exclusively. But it is the Jatapu, Savara and Kapu Savara of Srikakulam that practice a combination of both line sowing and broadcasting with millets and cereals. The Nukadoras and Kondadoras practice a combination of transplantation of seedlings as well as broadcasting of seed. Paddy is mostly cultivated as a mono crop in separate plots among all communities. Oil seeds and vegetable seeds in Srikakulam and Visakhapatnam are sown randomly in trenches and boundaries of fields.

In line sowing seeds are placed at proper and uniform depths. Along the rows, inter-culturing can be done. Uniform row-to-row spacing is maintained, and seed

The study found that almost all of the tribes practiced both line sowing and broadcasting techniques and the technique was unique to each seed, which has not changed over time.

Figure 9: Sowing patterns among the different tribal communities



requirement is less than in broadcasting. Sowing is done at proper moisture level. This technique is scientifically more helpful in the dry and water-scarce regions, which is the reason why it is so much in practice in the district of Adilabad. In Srikakulam in current practice it is used only for paddy cultivation.

Transplantation methods are used in *garu* land / terrace farming of Visakhapatnam district because of following advantages:

- Roots penetrate deep into the soil to get nutrients and moisture.
- There is no wastage of seeds; germination of seed is better in comparison to broadcasting technique.

3.2.5 Cropping Patterns and Ratio of Seeds

Traditionally, among all the tribal groups, millets, pulses, cereals and oils were the combination for mixed cropping. When we analyze the traditional mixed cropping pattern of various districts, it does not vary in practice. The broadcasting technique was used for mixed cropping of millets and pulses in different ratios by different tribes, i.e., it was 2:1 by Savaras, 2:2 by Jatapus , 4:1:2 by Kapu Savaras where four kg of *jowar* was mixed with one kg of any other millet and two kg of red gram. In Visakhapatnam millets and pulses were sown in equal ratio, whereas in Adilabad the ratio was 2:1 by all tribal communities.

Currently the practice of mixed cropping remains unchanged in Vishakapatnam as mono-crops and cash crops have not taken over the traditional mixed cropping pattern. In Srikakulam cashew plantations have been introduced as a cash crop, but in *podu* land they still practice mixed cropping, where the millets have reduced and pulses have increased in the ratio of 1:2 millet to pulses. However, in Adilabad mixed cropping is nonexistent and the ratio of cash crop (cotton) cultivation to pulses is 8:2

Perception of the community on mixed cropping practice

According to the perception of the community, mixed cropping was something not unique to the tribals. They knew the advantages of the practice of mixed cropping, yet in Adilabad we found that the tribals are fast moving towards mono-cropping .

Table 2: Mixed cropping ratios of millets to pulses, then and now

Ratios of Millets vs Pulses for mixed cropping								
	Traditional Practice				Current Practice			
Tribe	Millets (all)	Pulses	Only Jowar	Cash crop	Millets (all)	Pulses	Only Jowar	Cash crop
Savara	2	1		-	1	2		
Kapu Savara	1	2	4	-	1	2		
Jatapu	2	2		-	1	2		
Kondh	2	2		-	2	2		-
Kondadora	2	2		-	2	2		-
Gond	2	1		-	-	1		8
Kolam	2	1		-	-	1		8
Naikpod	2	1		-	-	1		8

Advantages of mixed cropping

1. Provides food security, as the different grains get harvested at different times, from August to February.
2. Maintains soil fertility.
3. Natural pest repellent.

Why pulses with millets?

Pulses and millet plant species have a symbiotic relationship. Millets require less water in comparison to pulses or other crops and act as pest repellents, while pulses being leguminous plants, help in nitrogen fixation. It provides food security as well.

3.2.6 Irrigation

The study locations are under rainfed agriculture, predominantly farmers undertake *kharif* cultivation; in a very few circumstances, if the soil moisture is good, just before the harvest of the *kharif* crop, they used to broadcast some pulses. Some specific villages had also developed some innovative irrigation practices, traditionally, to irrigate their farmlands and address the issue of drinking water. These traditional irrigation practices were evolved over a period of time by the villagers based on their need and importance of irrigation. However irrigation as a norm amongst any of the tribals was not found during the course of the study. The system was based on rainfed agriculture.

3.2.7 Pest management:

Farmers reported that traditionally the tribals did not use any chemical or non-chemical pesticides to control pests for conserving the crops. Instead pests were not a menace for farmers then. According to farmers, there were just five to six prevalent pests affecting the crops then – greenfly, whitefly, green worms. Now there are many more.

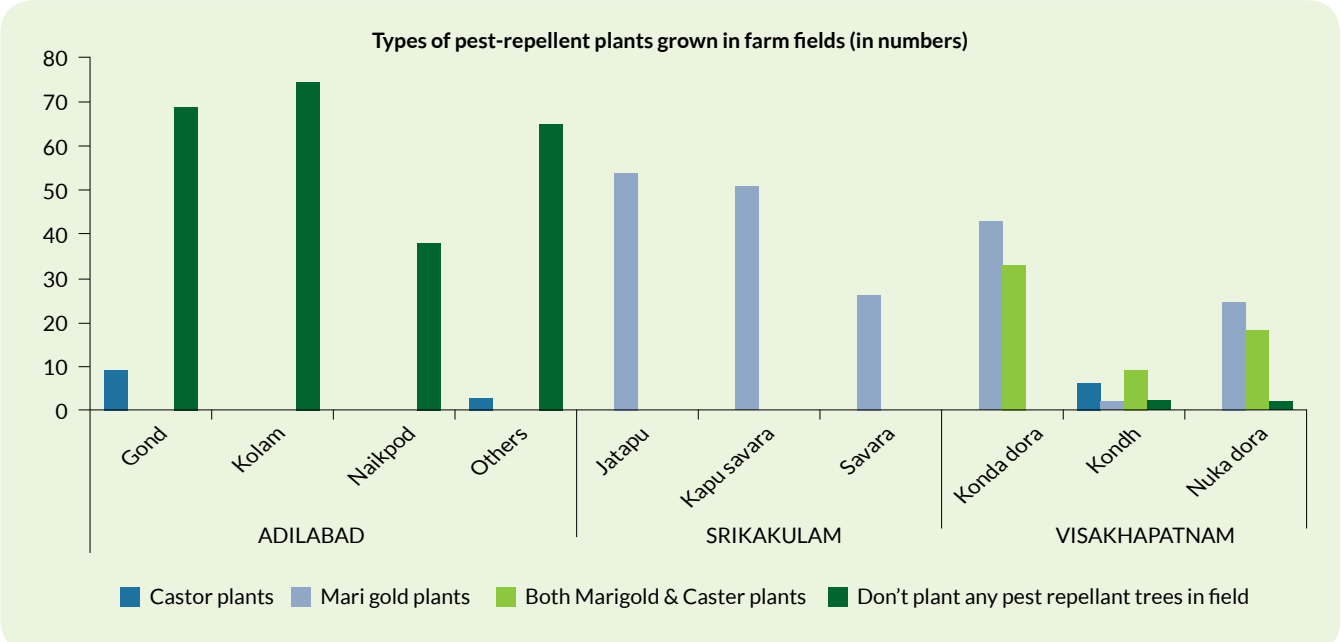
Natural Pest Management was traditionally undertaken using two methods:

Planting pest-repellent plants: To overcome and save the crops from the harmful pests, Srikakulam and Visakhapatnam farmers used to plant castor and marigold as border crops. In Adilabad farmers reported that in the past they did not need to take any measures to overcome pests and diseases. According to them traditionally they did not need any pest repellent as mixed cropping was in itself an effective mechanism for pest management.

In Adilabad, the tribals have completely shifted to the use of chemical pesticides, especially in their cotton farms. The study found that 100 percent of the Gonds, Kolams and Jatapu tribes are rampantly using chemical pesticides, whereas in Srikauklam 63 percent of farmers are using chemical pesticides but only in paddy farming, and in Visakhapatnam only seven percent of the tribal farmers are using chemical pesticides.

Other techniques: The farmers are also adopting other techniques. Out of 534 respondents, 528 (i.e. 99 percent) claimed that they undertook border fencing,

Figure 10: Pest-repellent plants grown on farms



field watch, fire, and making loud sounds to prevent pests and animal invasion to protect their agricultural fields.

3.3 Tools

In any agricultural production system, tools and implements play an important role to increase work efficiency and production. In India, most tribal farmers have small and fragmented land holdings and continue to use indigenous tools and implements as it is considered to be cheaper, economical and is easily available in the local market. But with mechanisation in farming, tractors, threshers and hurlers are also being used, especially by the tribals of Adilabad. It is important to standardize tools by blending traditional knowledge with modern scientific knowledge to making agricultural chores time-efficient, less labor-intensive and to reduce drudgery. Thus, the indigenous tools need to be documented so that these can be improved and serve as the basis for developing need-based new tools/implements for improved farming techniques.

The various types of tools in use are given below, with local names in parentheses:

1. Plough (*Langal*)

The basic components of the plough are a shoe, a body, a handle and a beam. This implement can be used with a pair of oxen to till fields before planting. It has a single plough share and the average depth of ploughing is 15 cm. It has a provision for adjustment of the hitching point, which can be adjusted according to the height of the oxen and the working depth. Tillage depth can be adjusted by applying manual force on the handle.

2. Plough (*Kanka*)

This is similar to the *lungal*, but without a handle. It is mostly used for making furrows and for making bunds by manual pulling, and is used in hill areas for tilling the land.

3 Hoe/trowel (Khurpa or Khurpi)

It is used to loosen the soil. It is a hand-operated tool also used to remove weeds. The narrow-edged khurpi is used to lift up the root media of weeds/carrot/radish. Farmers in villages, who cannot afford to buy weeders, use khurpa/khurpi to remove weeds manually and sometimes also for sowing.

4. Weeder rack (Hashkini)

It has a wooden plank of one-meter length to which twelve bamboo pegs of 0.16 m length are fitted, with a three-meter long bamboo shaft. It is used for breaking soil crust after rain and also for uprooting weeds

5. Long- and short-handled weeder (Khera)

The long-handled weeder allows weeding without bending, thus reducing the drudgery of the farmers and increasing the field capacity. This weeder is generally of the hand fork type (with four prongs). The uprooted weeds are collected from paddy or wheat fields using a long-handled weeder or *khera*. The total length of a *khera* is 2 m. The short-handled weeder or *khera* is used for removing weeds from vegetable fields. It has five prongs and the total length of the tool is 0.35 m.

6. Spade/Phaura

It is a multipurpose tool used for making bunds, ridges, furrows, shallow trenches for sowing seeds and planting materials, chopping weed and removal of crop residue, making irrigation channels and even to dig or move soil, such as when harvesting root crops. The handle is made of bamboo/wood and the working part is of iron of rectangular shape

7. Guity/Borigi

It is a miniature of the spade. It has a short wooden handle and is trapezoidal in shape. The soil-working tool is made of mild iron. It is used to move small amounts of soil, weed control by agitating the surface of the soil around plants, piling soil around the base of plants, creating narrow furrows, shallow trenches for sowing seeds, planting bulbs, chopping weeds and roots and other weeding operations.

8. Sickle (Kaste/Daw)

This is one of the most popular multi-purpose tools that has been used in agriculture by tribals for generations, primarily designed for harvesting most crops like cereals, pulses, millets and grasses. Sickle was designed "C" shaped/curved with a view to ease the harvesting operation. Hence, it is preferred more than other tools and implements. With the help of the sickle the ear-heads, branches or even whole plants could be harvested. The cutting or shearing part is made of iron and the handle is made of wood.

9. Long-handled Dauli

This cutting tool is similar to the sickle and is fitted with a long bamboo handle. It is used for cutting weeds from the trees, cutting nut leaves and dates, and cutting of grass on embankments.

10. Sabbal

It is the simplest tool still in use in agriculture for earth digging work. It is a solid rod with a flattened end, used for making holes in the ground in which plants can be transplanted or making holes to construct fencing/houses.

11. Stone hand-mill (Jatak)

It is used for grinding and crushing. The top circular stone is rotated on a pivot by the right hand grasping a wooden peg fixed on top near its circumference, over the heavy circular base stone, while the left hand slowly pours grains into a hole in the top stone. The rubbing of the grains by the two flat stones causes splitting and removal of husk. The milling stone is also used to grind wheat, and to split whole pulses .

12. Paddy spader

It consists of a wooden plank to which a long bamboo handle is attached. It is used in spreading the paddy for drying. It is also used to collect and deposit in one place paddy/pulses/wheat during and after threshing operation.

13. Bamboo baskets

It is a basket made out of bamboo, which is used by farmers during weeding and harvesting .

14. Mango juice extr

It is a wooden plank with a large hole in the middle to crush the seeds with another pair of wooden logs and drain the oil.

Traditionally the tools are mostly made of wood and iron. Wooden implements were at times made by the farmers themselves. They used to collect wood and bamboo from the forest and make the tools just before the onset of the agricultural season. The iron tools were made by the blacksmiths, who were located in the village or nearby villages. The farmers bought iron from the market and took it to blacksmith for making tools. Tools were designed as per the requirement of the farmers, both men and women. The tribal farmers usually paid the blacksmith in kind for his services.

In the current practice, farmers still make wooden tools by themselves, but also buy from the market, but iron tools are now readily available in local *haats* and markets and are bought in cash.

3.4 Grain Availability and Management

Traditionally the food produced on the farm was sufficient for the whole year and a cultivated grain reserve was also stored for a period of one year. The farmers used to cultivate a number of varieties of crop so there was adequate availability of grains, which were quite sufficient round the year and of much nutritional and medicinal value for good health. Millets and paddy were the staple food for most of the tribal community

Grain storage management was an important activity post harvest, for preventing losses which were caused mainly due to weevils, beetles, moths and rodents. Mostly the food grain produced was stored in homes in indigenous storage structures. The percentage of overall food crop production retained at the farm level and the period of storage is largely a function of farm yield per acre, family-consumption pattern, marketing pattern, and form of labor payment, etc. In the study location, traditionally, on an average the grain was stored for at least 6-12 months by each household. The storage containers were made from a variety of locally available materials, differing in designs, shapes, sizes and functions. The materials used included paddy straw, bamboo baskets, reeds, mud, cow dung, etc. Grains could be stored indoors, outdoors or underground.

Indoor grain storage management and structures

The *kanaja* is a grain-storage container made out of bamboo. The base is usually round and has a wide opening at the top. The height varies. The *kanaja* is plastered with a mud-and-cow-dung mixture to prevent spillage and pilferage of grains. The top is also plastered with the mud-and-cow-dung mixture or covered with paddy straw / *adda* leaf to protect it from pests. The *kanaja* was kept in kitchen lofts among the Savara and Kapu Savara communities. The smoke emitting from

Table 3: Agricultural tools used by tribal farmers

Tool name	Category	Tribes that use the tool	Men/Women
Plough (Langal)	Land preparation	All	Men
Plough (Kanka)	Land preparation	Kapu Savara, Savara, Jatapu, Kondh, Nukapora	Both
Khurpa	Sowing, weeding	All	Both
Weeder rack (Hashkini)	Weeding	All	Women
Long- and short-handled weeder (Khera)	Weeding	All	Both
Spade (Kodal/Phaura)	Land preparation	All	Men
Guity/Borigi		All	
Sickle (Kaste/Daw)	Harvesting	All	Both
Long-handled Dauli	Food processing	All	Both
Axe (Kular/Kulari)	Bush clearing	All	Men
Sabbal	Land preparation	All	Men
Stone hand-mill (Jatak)	Food processing	All	Women
Paddy spader	Drying the grain	All	Women
Bamboo baskets:	Multipurpose	All	Women
Oil press	Food processing	All	Women

the wood-fire stoves in the kitchens worked as a pest repellent for the stored grains.

Earthen pots were indoor storage containers for storing small quantities of grains for one or two months. These were made locally of burnt clay and were of different shapes and sizes. The earthen pots were placed on the floor and were arranged one above the other. This arrangement is known as *dokal*.

Kacheri is a traditional storage management system, especially for storing maize and jowar. Paddy- or wheat-straw is woven as rope and treated with mud and cowdung; then the stalks of the maize are tied together with the treated straw and the bunch is kept in the roof loft, in the kitchen or on the roof of the house.

All of the above mentioned grain storage systems are still in practice .

Outdoor storage of grain

Outdoor storage is done in structures made of bamboo or straw mixed with mud. Bamboo baskets are used for storing unthreshed and threshed paddy.

Gummi is an outdoor structure used for storing grains. This structure is made with bamboo strips or locally available reeds. It is usually circular or hexagonal in shape and plastered with mud. The base is also made of mud-plastered reeds. The roof of the structure is usually made from loose straw. The structure is placed on a raised platform. Bamboo structures made on a raised timber or stone platform protect grain from rat damage and prevent moisture absorption from the ground. Storing of grains in *gummi* is still in practice .

Hagevu was an underground structure that was used to store grains by the Gonds and Kolams of Adilabad. It was a simple pit. Underground pits were dug where almost 800 kg of millets were stored. After filling the structure to the top, straw was spread on top as a thick layer and the structure sealed with mud plaster. In some cases a small square or circular opening was provided at the top. The opening was raised above the ground level. The advantage of this structure was that fumigation was not required for disinfection. Grain couldn be stored for a longer period. This storage method is suitable for dry agro-climatic zones. Now the grains are not stored in *hagevu*.

It is, however, important to note that these indigenous storage structures are not suitable for storing grains for very long periods.

Table 4: Different types of storage containers in use by different tribal community to store grain

District	Tribe	Type of storage	Variety of grain stored
Srikakulam	Jatapu	Bamboo basket	Paddy
		Earthen pot	Millets and pulses
	Savara	Bamboo basket	Paddy
		Stalks of grain tied with rope	Millets: maize and jowar
	Kapu Savara	Bamboo basket	Paddy
		Earthen pot	Millets and pulses
		Stalks of grain tied with rope	Millets: maize and jowar

table 4 continued...

District	Tribe	Type of storage	Variety of grain stored
Visakhapatnam	Kondh	Bamboo basket	Paddy and jowar
		Earthen pot	Millets and pulses
		Stalks of grain tied with rope	Maize and jowar
	Kondadora	Bamboo basket	Jowar and paddy
		Earthen pot	Millets and pulses
Adilabad	Gond	Bamboo basket	Jowar
		Earthen pot	Millets and pulses
		Underground pit	Jowar
	Kolam	Bamboo basket	Jowar
		Underground pit	Jowar
	Naikpod	Bamboo basket	Jowar
		Earthen pot	Millets and pulses

Treatment of grains for storage

In general the grains are sun dried and may be mixed with neem leaf, ash, along with salt, to preserve the grains against pests. Regular mud plastering is required for a variety of indoor and outdoor storage containers and structures for increasing their life span and ensuring safe storage of grains, as the coat of mud and cow dung acts as pest repellent.

In the current practice, indigenous varieties of the crops are going extinct. Soil fertility is reducing, so the farmers are losing interest in cultivating indigenous seed varieties (as the yield depends on fertility of soil) and are more interested in HYV seeds which require less water than traditional seeds. The other reason given for this is that the old varieties have a longer crop duration of three to four months , whereas new varieties give yield in two to three months.

3.5 Seed Banks and Storage

Traditionally, all tribes maintained seed banks at household level. All varieties of grains were stored for seeds from the new harvest.

Tribals had intelligent management practices for storing and saving the seeds against pests and natural hazards, some of which are still practiced to some degree.

1. In the case of crops like maize and pearl millet, the grains are not singled out from their panicles or straw. The ears of maize, the major *kharif* crop, are tied into bundle and left hanging from a pole, in front of the house. The bundles are left to hang till the next season of sowing. The height of plant material from the ground is at least two to three meters, so as to keep the soil from spoiling it. Sometimes in place of a single pole, three or four poles are erected half a meter apart.
2. They make a braid of maize husk and tie the stalk along with the grain, with the husk braided in a round pattern. The significance of round pattern is that the houses have thatched roofs and vulnerable to fire. So if the house catches fire, the seeds can be saved, as the bundles can be easily rolled out of the house.
3. Other seeds were stored in small bamboo baskets sealed with cow dung to protect them from pests.
4. Lentils and pulses were stored in bottle-gourd containers in kitchens to save them from mouse attack, because of its narrow mouth and the natural fumigation from the kitchen fire.

In current practice seed grains are not stored as mandatory practice among the tribals. The study observed that most of the tribes are not storing seed grains and usually buy seeds for the new crop from the market, which is also a reason for increased input costs. This practice has led to the extinction of many indigenous seed varieties over a period of time. No tribe in particular is practicing the traditional seed storage systems; instead it is now an individual choice among the tribals.

The seed bought from the market has raised the alarming issue of decision-making, which is a fundamental right of the farmer. The tribals, over a period of time, have lost control on the choice of crops that will grow in the fields as it is now being controlled by big market players. The escalating

prices of seeds leave little choice with the farmers to seek another option.

Invariably the indoor/outdoor storage of grains and seeds involved techniques using mud, ash and cowdung, fumigation, and treatment through plant leaves like neem, adda, etc. This is proof that traditionally, organic methods to store grains were prevalent, which were environment-friendly , had no ill effects on human health and were easily available and cost efficient.

3.3 Food Habits and Food Security

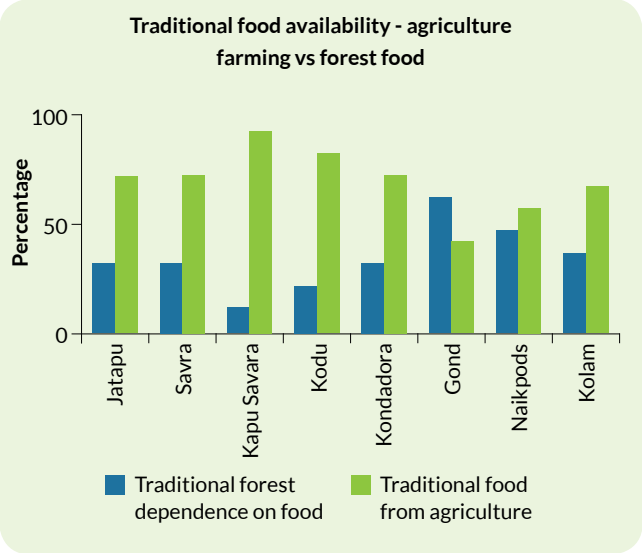
Traditional cultivated and uncultivated food: status and availability

The current study wanted to study the food habits of all the eight tribes – what are the changes that are taking place, how these changes came through, and their impact on food security.

The tribals of Srikakulam, Visakhapatnam and Adilabad traditionally have been dependent on the forest and, in many cases, on agriculture to meet their food and livelihood requirements. Some of the tribals in the area were exclusively forest dependent and depended on hunting and food collection, while others practiced farming as well, since time immemorial. Over a period of time there has been a shift in their lifestyle, wherein some adopted farming along with food gathering, some took to settled farming in place of shifting agriculture. Over a period of time there has been less dependency on the forest, which has brought about a great change in their food habits and cultivation patterns.

The findings of the study clearly indicate that originally the tribals in Adilabad – Gonds, Kolams and Naikpods – were entirely a forest-dependent community for their food requirements, whereas the other tribes located in Srikakulam and Visakhapatnam have been cultivating food in farms since the Neolothic Age and also accessed forest to collect uncultivated food and were fully dependent during the summer months. The Gonds, Kolams, Naikpods were food collectors and also hunted. It was also noted that uncultivated food was collected throughout the year, along with hunting. The uncultivated forest food comprised of a variety of tubers and leafy vegetables, nuts, fruits and mushrooms, and the farmed food was basically coarse millets, lentils and oil seeds. Vegetables were not grown in the farm fields but accessed in the form of uncultivated foods.

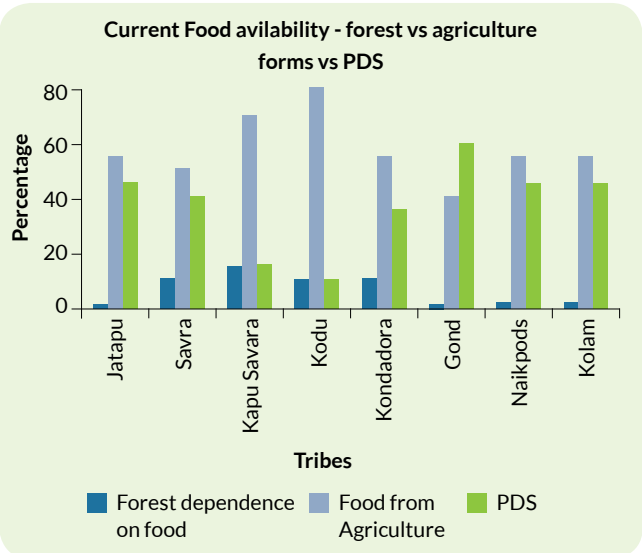
Figure 11: Availability of traditional food – forest vs farm



Some 50–60 years back the tribes based in Adilabad (Gonds, Kolams and Naikpods) took to farming. The need of farming did not arise out of a shortage of forest food, but the influence by the farmers from the plain areas who employed them as farm laborers; hence they learnt the art of farming and started farming for their livelihoods and sustenance. The laws banning hunting were also strictly implemented, thus encouraging them to take up farming.

The above graph (Figure 11) clearly shows that the Gonds, Kolams and Naikpods, who were originally food collectors and hunters, were comparatively more

Figure 12: Current availability of food – forest vs agriculture vs PDS



dependent on uncultivated food from forests for their sustenance.

Current cultivated and uncultivated food: status and availability

In current practice there is a significant change in the sources of food, wherein forest dependence for food has become insignificant for the Jatapus, Gonds, Naikpods and Kolams and reduced for the Savara, Kodu, Kondadora and Kapu Savaras. The government Public Distribution System (PDS) has become a significant source of food availability. The graph (Figure 12) below demonstrates that annually all the tribes are dependent on PDS food supply for almost 30–40 percent of their sustenance. But it has also come to light that the Kodu, a PVTG community located in Visakhapatnam, does not sell its farm produce in the open market, and also accesses the PDS scheme benefits; hence it is the only tribal group that currently has a grain reserve of 1-6 months

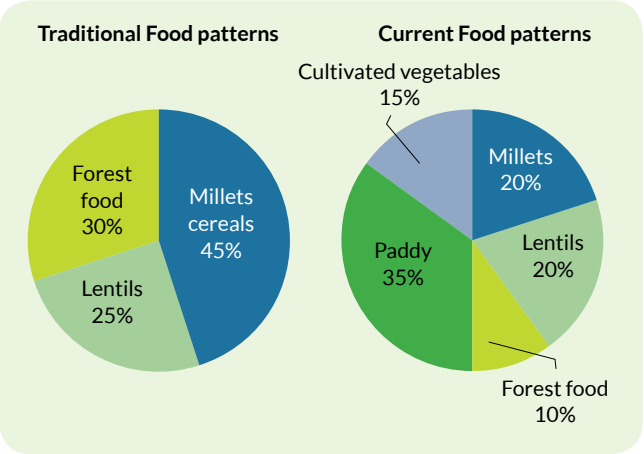
Food patterns

The study also tried to document the change in food patterns and food habits. The study highlighted the fact that traditionally, coarse millets like sorghum, pearl millet, barnyard millet, finger millet and foxtail millet, and cereals (dryland paddy), with lentils and uncultivated forest food (mostly during the monsoon months), were a staple of the diet. On an average 45 percent of the foods consumed were millets and cereals, 25 percent were lentils and 30 percent was uncultivated food.

But over the last 20–25 years there has been a drastic shift in the food habits of the communities. Paddy has overtaken millet amongst the communities in a big way. Now 35 percent of the food comprises of paddy, which is now cultivated in wetland areas, lentil consumption is 20 percent, and uncultivated food is no more a significant component in the staple tribal diet and is now replaced with vegetable cultivation. All the tribes have included paddy in their daily food. The reason for high consumption of paddy and change in the consumption pattern can be attributed to the following factors:

- Wetland paddy was adopted by the tribals some 20–25 years back in Srikakulam and Visakhapatnam and propagated by agriculture departments as part of their initiative to introduce HYV seeds.
- As part of the Targeted Public Distribution System of giving subsidized food crops to the tribals, paddy is given through the PDS shops, and not the traditional variety of millets that the tribals traditionally consumed.
- The tribal farmers have now shifted to growing cash crops and depend on the TPDS shops for their food for consumption; therefore they have little chance to maintain their traditional food habit of consuming coarse millets.

Figure 13: Food patterns – traditional vs current



Gender dynamics: role of men and women in traditional agriculture farming practice

To capture the traditional role of men and women in agricultural farming practice, a study of the division of labor/tasks amongst the tribals was undertaken in the study, in which agriculture tasks in the fields were categorized under land development, sowing, weeding, harvesting and processing, to analyse the patterns of division of work.

The analysis below elucidates on the roles traditionally undertaken by tribal men and women in the agricultural fields and their division of work and whether such a division of farm work was earlier gender driven or not. Out of a total of 534 respondents 73 percent

Figure 14: Agricultural tasks traditionally done by men

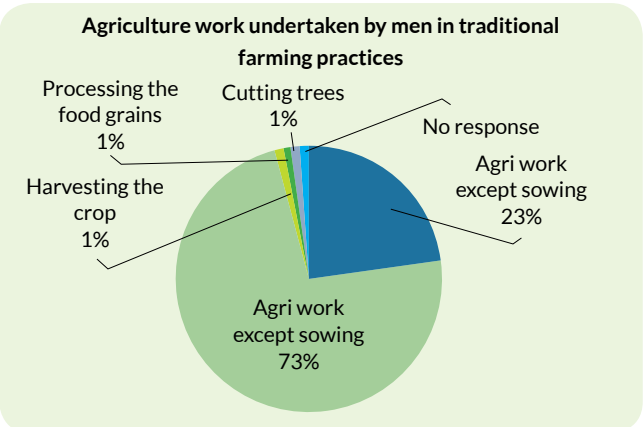
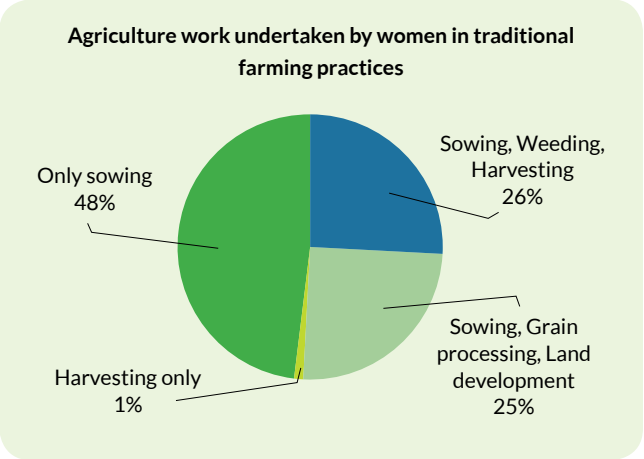


Figure 15: Agricultural tasks traditionally done by women



said that land development work like ploughing and tilling were undertaken by men only and 24 percent of the respondents said that except for sowing, men traditionally undertook all other tasks in the fields. The tribal women had a role to play in the farms, where they primarily undertook sowing; weeding and harvesting work, land development work by women was limited to bush clearing. Processing of food grains for consumption was the forte and responsibility of the womenfolk.

Traditional tribe-wise division of work

The study also captured the traditional division of tasks by tribal men and women in agriculture farming practice. As per the response by the respondents, it is interesting to note that in Srikakulam, Jatapu, Kapu Savara and Savara are the tribes where women undertook sowing and land development like bush clearing in the forest for farming and the men undertook land preparation works like ploughing, tilling, harvesting and all other works. The tribal women of Kondadora, Kondh tribes in Visakhapatnam and Naikpod of Adilabad undertook sowing, weeding and harvesting activities, while the men mainly contributed in land preparation – tilling and ploughing – while the women from Gond , Kolam and "Others" category undertook sowing in the agriculture farms, while all the rest of the tasks were undertaken by the men farmers .In none of the tribal groups did men exclusively undertake processing activities of grain meant for food consumption. Threshing was primarily done by males for millets and corn, while winnowing of millets and lentils and threshing of lentils were undertaken by both men and women.

Some of the traditional practices have remain unchanged over time, whereas others have changed, resulting in some changes in the roles of women and men in agricultural farms. Amongst most tribals the division of work in the farm fields continues to be the same, especially in the case of Kolams, Naikpods, Konds and Kondadora.

Figure 16: Agricultural tasks undertaken by men in different tribes

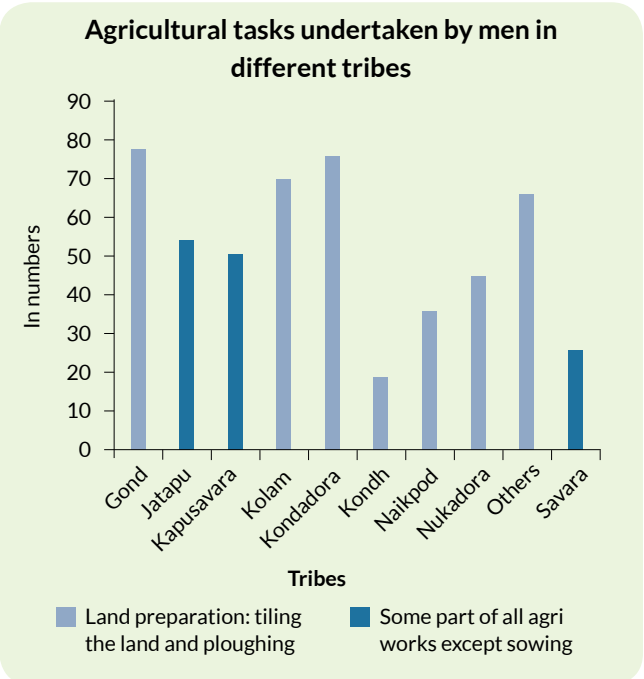
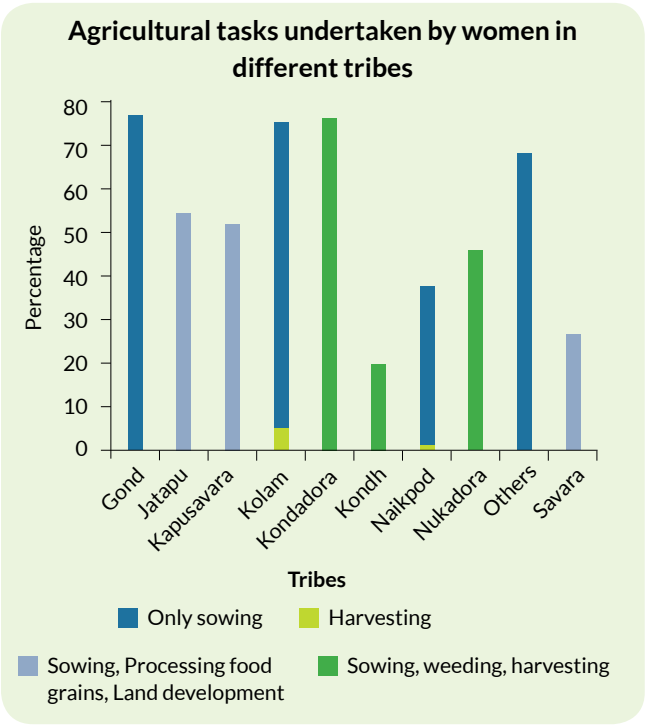


Figure 17: Agricultural tasks undertaken by women in different tribes



The tribals in Adilabad are engaged in extensive cultivation of the cash crop cotton. Amongst the Gonds, land development activities related to ploughing and harvesting have been replaced by machines like tractors and threshers, but women still do the weeding and sowing. The tasks involving labor in the farm fields have reduced by almost 50 percent with the advent of machines used for land development work. It has also been observed that with extensive use of hybrid seed, weeds have become a menace; therefore, this has increased the labor work in the farms; now farm laborers are being hired to do the weeding. Processing of grain for food consumption is still being undertaken by women. The Gond tribal women are now not so hard-pressed to undertake much labor work in the fields, as almost 42 percent of their work of weeding and harvesting is being outsourced to hired farm laborers. This is one of the factors for increased input cost of farming and reduced farm profits over time. The reason given by farmers for increased mechanization is the sporadic rainfalls during the pre-sowing period of the *kharif* season, thus leaving a short window of time to finish the ploughing and sowing.

On the other hand, the Kapu Savaras and Savaras in Srikakulam have now started the cultivation of cashew on their IFR lands; therefore, both men and women do not spend long hours in their plantations laboring at land development and weeding tasks. Cashew crops are now the major cash crop for the tribals in comparison to the food crop. Women are also spending fewer hours in the fields and plantations.

What the study found was a remarkably equitable division of labor among males and females where women perform an equal role in productive activities. For the men the first peak period of work in agriculture is in May or June through July, while women's first peak is in June or July through August, when, from morning till evening, women engage in sowing and weeding and men mainly in land preparation. The second peak period is October through November, when women are involved in harvesting, drying, pounding and de-husking, while men are busy in October with harvesting and after December onwards busy with selling the produce. Agricultural lands are often far away from homes, and men and women must leave for work early in the morning.

Gathering forest products – uncultivated food and minor forest produce

It is the tribal women generally who go to the forest as a group to collect uncultivated food from the forest, which is in the form of tubers, mushrooms, bamboo, fruits, nuts, etc. The peak season for the collection of food is during the distressed summer months – April to June. Tribals depend on the forest for their livelihoods, including for the non-timber or "minor" forest products. The collection of minor forest produce, which is also sold for a small cash income, is jointly undertaken by both men and women. This work is hard, and is made more difficult by the fact that men and women must often walk a long way to get to the forest to collect both uncultivated food and NTFP. With the increased distance of the forest from the current tribal habitations, the tribals have reduced their dependence on the forest for their food requirements.

Tools for men and women

Traditionally the tools were made of iron and wood, especially made by local blacksmiths and were not available in the markets / local *haats*. Tribal women would generally ask their husbands to get the tools made according to their needs regarding size, handle, etc. But over time the women themselves have increased access to the markets, they visit the local *haats* to buy readymade tools in the market and get them customized to suit their work requirement. The women farmers claim that the tools now are lighter, with smaller handles and size that suit their needs.

Access, control and decision making – traditional and current practices

The study also looked into the role of men and women regarding what was and is the stake of women in the farm resources in terms of taking decisions on the produce. Traditionally and currently , it is viewed that

Figure 18: Access and control of resources

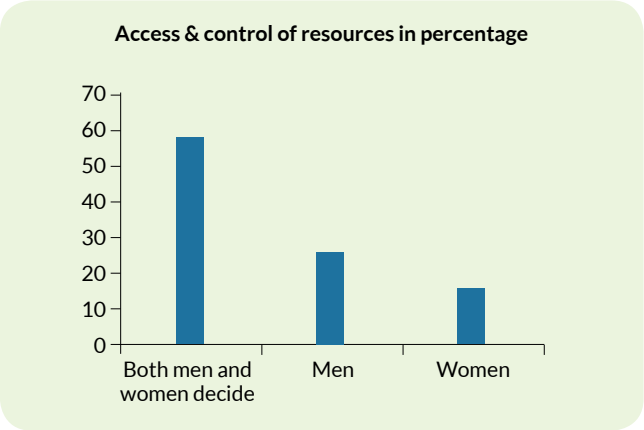
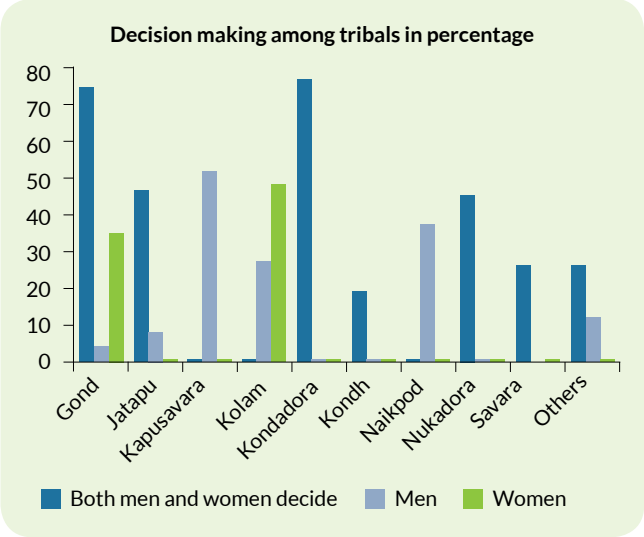


Figure 19: Decision-making among tribal men and women



the women have been major contributors as farm laborers, but it was also imperative to see whether women were only used towards the cultivation of the resource, or were the decisions on the resources also very much her right. The study analyzed the role of the woman in decision-making on the resource and what control she commanded.

Fifty-eight percent (312) of the respondents said that traditionally the decisions on the resources were taken by both men and women, i.e., what would be the amount that would be retained by the family for consumption and food reserve in case of calamity and how much would they sell in the market. Twenty-six percent (139) of the respondents said that this was a decision which was primarily taken by the men and 15.5 percent (83) of the respondents said that it was primarily taken by the women, i.e., it was the domain of the women. Therefore, it meant 74 percent respondents felt that women were an integral part of decision-making among tribals.

Tribe-wise analysis shows some facts demonstrating that while traditionally amongst the Kolam and Gond tribals women were an important part of the decision-making process on resources, Kapu Savras and Naikpods practiced little gender equity in terms of giving women rights on taking decisions on resources.

As per the study the access and decision-making on resources has remained unchanged over time and the trend till date remains the same as practiced traditionally.

Finance

It has also come to light that the tribal women have traditionally been the financial managers of their homes and amongst all the tribes women keep the money in their custody. The men, after the sale of the product, hand over the money to the woman of the family and the woman gives money to the man and the family as per requirement.

3.4 Climate Resilience and Coping Mechanisms, Strategies

Traditional knowledge is the store of wisdom, knowledge and practices of indigenous people, acquired over time through experience, which is passed orally from generation to generation. This knowledge evolved through learning and experience and, most important, was self sustainable. It has, over the years, played a significant part in solving problems, including problems related to climate change and variability.

Climatic variability is now a common phenomenon the world over, manifested in recurrent droughts, and unpredictable and erratic rainfall and temperatures. The resulting land degradation – soil erosion, deforestation – and desertification have posed a threat to the agriculture sector and communities who sustain on it and has implications on the viability of global food availability.

To analyse the phenomenon of climate change and the risks involved, the study tried to capture the traditional knowledge and practices that were resilient to incidences of climate variability, which reduced their vulnerability risk to minimum, and the changes in current practice and its impact. All the tribal communities covered in the study traditionally were predominantly food collectors and farmers. Agriculture in this region is rain dependent.

Traditional, climate resilient practices of tribals under study:

- In traditional food systems the prevalence of uncultivated food collection (wild tubers, fruits, vegetables, medicines, etc.) and farming for food was a practice amongst all the tribes, which worked in synchronization and maintained a natural ecological balance ensuring food nutrition, availability and most important, food security.
- Diversified cropping or multiple cropping systems was of key importance to the stability of productivity levels in farming systems. This strategy of minimizing risk by planting several varieties of crops (ranging from 10 to 15) is more adaptable to weather events and climate variability, and were resistant to adverse effects of pests and diseases. This practice endowed the farm land with nutrient-enriching plants, insect predators, pollinators, nitrogen-fixing and nitrogen-decomposing bacteria, and a variety of other organisms that perform various beneficial ecological functions.

Over time, the traditional knowledge and practices of the tribals that were eco friendly and provided them greater immunity and resilience to climate variability have eroded.

- Millets as drought-tolerant crops: The traditional practice of predominantly cultivating millets and sorghums that were more drought-resistant than other cereals – paddy, maize etc – therefore gave a good yield even with very little rain.

- The three-tier farming practice among the tribals of Visakhapatnam, where the farm lands are divided into different land use based on the elevation, slope and ecological considerations, growing a wide range of crops and varieties. In this system the upland is retained as forests, the mid elevation lands are used for slash-and-burn agriculture and in the plains, the tribal farmers grow the more economically viable varieties of crops. This practice, which maintains ecological balance, ensures food security and economic returns.

- Granaries: All tribals practiced storing of food grains, which were to be used in case of a drought. They had a granary stocked with grains (sorghum, millets, maize, lentils) for a period ranging from six to twelve months, especially those resistant to post-harvest pests.

Traditionally, food was sourced primarily from two sources – farm food and forest food. There was no concept of buying food grains or vegetables amongst the tribal communities. The tribals always had a grain reserve of six months to one year. The grain reserves were a management system that evolved over a period of time to ensure food security in times of climate distress and natural disasters, with no external support mechanism.

The traditional mixed cropping system was a mechanism to safeguard the tribal farmers against crop failure due to abnormal weather conditions and was a kind of insurance. Still, if food was scarce for some tribal households, the families borrowed grains from each other. After the new harvest the grains was returned by the borrower in the same proportion or double the amount, as per the agreement.

Deviations from traditional practice that have increased the vulnerabilty of poor tribals against climate change:

Over time, the traditional knowledge and practices of the tribals that were eco friendly and provided them greater immunity and resilience to climate variability have eroded.The study tried to capture some of those deviations that have brought these tribals under high risk and poor coping mechanism.

Forest dependence for uncultivated food was greater, especially during the distressed summer months or climate disasters, when crops failed. But in the current times it is no longer in practice amongst the tribals in Adilabad

Mixed cropping cultivation, which provided food security and sustenance to the tribals and was a practice followed by all the tribals, is fast being replaced with mono and cash crops. Crop diversification is fast shrinking, more so in Adilabad, where the Kolams, Gonds and Naikpods are undertaking cash-crop and mono-crop farming of cotton. Two to three varieties of crop are grown, with cotton being the predominant one. In Srikakulam, the tribals practiced mixed cropping in their *podu* farms, but with the introduction of cashew plantation, they are more inclined towards the latter, with very little variety of food-crop cultivation. The tribals of Visakhapatnam are still following the traditional mixed-crop farming, but the crop diversity has shrunk. The culture of growing mono crops in the farms has increased their vulnerability to weather change – droughts, insufficient/erratic rainfall – leading to entire crop failures.

Food crops: In Adilabad, the study found that the tribals have moved from cultivating food crops to cash crops. Eighty percent of the agricultural land is now being put under cash crops, in comparison to traditional practice where food crops were grown on almost 95 percent of their farmland. In Srikakulam food crops are now grown in 70 percent of their land, where in the past it was grown on almost 100 percent of their land in the form of *podu*. The study found that the tribals of Visakhapatnam are still growing food crops on 95 percent of their farm land. The study indicates that the tribals of Adilabad and Srikakulam have to look for alternate sources of food supply as they are not cultivating enough to sustain themselves.

Forest dependence for uncultivated food was greater, especially during the distressed summer months or climate disasters, when crops failed. But in the current times it is no longer in practice amongst the tribals in Adilabad; among the tribals in Srikakulam and Visakhapatnam it is not a standard practice and their food needs are not dependent on it any more. However they do collect some tubers, mushrooms, etc., but it is not considered essential for survival.

Cropping Patterns: Traditionally millets were the main crop, along with lentils and oil seeds, etc. Millets being a coarse crop, have greater resilience to climate variabilty and so were grown by the tribals. But over a period of time, millets have been replaced by paddy and cash crops in the farm fields.

Granaries: The tribals in Adilabad and Srikakulam do not have a food storage system beyond 5–8 months for their personal consumption, as they have moved from growing food crops to cash crops, which are sold immediately after the harvest. The traditional practice of granaries is not prevalent anymore.

HYV and hybrid: There is a shift from growing indigenous traditional crops to HYV and hybrid seeds, which are considered beneficial in terms of higher yield. The indigenous seeds which were more resilient and adaptive to local terrain and climate are almost extinct. The traditional practice of storing seeds has also reduced and the farmers are dependent on the market or government programs for seeds. The farmers do not have a store of seeds with themselves due to the high cost; they cannot afford the risk of re-sowing if the first sowing fails due to less rainfall or bad quality seed, thus increasing the risk further.

Chemical farming: The use of chemical fertilisers along with manure is fast replacing organic farming practices, more so in Adilabad and Srikaulam due to extensive cultivation of cotton, paddy and cashew. With the increased cultivation of mono crops, there is increased use of of chemical fertilisers and pesticides on farms. This is increasing the input costs every year and, most important, causing soil and water degradation, loss of soil fertility, and reduced yield.

Climate variability and coping mechanism in current practice

With the increased incidence of climate variability in current times, the vulnerability of the tribal farmers has increased considerably. Frequent droughts, sporadic/ erratic rains, less rainfall have now become a recurrent phenomenon. Adilabad is facing three consecutive years of drought-like situation, Visakhapatnam faced the catastrophe of cyclone Hud Hud and Srikakulam tribals have also reported insufficient and erratic rainfall over the past few years. The tribals, over time, have come up with some adaptation strategies to cope with the impacts of climate change. They are listed below.

- *Water and soil conservation works:* Traditionally, the tribals covered in the study practiced soil and water conservation in their fields, but these practices had fallen off over time in the recent decades. Increased awareness, mainly through government programs, has brought about a wider use of local knowledge and practical means to “harvest” water and conserve soil moisture (e.g., crop residue retention and mulching), and more effective use of irrigation water and managing water to prevent water logging, erosion, and nutrient leaching where rainfall increases. They undertake soil and moisture conservation works like bunding, LBS, channels, trenches, etc.
- Kitchen-garden farming is being propagated by the government, which is being undertaken by tribal farmers in plots either in the backyard or located close to the habitation, and is a mixture of vegetables, herbs and other ornamentals. This practice provides diversification of crop species and is of economic importance because of its food and nutritional (balanced diet) and medicinal value to the household. The farmer obtains food products, medicinal plants, spices and ornamentals, and some cash income all year round. These self-sustaining systems are ecologically and economically efficient.
- Restoration of watersheds is helping to reduce vulnerability to climate-change associated stresses in a number of regions. It helps improve soil conditions, increase water availability, regenerate landscape and diversify agricultural production through a number of activities, including water harvesting and the encouragement of natural regeneration .
- Increased mechanization in farm lands by the tribals is being done as the monsoon during the pre-sowing has become erratic and reduced, leaving little time for the farmers to undertake manual ploughing and tilling. They now use tractors for the same. They are also using sprinklers for irrigating the fields, and harvesters and threshers because of high incidences of sporadic rainfall during the harvest season
- Use of stress-tolerant and fast-maturing crop species. Hybrid and HYV varieties are being grown due to recurrent droughts and less rainfall .
- Increased access and dependence on PDS for food security is another way of coping with food shortage due to crop failure or mono and cash cropping

Chapter 4

Conclusion and Recommendations

The following conclusions have been made with regard to the three objectives of the study

4. Traditional Agricultural Practices and the Transition of Change among Major Tribes of Adilabad, Visakhapatnam and Srikakulam

Crop diversity

Traditionally, tribals have had a rich crop diversity that ensured food security at all times and also in times of extreme climatic adversities (drought, floods, etc.). It is concluded that with the propagation of cash crops and mono crops, subsidies from government on seeds, pesticides and fertilizers, promotion of High Yielding Variety of seeds, and increased market influence in the agriculture system, there has been a paradigm shift in the cropping pattern, where there is a decline in traditional indigenous types of crop cultivation. In the districts of Srikakulam and Adilabad there is a considerable shift from food-crop cultivation to mono/cash crop cultivation. The tribals of Visakhapatnam, till date, have been able to insulate themselves considerably from adopting cash crops, chemical farming, etc. This has been possible since the government schemes and programs could not reach them due to the poor accessibility.

The crop diversity that traditionally existed has shrunk by almost 50 percent in terms of millets and pulses in their agricultural land. If there is any cropping system that can withstand these challenges, survive and flourish, it is the millet. While wheat and rice might provide only food security, millets produce multiple securities (food, fodder, health, nutrition, livelihood and ecological).

Agroecological farming

The intensive mono and cash cropping with use of chemical fertilizers and pesticides has firstly led to the potential threat of extinction of traditional seed varieties and traditional knowledge of cultivating them and secondly has caused ecological damage. The extensive use of chemical fertilizers and pesticides poses an environmental risk of soil degradation, water contamination and high input cost and low profitability in the future.

Traditional millet cultivation was beneficial as it needed very little water for cultivation and required just around 25 percent of average rainfall. Grown under traditional methods, no millet attracts any pest. Thus, they are of great advantage to the agricultural environment and are amazing in their nutrition content.

Storage of grains and seeds

The tribals have indigenous knowledge, which is scientific as well, for protecting seeds and grains for long periods of time. The smoke emitting from the wood-fire stoves in the kitchen worked through fumigation as a pest repellent for the stored grains. Bamboo structures made on a raised timber or stone

platform for storage of grains and seeds involved techniques using mud, ash and cowdung, fumigation, and treatment through plant leaves like *neem*, *adda*, etc. This is proof that traditionally, organic methods to store grains were prevalent, which were environment-friendly, had no ill effects on human health and were easily available and cost-efficient, protected grain from rat damage and prevented moisture absorption from the ground.

In the above context, seeds are now mostly procured from the market. The seed bought from the market has raised the alarming issue of decision-making on farm crops, which is a fundamental right of the farmer; the tribals over time have lost control on the choice of crop that will grow in the fields as it is now being controlled by big market players. The escalating price of seeds has left the farmers with little choice to seek alternative options.

4.2 Dynamics of food Security and Nutrition in Terms of Cultivated (farm-based) and Uncultivated (forest-based) Food and the Role of Women

Over time there has been reduced dependency on the forest, which has brought about a great change in their food habits and cultivation pattern.

Traditionally, there was no concept of buying food grains or vegetables amongst the tribal communities. The tribals had a grain reserves for up to one year. The traditional mixed-cropping system was a mechanism to safeguard the tribal farmers against crop failure due to abnormal weather conditions and was a kind of insurance. But over the last 20–25 years there has been a drastic shift in the food habits of the communities. Paddy has overtaken millet consumption amongst the communities in a big way. They do not access the forest for their uncultivated food needs. This has put more pressure on farm fields to meet the current food requirement.

With the advent of the Targeted Public Distribution System (TPDS), the tribals are food secure and gradually forgoing their traditional practice of grain-reserve management. They have gradually moved towards growing cash crops, thus reducing, year by year, the extent of land area devoted to growing food grains for their personal consumption. The above factors have posed serious questions on the issue of food security locally and nationally.

Sustenance from the PDS system: The PDS thrives on a system where the government buys food grains from the farmers themselves under a Minimum Support Price (MSP) and then the food grains collected from the farmers are supplied at subsidized rates through the PDS shops. It ensures food availability for the national population who are in non-farming activities and are solely dependent on farmers selling the extra grain that they produce in the market.

Any shortage of food supply will create famine-like conditions amongst the tribes with the erosion of their traditional agriculture practice of sustenance.

Increased input costs due to increased prices of HYV of crops, chemical fertilizers and pesticides, etc. will lead to reduced profit for the tribal farmers, which may discourage them to continue agriculture farming.

4.3 Traditional Practices were Climate Resilient and served as a Coping Mechanism Against Climate Change

The study observed that the traditional agricultural practices demonstrated inbuilt coping mechanism against adverse changes in climate. Three-tier farming practice, *podu* farming or mixed-crop (millets, lentils and oil seeds) farming, granaries, organic farming, forest dependence on food, were agroecological practices that were environment-friendly and sustainable.

The current agricultural system has deviated from the traditional agriculture practice which was self reliant and was climate resilient. The chemical fertilizers used for prolonged duration have damaged the soil and increased the risk of pests .

4.4 Impact of government policy and programs on tribal agriculture practice

In the case of the tribals that fall in the Agency area, ITDA and Agriculture Department programs post Green Revolution have been instrumental in impacting the tribals' livelihoods. Apart from the government programs that propagated cash-crop plantation and farming, chemicals-based farming, etc., the market-driven economy has also been a major influence on the choices that the tribals are making in the agriculture farms for increased cash inflow, which is unsustainable.

In Srikakulam, some 20 years back, the ITDA actively propagated cashew plantations amongst the tribals on

IFR lands and the Agriculture Department pushed for High Yielding Variety (HYV) of crops along with the use of chemical fertilizers and pesticides, which were highly subsidized to begin with.

In Visakhapatnam the ITDA and Forest Department attempted to propagate coffee plantations and chemical farming amongst the tribal communities, but met with little success as the tribals were located far from the metalled roads and therefore the outreach of the program was poor.

In Adilabad, the ITDA, the Agriculture Department and the market propagated HYV of cotton and other cash crops along with the use of chemical fertilizers and pesticides. Therefore, mono cropping has replaced the traditional mixed cropping systems.

To revive the traditional agricultural practices based on agroecofarming practices, the Government of India is currently implementing one such scheme, "Paramparik Krishi Vikas Yojana", with the Agriculture Department also promoting intercropping with cash crops. These initiatives undertaken by the government are at a nascent stage of implementation and the impact is as yet unknown.

4.4 Recommendations

The recommendations and suggestions have been made for all the stakeholders – Agriculture Department, ITDAs, Forest Department, Communities and NGOs. It is imperative that agriculture policies and programs should be based on the following parameters:

- Agriculture farming should be able to sustain economic viability
- It should address human food, fiber, feed and bio-fuel needs
- It should improve the quality of life for farmers, especially the small and medium farmers and farm laborers
- It should protect and enhance environment quality and natural resources
- It should be able to converge traditional practise with modern scientific knowledge

Based on the above parameters and the gaps that have been identified in the current agriculture farming, some suggestions have been made to improve agriculture, especially for the small and medium tribal farmers to make it a sustainable, viable option

Agriculture department

The agriculture policy should outline an Agriculture Land Use Policy, for the extent of land that can be undertaken for food crops and for commercial crops by farmers. This would address the current imbalance in the farming sector between availability of food crops for food security and economic viability through cash/ mono crop farming. Farmers should be compensated for the extent of land undertaken for food crop to sustain the practice.

***Agriculture programs and extension services*:** Agriculture research, programs and extension services should align modern technology with traditional practice and build on traditional knowledge and not ignore it. By integrating the systems of both traditional and scientific communities, a much larger range of new ideas and practices could be generated with the "participatory approach" to agricultural innovation and leading to balanced choices in agriculture.

Agricultural research should also be based locally, to demonstrate economic and ecological benefits based on best management practices, so that it is relevant and has a local history of use and can be field-tested locally for the farmers to see the environmental and economic benefits first-hand for adoption.

***Propagate mixed cropping and intercropping on a mission mode*:** There is a need to revive the agricultural practice of mixed cropping and intercropping, and organic/non-chemical farming. This can address the issue of food availability, nutrition, soil and water degradation and, most important, reduce climate-related vulnerability. The practice should be scaled for it to be a viable option.

***Small and midsized family farms*:** Agriculture has become increasingly dependent on large-scale, high-input farms that are highly mechanized and specialize in a few crops in large farms. These developments can be partially attributed to technological innovations, economies of scale and markets. But small and midsized family farms, which are currently declining in number and importance, are vital for the rural community to deal with the issue of hunger and poverty. Smaller farms feed a large number of people and therefore need larger protection and safety nets through high crop insurance, credit and bank linkages, incentives and subsidies. They should be the prime focus of the government to ensure that agriculture as a livelihood is sustainable amongst the tribal farmers.

- Mechanization of farming should be considered keeping in mind the local terrain, practice and, most important, a gender perspective – the needs and changing roles of women as farmers. Women should be trained in the use of technology and farming equipment, which should not be limited to be a man's domain
- Small farmers have not benefited from mechanization in agriculture as it is not economically viable due to the high cost of equipment. Institutional mechanism needs to be improved, where the "Custom Hiring Centre" scheme of the Agriculture Department should be revived and re-strengthened to benefit and support mechanization amongst small and marginal tribal farmers.

Forest department

The Forest Department should facilitate recognition under FRA of the rights of tribals on Community Forest Resources, at the earliest, so that tribals can excersise their NTFP and uncultivated food rights.

- The Forest Department afforestation program should maintain a balance between the indigenous, local species and commercial species, so that the tribal communities can maintain their traditional livelihoods practices, which were farm and forest based.

ITDAs / Tribal Welfare Department

- ITDAs should have participatory dialogue and brainstorming with the tribals on the tribal ecosysytem issues and challenges and their aspirations and perceptions.
- The solutions and policy decisions should not be based on a top–down approach but should evolve through a bottom–up approach.
- All the schemes that are to be implemented to propogate livelihoods – farming and non-farming – should undergo a sustenance audit and should be organic in nature to ensure that the outside knowledge and practice does not undermine their core philosophy of sustainable livelihoods.
- The IFR land development should look into food security and nutrition as the primary focus and not be based on cash-crop farming only.

Civil Supply Department

- TPDS should decentralize the procurement of food grains from state and downwards to reduce overhead costs of procurement and supply, which will also ensure that local food habits are protected. Fair price shops should be with the Gram Panchayats.
- The TPDS should diversify to address the issue of food nutrition apart from providing food security by supplying commodities, viz. millets, pulses, cereals and vegetables.

Tribal Communities

- The tribal communities should initiate dialogues and brainstorm on the challenges and issues to their sustainable livelihoods and develop a road map and themselves articulate their needs and expectations from government and programs.
- Their livelihood model should be a blend of traditional and modern scientific knowledge and adopt those practices and technology which complement and supplement their livelihoods.
- The communities should actively partner and build their capacities to manage, conserve and protect their forests and biodiversity for their very own sustenance.

Non Government Organisations/ other organisations

- NGOs should act as facilitators in the integration of traditional with modern knowledge practices and not influence the choices as per their own perception.

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Annexures

Annexure 1

Unique/Innovative/ Agricultural Practices

1. Traditional oil extraction of the Indian beech seed

Kusumuru and Titukupaidua are tribal villages from Seethampeta of Srikakulam district. Traditional Indian beech seed (*pongama* seed) has been grown by the tribals, which they use for lighting lamps, oiling hair and for body massage in winters to keep the body warm.

The tribals had developed an indigenous system for extraction of oil from the seeds, which they had been practicing since centuries, but over time this practice became extinct.

They collected the seeds and sun-dried them. Once the seeds dried they crushed the seeds in a wooden mortar and pestle. After the seeds were crushed they put them in earthen pots and added just enough water to soak the seeds. Then they boiled the seeds in the earthen pots. This was done so that the oil seeds released all the oil from the kernels.

Then they cooled the seeds. Once the seeds cooled, they placed cakes of seeds in flat bamboo baskets. Seven to ten baskets of the cake were layered one on top of the other. They would now press the bamboo baskets that had the seed cakes with a very unique indigenous contraption that worked as a press.

They made a hole In a tree and inserted a long log that worked as a handle on the lever principle for pressing. Under the handle they stacked the baskets. These baskets were kept on a hollowed stone plate or basin with a channel leading out that acted as a decanter and collected the oil when pressed with the handle from the top. To ensure that the seeds release all their oil a huge stone was kept on the handle. The handle was then pressed. As the baskets were pressed the oil was released from the seeds and would sieve out of the bamboo baskets and collect in the stone basin and run out to be collected in containers for further use.

The collected oil was then used for massaging, lighting of lamps, etc.

2. Grain storage management system – the underground granary

Village: Gadiguda, S.T.: Gond, HHs: 180

Gadiguda village is located in Narnoor mandal of Adilabad district in the state of Telangana. The village comprises of 180 HHs where the majority of the community of the Gond tribe (Pradan tribe being in the minority). Originally the village habitation comprised of Kollam and Gond communities but the Kollam community moved out some 30–40 years back .

Traditionally the Gonds had been practicing agriculture in the forest land and collecting uncultivated food and NTFP from the forest. The village was settled around 1920–25 with 99 percent of the people dependent on agriculture as their primary source of livelihood and sustenance.

Traditionally, the knowledge of agriculture practice and management was handed down from one generation to the next.

Storage practices

Traditionally, the community stored the seed at home in bamboo baskets which were treated with cowdung paste and neem leaves, which worked as a pest repellent.

Jowar was the main millet crop that the community grew in their fields, on an average each HH grew somewhere between 40 to 80 quintals of *jowar*. The tribal community devised the practice of storing the grains in underground granaries which were manmade and were in the shape of an urn. The underground granary was used mainly for storing *jowar*.

The tribals discovered this underground grain storage management system as they had little or no storage space in their thatched mud houses. They also feared that the grain kept in open might be susceptible to catching fire since they had thatch-roofed houses. This underground granary was present in each household.

The structure: The underground granary was in the shape of an urn. It was around 7–8 ft deep, the mouth of the urn around 3–4 ft in diameter, which was sealed except for a small opening, and the base could be about 8–10 ft in diameter. The opening of the mouth of the granary was small so that it could be pest free, and was also kept closed.

Management: After the harvest season the grains were threshed and winnowed and sun dried. After that the *jowar* was stored and the mouth of the granary was sealed with grass straw and covered with cowdung paste, to ensure it was airtight. Each household ensured that they stored jowar grains in small bamboo baskets in the house, which could cater to their food needs for a minimum of two to three months. After the grain was consumed they would open the lid of the granary and again take out enough grain for consumption for two to three months. But before the onset of monsoons, around mid-May they removed all the leftover *jowar* from the granary and stored it in their homes in bamboo baskets. This was done to ensure that the grain did not decay due to seepage of rainwater in the granary. After the *kharif* harvest the *jowar* was again stored in these granaries as they were dry and ready for use.

Current Practice: The community practices cash- and mono-crop farming. Their food habits have also changed, wherein they have started growing and eating rice from their farm or procured from the TPDS shops. They do not have enough millets that would need a granary for storage. Some of the farmers also said that the current hybrid variety of *jowar*, if kept in these underground granaries, turns to powder.

3. Case study on transplantation method: Nereduvalsa, Visakhapatnam

Nereduvalsa is a tribal village in the Agency area of Visakhapatnam district of Andhra Pradesh.The village is inhabited by the Kondadora and Nukadora tribal communities. The main sustenance of the tribal was based on agriculture. They practice the three-tier sustainable model of farming, based on the gradient of the land, in the hills: the first, topmost tier is under *podu* cultivation, the middle tier is known as *garu* land, in which terrace cultivation is done, and the third tier, in the plain of the foothills, has *pallam* cultivation .

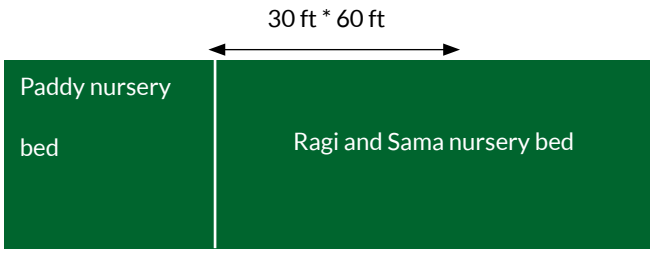
The most striking feature of cultivation among these tribal communities is that for many generations they have done transplantation of seedlings in terrace farming in the *garu* land. They cultivate millets and paddy in this patch of land. The scientific rationale behind this transplantation is that the middle layer of hill portion is not as fertile as *podu* land or *pallam* land due to extensive soil degradation. Soil moisture and nutrient is poor in the top layer, as a result germination of seeds may or may not happen. But when the seedlings are developed and transplanted to the field the roots penetrate deep into the soil and are able to utilize the soil moisture and nutrients. Moreover, fewer weeds develop in the transplantation procedure and it becomes easier to manage it. Transplantation procedure, which is well accepted in modern agricultural practice, was actually a process that evolved through trial and error over generations and was practiced in traditional agriculture.

A nursery bed is prepared in 15–20 meters of land (size of volleyball court) for transplantation of one acre of land. The land is tilled and cowdung manure is used for the preparation of the nursery bed. Once the land is prepared seeds are sown by broadcasting method to develop the seedlings. It takes about 20–30 days for the seedlings to develop.

Seedlings of three varieties of millets, i.e., *sama*, *ragulu*, *ulusulu* and one variety of cereal, i.e., paddy are developed in the nursery bed. Three kg of *ragi* is mixed with 250 gm of *sama* and broadcast in a patch in the nursery bed but paddy seeds are broadcast in a separate patch of the same nursery bed.

Once the saplings are ready, it can be transplanted anytime within a day if the climate is cloudy or cool but in dry and hot climate it should be done within four to five hours, preferably in the early mornings. Seven to ten persons are involved in this activity. It is a collective activity where households contribute their labor in each other's farms for transplanting. There is no hiring of extra labor from outside. Sowing of seeds in the nursery is done by men, plucking is done by women, seedlings are carried to the field by men and transplantation is done by both men and women.

The transplantation is again mixed cropping in the main field but they maintain a minimum gap of 10–12 cm between each sapling. If distance is maintained the yield is good.



4. Traditional indigenous practice: Bamboo irrigation system

Srikakulam District
Block: Heeramandal
Village: Morrigudda
S.T.: Jatapu, Savara
Total HHs: 35

The village Morrigudda is located in Heeramandal block of Srikakulam with Savara and Jatapu tribal communities inhabiting the village. The village is located near a reserve forest along with some fallow land. The means of sustenance of this community in the past was agriculture, which had mixed crops along with paddy, and forest collection for uncultivated food and NTFP. Over time, some 20–30 years ago ITDA propgated cashew farming amongst the tribal communities; therefore, the tribals now also grow cash crops – cashew, turmeric, pineapple, along with paddy in their IFR lands.

Agricultural farming was the traditional source of livelihood and sustenance for these tribal farmers, which they have been practicing since ages. Some 60–70 years ago agriculture was rainfed and the tribals grew crops during the *kharif* season only as they did not have any source of irrigation.

Near this village rainwater used to get stored in a natural pond higher up on the hill. This water was not used for any purpose as it was a bit far away, and so the water would seep into the soil and also flowed out and was wasted. The farmers felt the need to use this water in their fields and some 60 years back this village developed an irrigation system with the use of bamboo.

The topology of the region is hilly with steep slopes and rock boulders. Though the region got reasonably good rains during the monsoon season, they wanted to tap this water to irrigate their fields, when there was not much rain. The terrain imposed a challenge in bringing the water from a distant water source to the plantations. Diverting water through ground channels was not possible. Faced with this need for water and the challenges imposed by the terrain, the tribal farmers came up with this unique irrigation system made of bamboo channels. The bamboo channel irrigation system was based on gravity and the steep slopes helped in implementing it .Water from the uphill source was tapped and brought to the fields by a main bamboo channel and also used for meeting their household needs. The cost involved in building the system was minimal as bamboo was available freely in this region.

The tribals channelized the water to grow vegetables in the farms. The pond that was hitherto unused now economically benefited them.

This technological innovation evolved by the tribals of Morrigudda demonstrates the determined approach of the people to seek solutions within their ecosystem and thereby developed the bamboo irrigation system.

With the advent of government programs, and to address their issue of drinking water, the villagers in facilitation with ITDA, built a water tank and replaced bamboo pipes with plastic pipes. Now elephants are moving in their area and have destroyed the pipeline, which stands unrepaired till date.

5. Indigenous channel irrigation practice of Village Kusumuru

Kusumuru, Titukupaiguda and Titukupai are tribal villages located in the Agency area of Srikakulam district in the state of Andhra Pradesh. The village is inhabited by Savara and Jatapu tribal communities. The sustenance of these tribals is based on agricultural farming and dependence on forests for uncultivated foods and collection of NTFP. The tribals practice *podu* farming, in which they cultivate lentils, millets and cash crops like cashew and turmeric.

The three villages practice farming that is rainfed. These villagers have developed a source for irrigating their fields which are located in the forest up to the foothills. The upstream, topmost village is Titukupai, followed by Titikupaiguda and the third village, in the bottom of the slope, is Kusumura. The three villages developed an irrigation system from a stream, Koduru Veeraghattam at Jakaramma Konda, flowing through the hills, to water their fields by building a channel which feeds the fields on the way downstream. This irrigation system was built by the tribals more than 50–60 years back.

The stream flows almost throughout the year. The three tribal village cut a channel from this stream to water their fields for two or three months during the *kharif* crop, especially the paddy fields .But they realised that they were not able to tap the entire water as the channel was not "*pucca*". So they made stone bundings "*rallagadda*" along the wall of the channel for more effective use of the channel and diverted the flow of the stream to paddy fields. They call it Jagara Batti.

The channel flows nearly three km through the reserve forest and then near Gudimella Polam it irrigates the farmers' fields in three villages, covering 11 HHs and eight acres of land.

Annexure 2

Type of Crops Cultivated

Crop varieties	Local name	English name	No. of varieties available then	No. of varieties available now
Millets	Sajjalu/ gentalu	Pearl millet	2	1
	Ragulu/ Chodi	Finger millet	2	1
	Arika/ Arikaelu	Kodo millet	1	0
	Korra/ Korralu	Foxtail millet	3	0
	Sama	Little millet	2	1
	Udalu	Barnyard millet	2	1
	Jonna	Sorghum	2	1
	Variga	Proso millet	1	0
Pulses	*Junumulu*	Red lentil	2	0
	Kandulu	Pigeon pea	3	2
	Chikkadu	Red kidney beans	2	1
	Bobarlu	Black-eyed peas	3	1
	Minimulu	Black gram	1	1
	Ulwalu	Horse gram	2	0
	Senagalu	Chickpeas	1	0
	Pesarlu	Green gram	2	1
Cereals	*Wari*	Rice	4	1
Vegetables	*Sorakaya*	Long gourd	1	1
	Beerakaya (ridge gourd)	Ridge gourd	*1*	*1*
	Cheekudkaya	Flat beans	1	1
Oilseeds	*Amudalu*	Sesame	1	1
	Nuvulu	Castor	1	1

Annexure 3

Agricultural Implements/Tools

Annexure 4

Pictures of Grain and Seed Storage

Annexure 5

Questionnaire

"A Study of Indigenous Agricultural Practices among the Tribals of Andhra Pradesh and Telangana – the Trajectory of Transition and Impacts on Livelihoods and Food Security"

District: _____ Mandal: _____ Gram Panchayat: _____

Village: _____ Household no.: _____

Name of the head of the household: _____

Family size: _____ Land size in acres (all kinds): _____

Basic demographic details

Name of the family members (all adult members)	Age	Gender (M/F)	Education	Occupation	
				Primary Occupation	Secondary Occupation

Agriculture

S. No.	Agricultural practices	Traditional practices (what was happening 50 years before)	Current practices
1	**Agriculture Model**		
	Type of agriculture farming – explain in detail their farming pattern		
2	**Cropping pattern :**		
	Cropping duration: once/ twice a year		
	How many crops grown at one time – mixed cropping		

Types of crop grown

Sr. No.	Types	Rabi / Kharif	Name of traditional variety	Acreage Grown	Rationale
I	**Millets**				
1					
2					
3					
4					
5					
II	**Cereals**				
1					
2					
3					
4					
5					
6					
III	**Oilseeds**				
1					
2					
3					
4					
5					
6					
IV	**Vegetables / Fruits**				
1					
2					

3					
4					
5					
6					

4	**Manure/Fertilizers used**		
	Process of preparation		
	Its effects on farmlands		
	From where it is collected		
5	**Pesticides**		
	Process of preparation		
	Its effects on farmlands		
	Variety of plants planted which act as pest repellent		
6	**Irrigation practices**		
	Rainfed		
	Any traditional mode of irrigation		
	Tube well/ bore well/ open well		
	Ponds / streams / natural sources of water		
7	**Farming Practice**		
7.1	*Land preparation: General practices/tools used:*		
	for tilling the land		
	for soil testing		
	for soil treatment		
	Equipment used for land development		
	Tools used		
7.2	*Sowing*		
	General practices used		
	during sowing		
	during seed testing,		
	during sowing pattern		
	Tools used		
7.3	*Pest control*		
	Most prevalent pests		
	Practice against pest and animal invasion		
	Pest-control crop variety		
7.4	*Harvest: What were/are the general practices used*		
	Months of harvest		
	Practice for identification maturity of seed		

	Tools used for harvest		
	Do they exchange seeds like a barter system or buy from each other		
8	**Credit mechanisms**		
	What were/are the practices for credit or loan		
9	**Gender dynamics**		
9.1	Roles of men in farm activities		
	Role of women in farm activities		
9.2	Practice on who takes the decision on selling, who keeps the money after sale? Male or Female: Then and now		
10	**Seed bank: Is it practiced or not: yes/no**		
10.1	It is practiced at household level / community level		
10.2	Process of maintainance of seed bank		
11	**Any other**		

Any Others:

Date of data collection: **Signature of the investigator**

Annexure 6

Checklist for Focused Group Discussion

a. Land under agriculture – history, management, where the fields is located

b. Crop grown and cropping pattern:
   - No. of times land is under cultivation in a year
   - No. of varieties of crop grown
   - No. of indigenous varieties for each crop
   - Cropping pattern: broadcasting / line sowing
   - Crop rotation, etc.

c. Irrigation

d. Manure

e. Pesticides

f. Tools for farming
   - Traditional tools: Who were/are the user; artisans; quality
   - Were they specific to women?
   - How beneficial and for what they were used in the farms.
   - Modern: Material used; how do you procure them
   - Advantages and disadvantages
   - The economics of farm tools – total buying/ rental cost of equipment and the financial benefit in terms of production and income

g. Concept of grain bank (HHs / community level) Types of grain stored, varieties
   - For how many months/years they had the grain available

h. Seed bank – do they have a concept and what is the system

i. Processing of grain Y/N. If Y what value addition do they do, is value addition for sale and consumption both or only for sale

j. Self Consumption – how many months they consume their grains; if shortage, what was the system then and now.

k. Food habits – change and what kind
   - Combination of forest foods
   - Fruits and vegetables
   - Cereals / millets / pulses

l. Role of children then and now
   - Children's contribution towards farm activities then and now
   - How things have changed after more number of children going to school

m. Gender dynamics
   - Traditional vs current practice in roles of men/ women in farm activities
   - Division of work was/is gender based
   - Access and control over the resource, once ready.
   - Traditional vs current practice in who takes the decision on selling, who keeps the money after sale

n. Resilience and coping mechanism for climate change
   - Traditional practice of forecasting weather – rain, drought or medium

- Decision on what crops to grow based on forecast Y/N and if Y what
- Management practice to cope against drought, natural calamity; concept of grain bank (HHs /community level); seed bank; how many months/years they had the grain available for
- Was the management system community-based or individual; then and now?

o. Rituals related to farming:

p. What were/are the support mechanisms – (govt., NGOs, etc) how have they changed over time; what are their expectations in future from CPF on it?

q. Before they were in their own shielded environment. Over a period of time what are the external factors that have influenced them / their lifestyle, and their impact.

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