# A resilience approach to assess climate augmented migration in Indian farming systems

## Case study from Andhra Pradesh

**A resilience approach to assess climate augmented migration in Indian farming systems: Case study from Andhra Pradesh**

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# Executive Summary

## Executive Summary

Situated in the Rayalaseema region of Andhra Pradesh, this study examines the impact of an ongoing agroecological transition: the Andhra Pradesh Community Managed Natural Farming on distress seasonal migration, a key coping strategy to absorb climate related shocks. Predominantly comprising small and marginal farmers, agriculture in Rayalaseema has always suffered from harsh agroecological conditions and resource scarcity. It has been historically drought prone and since the 1980s, the region has been experiencing periodic droughts and erratic rainfall (Salmi 2023). In a region that is already reeling with multiple crises, the threat of climate change has put those already suffering from injustices of the current food system regime under even more pressure. Consequently, there have been numerous efforts by the government and civil society organizations to make agriculture more sustainable and resilient to climate change impacts. The state-sponsored programme of Andhra Pradesh Community Managed Natural Farming (APCNF) has been one of these initiatives. Launched by the state government in 2016, it is the largest example of regenerative agriculture in India based on principles of agroecology. The target of this initiative is to eventually train and convert all the 6 million chemical farmers in Andhra Pradesh across 8 million hectares of land by 2031 (Sandhu et al., 2023). However, despite celebrating wins for improving ecological sustainability, there has been limited acceptance and improper adoption of this method.

While existing studies in India have largely focused on outcomes such as crop yields and farm incomes, less attention has been paid to how such transitions reshape agrarian livelihoods and adaptive capacities. This study addresses that gap by examining whether the adoption of APCNF is associated with differences in households' resilience and, in turn, their reliance on distress migration as a risk management strategy. Using a comparative case study design, we use resilience as an explanatory framework to infer whether the adoption of APCNF by farming households is associated with a reduced incidence of distress migration as compared to those practicing chemical farming. The study draws on primary data collected through 200 household surveys and 22 semi-structured interviews

with key stakeholders in the districts of Anantapur and Kurnool. Analysis was conducted using thematic coding alongside relevant statistical techniques.

Our findings reveal that seasonal migration is a major risk management strategy for vulnerable households in Anantapur and Kurnool districts in order to deal with the magnifying impact of climate shocks on preexisting socio-economic drivers: declining agricultural livelihoods, search for employment, increasing indebtedness and better lives for their children. Moreover, a household's decision to engage in this distress migration is a complex decision mediated by its resilience (a composite index comprising three capacities: buffer capacity, self-organisation and capacity to adapt and learn), the type of farming system it is embedded in, and its navigation of historically entrenched marginalization. We observed that households that migrate seasonally had a lower resilience on an average than those that didn't primarily due to lower assets and capitals and lack of local support networks. In fact, 69% of seasonal migrants in our sample were small and marginal farmers.

Moreover, households practising natural farming showed an overall higher level of resilience (across all three capacities) compared to those practising chemical farming. This can be attributed to higher crop diversity, improved soil health due to natural inputs and participation in local formal and informal networks like the Self-Help Groups. The capacity to self-organise was significantly higher for the natural farmers as SHGs are the chosen body for the dissemination of APCNF practices. Similarly, shared learning about practices like the pre-monsoon dry sowing among APCNF farmers resulted in a higher capacity to adapt and learn. These findings suggest that that chemical farming households are less resilient and hence more likely to engage in seasonal migration. At the same time, the near absence of past seasonal migration among natural farming households indicates that the most vulnerable (least resilient) may be excluded from such transitions, reinforcing existing vulnerability traps. The act of migration itself reduces their access to institutions where they might learn about new practices like APNCF which can potentially improve their resilience in the long run. These households primarily comprised small and marginal farmers from lower caste groups who have been historically disadvantaged.

The analysis further highlights the role of structural vulnerabilities (for e.g. caste) as a key determinant shaping both resilience and migration patterns. Caste can affect resilience through lower asset ownership, reduced access to information and technologies, lack of access to informal institutions, and other public infrastructure and services. Hence, it was not surprising that the least resilient households often belonged to lower castes. Caste was also seen to influence the choice of destination and the outcome of migration among these seasonal migrants across both districts. With respect to the outcome of migration, while in most cases, lower caste migrants end up in precarious livelihoods and living conditions which could further lower their resilience, there were also instances when decades of engagement has led to their upward social mobility and improved agency.

Overall, these results have relevant implications for both scholarship and policy making as resilience can be a valuable conceptual lens to identify not just the most vulnerable populations but also key leverage points for making interventions. Our analysis has identified three such points of action to make agroecological transitions like APCNF more inclusive and accessible. First and foremost, a key challenge for the interventionists is to create more innovative models of dissemination that do not exclude the households that are already below the threshold level of resilience which is required to access information on newer technologies and interventions. One of the ways of rectifying that can be through co-creation of grassroots institutions with the civil society. Secondly, better access to raw materials for preparation of natural inputs within the farming system is required to improve the uptake of natural farming by households that are exposed to it but are apprehensive. Lastly, proper integration of the APCNF programme with the existing agricultural extension system could play a critical role in scaling out of the intervention.

# 01

# Introduction

# 1 Introduction

With food systems across the world experiencing multiple socio-political and economic disruptions, the added threat of climate change is bound to have significant repercussions. This is reflected in the latest IPCC report which states that the increasing complexity of the climate change risks and impacts, and their interactions with the non-climatic risks, are going to result in 'compounding overall risk and risks cascading across sectors and regions' (IPCC, 2023). The magnitude of such repercussions will, therefore, be determined by context specific vulnerabilities making the poorest and the most marginalised populations the most impacted and least prepared. For instance, agricultural households in developing countries are more susceptible to these multidimensional risks due to various structural factors and socio-economic circumstances (FAO, 2020). Any sudden fluctuation in the stream of income from farming activities would severely threaten and destabilise the livelihoods of these vulnerable households (Pagnani et al., 2021).

While subsistence farming communities across the Global South have been known to engage in off-farm activities, the growing unreliability of agricultural income in the wake of climate change, has made finding alternate livelihoods pertinent to their survival (Gautam, 2017). Historically, migration has been a widely adopted risk management and livelihood diversification strategy for the vulnerable populations in regions with ecosystem-based livelihoods. Especially when we talk about rainfed cultivation in arid/semi-arid regions (52% of the arable land in India is rainfed), farmers in these areas have engaged in seasonal/circular migration as a norm to cope with climate variability as well as to manage production and investment constraints in agriculture (Deshingkar, 2012; Tebboth et al., 2018). In some cases, remittances from this temporary migration become a major source of income when agriculture ends up being non-remunerative, and more so during drought years. We find evidence of this in India as well (Jülich, 2011).

Even though the share of agriculture in the country's GDP is merely 15% in the present times, we are still a largely agrarian economy employing 46.1% of the

people[1] in the agrarian sector (Dhar & Kishore, 2021). The performance of this sector, however, has been characterised by consistently low growth rates and declining labour productivity as compared to non-agricultural sectors. The added threat of climate change puts further pressure on the already precarious agricultural livelihoods. So far, the observed impacts of climate change in India have been in the form of decreased rainfall during the monsoon season and a trend towards more extreme distribution of rainfall. The pace of increase in annual average surface temperature has also risen (Sedova & Kalkuhl, 2020). Without appropriate adaptation strategies, the impacts of climate change could depress the agricultural yields by 25% in the long-term (2070-2099) and reduce the annual agricultural incomes by 15-18% on an average (Guiteras, 2009; Ministry of Finance, 2018). In fact, a primary survey of 18 Indian states back in 2013-14 had revealed that 67% farmers felt that the agricultural income wasn't enough to sustain their families, and 70% farmers had experienced crop losses in the past three years primarily due to climatic factors, which were compounded by a lack of irrigation facilities (CSDS, 2014). In such a scenario, short-term migration is a preferred household response strategy to deal with multiple climatic and non-climatic risks.

Despite substantial empirical evidence to illustrate the correlation between climate shocks and human mobilities in the context of declining agriculture, establishing a direct causal relationship between the two is not tenable. This is because climate change acts as a threat multiplier, interacting with various drivers and intersecting vulnerabilities in context specific ways, resulting in different trajectories of migration outcomes (Cundill et al., 2021). Hence, a household's decision to migrate is a consequence of social, economic, political and environmental factors operating at different scales (Black et al., 2011; Maharjan et al., 2020). For instance, state response to the impending threat of climate change on India's agricultural sector has been towards promoting sustainable and climate resilient agricultural practices through multiple national and regional interventions. The implementation of these initiatives will impact the existing institutions and structures of a given farming context's agrarian economy, and indirectly, also influence the decision to migrate. Therefore, the causal relationship between climate change, agriculture and migration is not a simple

[1] Economic Survey of India (2023-24)

one. In such a scenario, employing a systems approach rooted in **resilience thinking** to understand climate mobilities in agriculture can be an effective and novel way to capture the complex interdependencies among drivers of migration, household vulnerabilities and the whole spectrum of mobility outcomes.

To that end, this case sItudy aims to unpack the relationship between climate change and migration by observing this household coping strategy in the context of the rainfed farming system, as a whole. Broadly defined as the emergent property of a system to maintain stability in the face of change by bouncing back or bouncing back better, *resilience thinking* has come to be relevant for farming systems research to study the multilayered processes that determine the well-being of rural households in the face of change (Constas et al., 2022; Darnhofer, 2014). It is predicated on the understanding that each farming system has certain micro and macro-level characteristics ranging from socio-economic circumstances, demography, cropping systems, farming strategies to institutions, ecosystem health, and its agroclimatic context. These characteristics play a crucial role in determining the nature and level of resilience of a household within a particular farming system. Hence, when a farming system is exposed to climate risks like droughts, households' resilience will determine how they respond. This in turn will help us explain why mobility pathways and outcomes may differ across farming systems when faced with climate risks.

### 1.1 Study Objective and Research Questions

46.1% of the total arable land in India is under agriculture, and more than half of it (52%) is rain-fed (MoA&FW, 2018). Within the agrarian landscape, rainfed areas are more vulnerable to climate change impacts like changing monsoon patterns and increased surface temperature. Moreover, they are cultivated by about 61% of our total farming population and contribute to 40% of our food production (NRAA, 2022). Since more than 89% of farmers in India are small and marginal (less than 2 hectares of landholding), most of them are rainfed farmers (MoA&FW, 2023). In addition to their socio-economic vulnerabilities, these agrarian communities have limited resources and adaptive capacities (NRAA, 2022). Most of the poorest farming households lack access to 'timely weather information, improved technologies and credit and insurance cover' to withstand vagaries of climate change (MoA&FW, 2018).

To deal with these multidimensional challenges, there have been numerous efforts by the government and civil society organisations, especially in the Global South, to revive agriculture and build resilience among communities. In India, the introduction of the Andhra Pradesh Community Managed Natural Farming (APCNF) programme since 2016 has been one such experiment to initiate an agroecological transition of agriculture in the state. It is one of the biggest examples of regenerative agriculture in India based on principles of agroecology. While globally, the agroecology movement has evolved into an emancipatory movement for food sovereignty that critiques the hegemonic food system, its trajectory in the Indian context has been different. As a state sponsored initiative, it has celebrated wins for improving ecological sustainability while also dealing with challenges of limited acceptance and improper adoption of this method.

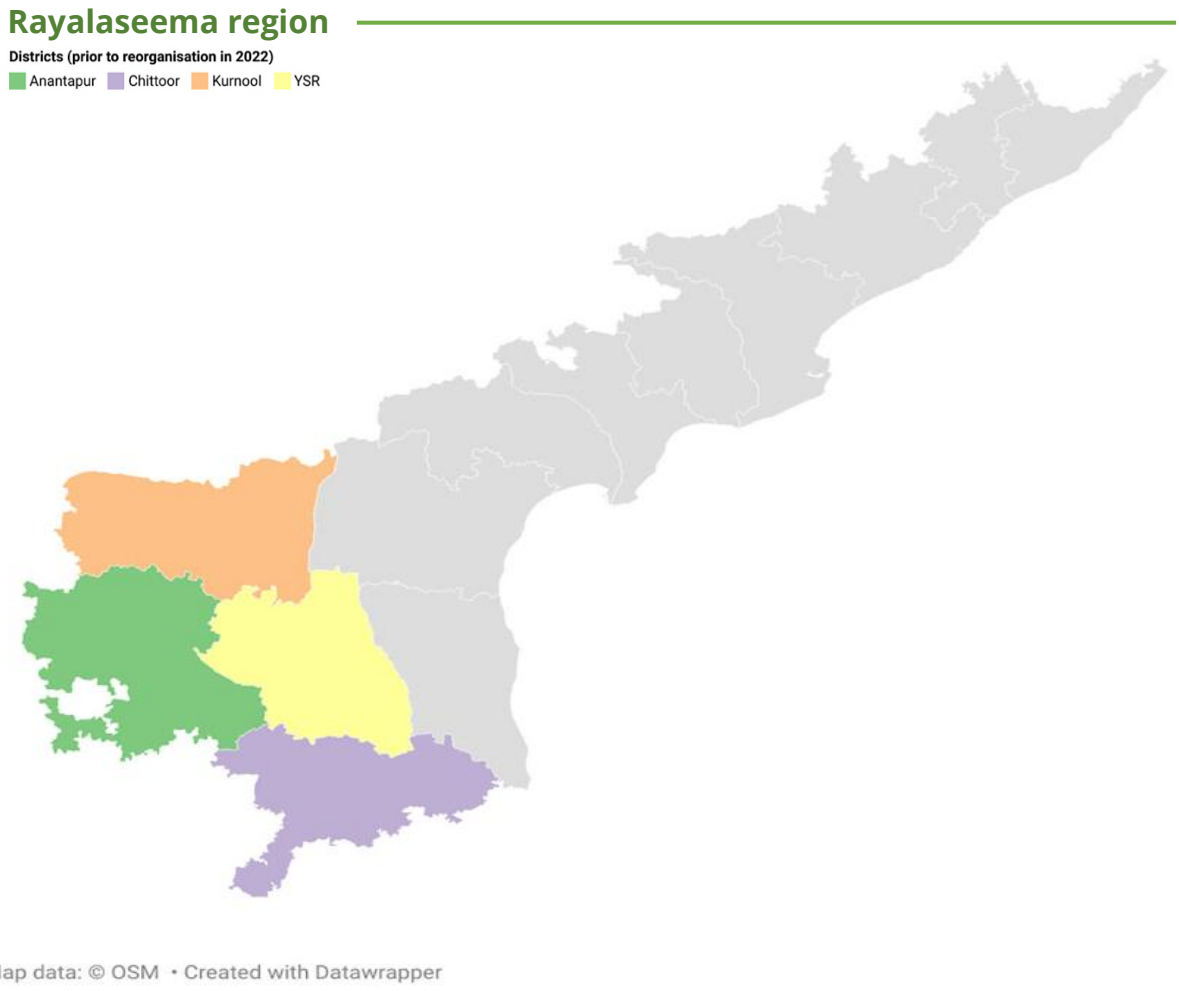



Figure 1: Map depicting Rayalaseema Region

Source: Author

Situated in Rayalaseema region of Andhra Pradesh, this project seeks to do a comparative study to assess the resilience of the APCNF farming experiment with the conventional input-intensive Green Revolution-based farming system. Historically a drought prone area, Rayalaseema is the most economically backward part of Andhra Pradesh. Predominantly comprising small and marginal farmers, agriculture here has always been a victim of harsh agroecological conditions and resource scarcity. In a region that is already reeling with multiple crises, the threat of climate change has put those already suffering from injustices of the current food system regime under even more pressure. For instance, while seasonal migration for diversification of livelihoods emerged as a coping strategy for the most marginalised in the rural society in late 80s and 90s, the changing pattern of rainfall and increasing frequency of droughts has led to more and more people opting for it (M. Reddy, 2015; Salmi, 2023) Implementation of the APCNF model to this socio-economic context is likely to have implications on agrarian livelihoods and concomitantly, the households' capacity to adapt to climate change impacts. Therefore, it is imperative to look at both, the state and household response strategies, while examining the relationship between climate change and migration.

The **primary objective** of this research is to use resilience as an explanatory tool to understand if and how the ongoing agricultural transition (APCNF) in the Rayalaseema region of Andhra Pradesh has impacted climate change augmented migration. To that end, this study has tried to answer two main questions:

- Question 1: What is the relationship between the choice of migration as a coping strategy and the resilience of a farming system?
- Question 2: How do the intersecting household vulnerabilities impact the decision to migrate as well as the migration outcomes?

The report is structured as follows: We first begin with a brief review of literature on the relationship between climate change and migration, especially in the context of declining agriculture. This is followed by the section on our theoretical framework for the study. We then introduce our case study region by diving deep into its historical and socio-political context, as it forms a backdrop to the current ongoing agrarian transition in Andhra Pradesh. We briefly discuss the

introduction and implementation of the APCNF intervention before moving on to describing the methods for data collection and analysis. This is followed by an in-depth description and analysis of the findings of the study, and finally, its implication for policy making and conclusion.

# 02

# Climate Change and Migration Nexus

# 2 Climate Change and Migration Nexus

## 2.1 Historical evolution of the field

Tracing the documented literature on migration as far back as the late 19th century, we find that environmental factors like droughts and desertification were once considered to be key drivers of human mobility (Ravenstein 1889). But as the field developed, more economic explanations as drivers of migration took precedence during the entire 20th century (Piguet et al., 2011). Since then, from neoclassical theories on individual agency to being seen as 'the human face of climate change', the understanding of migration as a phenomenon has become increasingly convoluted over time (Clement et al., 2021). The popular push-pull analysis of the 1960s, the migration systems theories and neoclassical equilibrium models, were all a part of the 'functionalist' paradigm of social theory that viewed migration as an optimisation strategy (De Haas, 2021). These theories largely focused on different factors at the origin and destination, thus influencing an individual's decision to migrate.

Functionalist approaches eventually gave way to 'historical-structuralism' in the 1980s. This paradigm recognised migration as an inevitable aspect of social and class change (Kaczan & Orgill-Meyer, 2020). Theories like world systems theory, dependency theory and critical globalisation theory began conceptualising migration as a consequence of 'structural economic and power inequalities, both within and between societies (De Haas, 2021). The legacy of these approaches resulted in the New Economics of Labor Migration (NELM) theory that looked at a household rather than an individual as the unit for analysis. The NELM, widely used even today, considers a wide range of socio-economic and institutional drivers behind a household's decision to migrate (Kaczan & Orgill-Meyer, 2020).

It was not till the late 1980s however, that environmental factors began to re-appear in the discourse on drivers of migration. Alarmist predictions of millions of environmental refugees being created by the end of the 21st century owing to anthropogenic climate change came forth (Myers, 1993). Since then, the discourse on climate change-migration nexus has evolved rapidly. At its heart has been the maximalist vs minimalist debate among the experts with respect to the phenomenon of environmentally induced migration. While the maximalists give

staggering figures in its favour, the minimalists highlight the complexity of interaction between various drivers of migration, making it difficult to distinguish migrants for whom environment has been the primary factor (Baldwin et al., 2014). For the longest time, global discourse around climate change and migration was dominated by maximalists advocating securitised perspectives on 'climate change refugees'. The politics behind such a positioning can be seen as a projection of unease in the Global North about the potential influx of climate refugees from the Global South. However, despite the alarming figures quoted in policy circles, there is limited empirical evidence to support these claims (Cundill et al., 2021).

Since the 2010s, however, it is the minimalist position that has come to be widely accepted and established. This is because, even in the regions with extremely high exposure and vulnerability to climate change hazards, the environment has rarely been perceived as the primary push factor among migrants as compared to economic and social drivers. While this positioning has been referred to as minimalist within the literature, we shall use the term 'panoramic' as it is more representative.

### 2.2 The current scholarship on climate change and migration

Within the maximalist paradigm, some empirical work has been done to understand the causal impact of past climatic events in stimulating migration and future predictions are made based on that (Dallmann & Millock, 2017; Kaczan & Orgill-Meyer, 2020). One of the biggest high-profile studies conducted recently, uses demographic, socio-economic, and climate impact data to project that slow onset climate change (water stress, crop failures etc.) will push over 143 million people in South Asia, Sub-Saharan Africa and Latin America to move internally by 2050 (Clement et al., 2021). Even though these studies have become more conceptually nuanced with sophisticated models, they still represent a reductionist approach to understanding the phenomenon.

On the other hand, there has been a growing body of panoramic literature that has looked at climate change as a threat multiplier interacting with the preexisting drivers of migration (Gautam, 2017). These drivers can be both, micro and macro level, and it is essential to aggregate them to understand people's decision to

migrate (Parrish et al., 2020). There have been a variety of theoretical and methodological approaches to do that. For instance, Kaczan and Orgill-Meyer (2020) use a household capability and vulnerability lens to see how socio-economic drivers affect the decision to migrate. Sedova and Kahlkul (2020) on the other hand employ the ROY-BORJAS mode of occupational choice to observe if weather distribution in rural India impacts the self-selection of migrants. This model focuses on relative inequality at the origin and destination for migrant self-selection, which is then used to establish that climate migrants are usually from the lower end of the skill distribution and belong to agricultural households. Furthermore, beyond the multiplicity of drivers, come the interactions between them as well as the structural and household vulnerabilities that determine the outcome of a migration decision and hence need to be accounted for. This is extremely pertinent, especially when looking at the impact of climate change hazards on mobility patterns. For instance, there is evidence to show that even among the most vulnerable, it is the relatively better-off who can resort to migration as a coping strategy (Pragathi & Anitha, 2019).

For most cases described in the literature, migration in the context of climate change is seen as either failure of households to adapt, or as a successful adaptation strategy. However, the actual outcomes of migration do not conform to such binaries (Singh & Basu, 2020). Many recent studies have established that depending on the context-specific vulnerabilities and drivers, a whole continuum of outcomes of migration is possible. They have been categorised as *forced displacement, migration as an adaptive response, planned resettlement and, trapped and immobile* (Parrish et. al, 2020). Other works have characterised migration based on its outcomes and the context of decision making as either *discretionary* or *risk reducing*. While the former is choice based, the latter is a coping mechanism to deal with agrarian distress and is most often associated with seasonal migration (Kaczan & Orgill-Meyer, 2020).

Beyond these binaries, recently developed approaches have also questioned the mobility bias in migration research which neglects looking at factors that lead to diverse immobility outcomes. The aspirations-capabilities framework for instance, has been seminal in defining how structural and personal factors can shape why and how people move. Drawing on Amartya Sen's 'capability approach', this framework reimagines migration as a function of both, individual aspirations

and people's capabilities (Schewel, 2020). Both, aspirations and capabilities get influenced by macro-structural processes resulting in a range of mobility-immobility outcomes: involuntary immobility, voluntary immobility, involuntary mobility and so on. (De Haas, 2021; Schewel, 2020).

While there are many nuances in literature, we observe two main takeaways from the current state of scholarship. First, the relationship between migration and climate change is not linear but rather mediated by multilevel drivers and context specific vulnerabilities. Second, the heterogeneity and dynamism of interactions between the multiple drivers is mirrored in the heterogeneity of migration outcomes and patterns. In the context of our study area, there are studies that show how distress migration from the Rayalaseema region leads agricultural migrants into contractual employment as bonded labourers in informal sectors like construction, brick building and so on (Pragathi & Anitha, 2019). Migrants escaping from one set of vulnerabilities in their place of origin may encounter a new set of vulnerabilities at the destination, turning it into a maladaptive response strategy (Cundill et al., 2021). On the other hand, there is also a portion of literature that has traditionally focused on how the decision to migrate can result in an increased social resilience of the whole community and may bring improvements in agriculture through remittances (Deshingkar, 2012).

When we look at the contextual factors, certain government policies in Andhra Pradesh have also sometimes triggered among people the decision to migrate. In some cases it was the failure of watershed development projects, while in others, it was free electricity and drought mitigation policies promoting private borewells (YSR Jala Kala 2019) that resulted in overexploitation of already depleted groundwater. In both the scenarios it was the small and marginal farmers who got exposed to high financial risks (Ramachandran & Susarla, 2010; Salmi, 2023).

As a result, this study theoretically positions itself within the climate mobilities paradigm that conceptualises movement in the context of climate change as heterogeneous, having 'a wide range of mobilities and immobilities' (Boas et al., 2022). Within this paradigm, the relationship between climate change and migration is visualised as being embedded in the existing power structures and inequalities that have shaped historical and current patterns of mobility (Boas et al., 2022). This essentially means that the impacts of climate change on migration

cannot be modelled without the context of the agricultural system and its socio-political and economic institutional structures.

# 03
# Theoretical Framework

# 3 Theoretical Framework

With climate change becoming an omnipresent reality, an added layer of pressures interacts with the preexisting structural and socio-economic vulnerabilities, thus reshaping the mobility patterns in local agrarian economies. Migration has been established as a widely adopted coping strategy among the resource poor households at times of agrarian distress. But we must understand that migration is just one of the risk management strategies among others like intensifying agriculture, selling assets, reducing non-essential expenditures, relying on social and institutional support systems etc. (Kaczan & Orgill-Meyer, 2020). Each decision taken at the household level is not in isolation but depends on the farm, farmer and their socio-economic, political and environmental context (Madhuri and Sharma 2020; Singh, Dorward, and Osbahr 2016). One study highlights how droughts and desertification indirectly affect the decision to migrate by impacting household agricultural income and livelihoods (Michelle Leighton, 2011). This income is not absolute but rather relative to others in the same community. This relativity determines a household's vulnerability and hence the likelihood of migration.

Hence, contextualising the agricultural household within a larger farming system can help in a more nuanced understanding of migration drivers, patterns and outcomes. Furthermore, in a farming system context, the decision to migrate is an outcome of the interplay between a complex set of variables ranging from household assets and capabilities to systemic factors like availability of labour, market prices, social networks, access to financial resources, state support mechanisms, policy interventions, ecological context and so on.

For this study, a systems approach, rooted in resilience thinking, is suitable to analyse the impact of climate change on migration in the context of an ongoing agroecological transition (APCNF in Andhra Pradesh). Additionally, to reflect on mobility justice for the agrarian context, it is necessary to explore the system related conditions that create the need for short distance 'adaptive circular mobilities,' which may or may not lead to optimal outcomes (Boas et al., 2022). Hence, we need a better understanding of socially differentiated vulnerabilities alongside the system processes and characteristics that provide context for different coping strategies to build long term resilience to future shocks. In the

following subsections, we briefly discuss our theoretical framework and the conceptualisation and operationalisation of key variables.

### 3.1 Resilience thinking

Having become the new development buzzword, 'resilience' has emerged as a new transdisciplinary approach within the global policy agenda (Schipper & Langston, 2015). It has wide applicability from development issues to humanitarian crises to climate change. Within academic literature, it features in disaster management studies, economic theory, psychology, institutional analysis and so on (Constas et al., 2022; Shaw & Maythorne, 2013). In the realm of climate policy, resilience thinking featured relatively late but has since filled a crucial conceptual gap within 'vulnerability and adaptation' discourse by bringing focus on the ability to respond to uncertainty and change.

There is no academic consensus regarding the conceptual origin of 'resilience'. Different disciplinary definitions emphasise its different aspects. Many scholars have traced the origins of resilience perspective to the field of ecology in 1960s and 70s. An ecologist, C.S. Holling introduced the concept in 1973, defining it as the measure of the ability of systems to absorb changes and persist while maintaining their structures and functions (Cote & Nightingale, 2012; Folke, 2006; Walker et al., 2002). Since then, resilience has been widely used in social sciences in various contexts. The idea of resilience in the context of farming systems is not just about their capacity to absorb shocks and stresses, but also about an opportunity to reorganise into more desirable configurations or evolve into new trajectories (Beauchamp et al., 2020; Berkes et al., 2008; Folke, 2006; Young & Oran R. Young, 2017).

Being a multidimensional and dynamic concept, resilience has been exceedingly difficult to operationalise. It is rooted in different disciplinary interpretations and there exists a plethora of approaches and frameworks employing quantitative or qualitative methods or both (Constas et al., 2022; Schipper & Langston, 2015). We base this study on three key frameworks that have been used in literature to assess and measure resilience. The first and main framework was developed by Meuwissen et.al (2019) to assess the resilience of farming systems by focusing on three capacities: robustness, adaptability and transformability. In addition, they

also look at certain attributes (farming practices and resources) that are rooted in the adaptive cycle processes of agricultural practices, farm demographics, governance, and risk management (Meuwissen et al., 2019). The second framework was developed by Cabell and Oelofse (2012), who produced thirteen behavioural indicators to assess the resilience of agroecosystems. For them, resilience gives farming systems the capacity to build and safeguard different livelihood capitals in the face of shocks. The last framework we refer to describes three different dimensions of resilience as delineated by Carpenter et. al (2001): buffer capacity, self-organisation, and capacity for learning and adaptation.

These frameworks have been often applied to study resilience of agroecosystems in different contexts. Two seminal studies on the Global South that have also applied these frameworks are by Tittonel (2020) (Brazil) and Jacobi et. al (2018) (Bolivia and Kenya). For our own case study, we have used context-relevant indicators and added migration as an outcome of the resilience of a household within a particular farming system (Fig. 2).

The following subsection describes briefly each of the components in our farming system framework for measuring household resilience.

### 3.2 Farming system

For this study, we have referred to the following definition of a farming system: 'a group of individual farm systems that have 'similar production and livelihood patterns and broadly similar development constraints and opportunities' (Dixon, 2019). At the centre of the farming system is an individual household which is our unit of analysis for measuring resilience. We define a farming household as per the National Statistical Office's (NSO) 'Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India' report of 2019: 'households having at least one member self-employed in farming and whose annual value of produce from such activity exceeds Rs 4,000. Farming or "agricultural activity" includes cultivation of crops (field, horticultural, plantation and fodder) as well as animal husbandry (dairying, poultry, goat/sheep-rearing, piggery, inland fishery, beekeeping, sericulture, etc.)' (NSO, 2019). Our resilience assessment is predicated on the understanding that each farming system has certain micro and macro-level characteristics ranging from socio-economic

circumstances, cropping systems, to institutions, ecosystem health, market linkages and its agroclimatic context. We have derived our characterisation of a farming system from Meuwissen et. al (2019) based on which the actors are of two types: system actors (the second circle in Fig 2) and context actors (outermost circle). For our case study context, the former includes farm households in analysis, agricultural labourers, tenant farmers, input dealers, extension services like Rythu Seva Kendras, KVKs, local agricultural research stations etc. Other system actors are informal institutions like the women self-help groups, and formal ones like the Farmer Producer Organisations. The context actors on the other hand include financial institutions like the cooperative banks, private banks, technology providers, farmer unions, regional and national agricultural research universities, civil society organisations and markets.

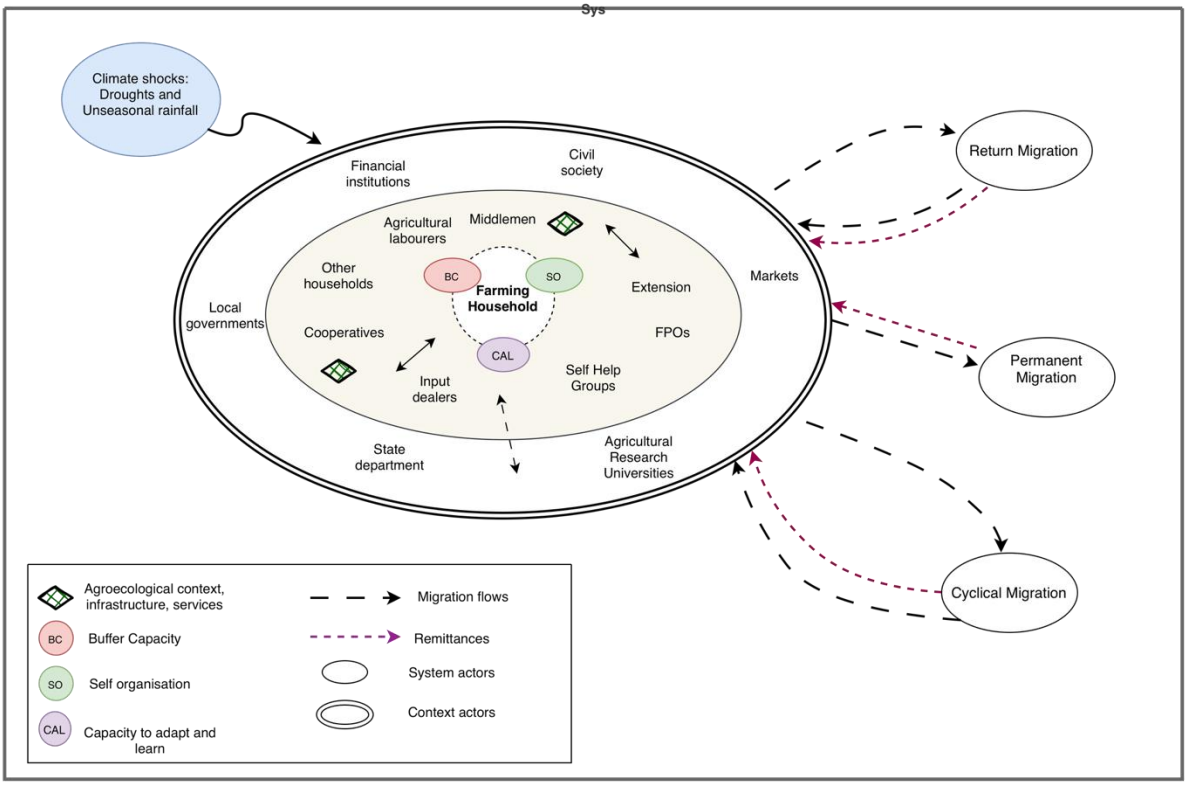



Figure 2: Framework for household resilience in a farming

## 3.3 Resilience capacities and attributes

Defining the specific resilience capacities of a household has gained much attention in resilience literature. Each capacity pertains to a different aspect of resilience. Multiple farming system characteristics and functionalities contribute to building one or more of the three resilience capacities. Each capacity has

attributes that are essentially 'individual and collective competencies' as well as enabling conditions in the farming system context. (Cabell & Oelofse, 2012; Meuwissen et al., 2019). The detailed operationalisation of each capacity is given in Table 1.

**Buffer capacity**: It is a farming system's capacity to withstand sudden disturbances as well as long-term stresses through coping mechanisms. Many scholars also refer to it as the robustness of a system to absorb a certain perturbation without change in its structure and function (Meuwissen et al., 2019). Within farming systems, this can be done through temporary reallocation of resources, mobilising financial and other resources, sale or mortgage of assets and so on. Essentially, it provides the capability to a farming system to deal with short term disturbances or buffer through initial phases of large shocks (Darnhofer, 2014). The main attributes associated with buffer capacity are *functional and response diversity, and livelihood capitals* (Jacobi et al., 2018). *Livelihood capitals* refer to various tangible and intangible assets that provide the resource base to deal with shocks and stresses. We consider four types- *human capital, natural capital, physical capital* and *financial capital*. Human capital captures the household size, family involvement in agricultural production, level of education of the head of household, and whether anyone has a special skill or training. Indicators like ownership of land, access to irrigation, availability of water and so on are used to measure natural capital. Physical capital refers to assets owned by the household, access to machinery and inputs, and access to basic services. Financial capital of a household is captured by access to credit, remittances, bank services and so on. *Functional diversity* refers to the diversity of the type of elements within the farming system and the services they provide. For instance, crop diversity and diversity of farming practices. Essentially farming systems that depend only on one or a narrow range of resources are less able to cope with change. Hence, input-intensive monocultures are more vulnerable than farming systems with high biodiversity (Altieri & Nicholls, 2017; Bahadur et al., 2013). *Response diversity* on the other hand, refers to the diversity of response options in the face of change - such as diverse sources of income from the farm (integrated farming, agroforestry and so on), off-farm livelihoods, diverse sources of credit and other support systems (Cabell & Oelofse, 2012).

**Self-Organisation**: This largely refers to the ability of multiple stakeholders within the farming system to organise into *informal local and regional networks* such as small institutions of governance based on their needs and desires. Studies have shown that collective action as well as consolidation and extension of local social networks in traditional rural societies has increased the resilience of agroecosystems to external stresses (Altieri & Nicholls, 2017; Cabell & Oelofse, 2012). Moreover, *decentralised organisational structures* and multi-layered institutions better address the context and needs of local communities if they have the necessary resources and knowledge to function properly (Bahadur et al., 2013). Another dimension is having a *large number of connections* within and between systems, that increases resilience. In fact, having a large number of weak connections in an agro-ecosystem ensures that no single element is indispensable to overall system performance. Examples of this type of connectedness are farmers collaborating with more than one supplier or outlets, having a large labour pool with diverse set of skills, having wide social networks and flexible laws (Cabell & Oelofse, 2012). Lastly, self-organisation is also associated with reliance of system processes on *local* as opposed to *external resources* (Jacobi et al., 2018). This essentially favours a localised food economy based on locally accessed inputs, local marketing of produce and household consumption of the cultivated items.

**Capacity to learn and adapt**: This last capacity is associated with the dynamic aspect of resilience 'the learning aspect of a system behaviour in response to a disturbance' (Jacobi et al., 2018). This capacity is primarily dependent on local adaptability which can be attributed to *the presence of local traditional knowledge, perception of the threat of climate change to agriculture, shared learning from the past as well as uptake of latest knowledge*. To deal with problems like climate change, scholars have emphasised that different forms of knowledge need to complement eachother in an ongoing process of social and institutional learning (Altieri & Nicholls, 2017; Bahadur et al., 2013; Berkes et al., 2008). Furthermore, it has been observed that local level and community-based institutions are more efficient in learning and responding to environmental feedback. Eventually, the presence of mechanisms within a farming system to learn from past experiences and share and co-produce knowledge will enhance its capacity to adapt and transform (Cabell & Oelofse, 2012; Davidson-Hunt & Berkes, 2003). Similarly, the legacy of a farming system is important to its transformative capacity and comprises its

social, institutional, and cultural memory. It can be in the form of traditions, indigenous knowledge or institutions. For instance, research has shown that many traditional resource management practices like the tank system in South India were both resilient and sustainable (Green et al., 2020). Hence, maintaining these legacies through cultural engagement and transmission is crucial to building resilience in agro-ecosystems (Cabell & Oelofse, 2012).

As mentioned in Table 1, a quantitative index was constructed to measure each resilience capacity and its dimensions. Both the dimensions and indicators were identified after an in-depth literature review and context-relevant adjustments were made after a scoping visit and a pilot survey in the field.

**Table 1: Operationalisation of Resilience Capacities**

| Variable | How it is measured | Dimension | Indicators |
|---|---|---|---|
| Buffer Capacity | Index | Functional and Response Diversity | Flexibility with respect to labor resources<br>Heterogeneity of the landscape<br>Diversity of inputs<br>Diversity of income sources<br>Access to insurance |
| | | Livelihood Capitals | Human capital, Natural capital, Financial Capital, Physical Capital |
| Self-Organisation | Index | Decentralisation and Independence | Selling and buying inputs locally<br>Direct trade relations<br>Participation in informal institutions |
| | | Local consumption of production | Proportion of produce kept for household consumption |
| | | Appropriately connected | Having multiple suppliers<br>Collaboration between farmers |

| | | | |
|---|---|---|---|
| | | | |
| | | Ecological self-regulation | Planting native species<br>Recycling crop residues<br>Soil biological health |
| Capacity to adapt and learn | Index | Knowledge of threats and opportunities | Perception of climate change and its impact on cultivation<br>Access and avail of extension service |
| | | Reflexive and shared learning | Adaptive measures for drought management<br>Mode of knowledge creation and dissemination |
| | | Honoring legacies | Using traditional knowledge |

### 3.4 Migration

Within agriculture, migration is an important livelihood strategy to manage income shocks, and it can be either voluntary or involuntary, short term, circular or permanent. As mentioned in Section 2.1, the drivers of migration are multiple, and climate change tends to exacerbate them in complex ways. Deshingkar (2012) has shown that climate-stresses on agriculture through slow impacts could increase the reliance of poorer households on migration as an adaptation strategy. In a separate study, crop-wise analysis showed that a 1% decline in rice yield due to weather variation contributed to a 2% rise in the out-migration from the state (Kavi Kumar & Viswanathan, 2013). For states like Maharashtra, Andhra Pradesh, and Orissa, villages in the dry areas have shown high out-migration rates (Basu & Shaw, 2014) and sudden climate extremes like droughts have caused more members of the poorer families to migrate for longer durations of time.
Depending on the context, such migration can lead to a wide variety of outcomes that range from increasing vulnerability in some cases, to building adaptive capacities in others (Bhatta et al., 2017; Debnath & Nayak, 2022; Gautam, 2017; Mutabazi et al., 2015; Pagnani et al., 2021; Scoones, 1998). Often, these temporary migrants end up living in overcrowded, informal settlements of big cities that lack

basic standards of living. This not only increases their socio-economic vulnerability but also their vulnerability to climate threats, since many of these settlements are susceptible to flood-risks, human-induced water scarcity and urban heat island effect (Michael, Deshpande, & Ziervogel, 2019). Hence, migration can act as a dangerous 'vulnerability trap'[2] when it reinforces the structural vulnerabilities that led to migration in the first place, or when it creates new vulnerabilities (Singh & Basu, 2020). Even in the cases where remittances from migration help in paying off debts and result in upward social mobility, there may still be gendered outcomes at the intra-household level. Therefore, our lens of looking at migration has to be cognizant of these intersectionalities.

For our study, we focus on this distress migration which is seasonal in nature. It can be both rural-rural or rural-urban. We only document the 'aspirational economic migration' and 'return migration,' which refers to the return of entire households who had permanently out-migrated in the past.

[2] This term, derived from the notion of a 'poverty trap' refers to a situation when households' coping strategies to overcome certain vulnerabilities end up reinforcing them which causes the households to get stuck in a vicious vulnerability-coping cycle.

# 04

# Case Study Context

# 4 Case Study Context

This case study has sought to understand the impacts of slow onset climate change, specifically droughts and unseasonal rainfall, on farmer migration from the Rayalaseema region of Andhra Pradesh in the context of an agroecological transition- the Andhra Pradesh Community Managed Natural Farming (APCNF). Before discussing the case study design and methods we will try to understand the agricultural landscape in Andhra Pradesh. We will then look at the state modernisation project over the years to contextualise the APCNF initiative, followed by an introduction to the geographic, climatic and socio-political and agricultural context of the Rayalaseema region.

## 4.1 Agriculture in Andhra Pradesh: a historical overview

Andhra Pradesh, popularly known as the 'rice bowl of India', is a predominantly agrarian state with 63% of the population dependent on agriculture for their livelihood. However, the contribution of this sector to the state's gross domestic production is only 17% (Rao, 2021). The state grows a wide variety of crops including paddy, jowar, maize, bajra, finger millet (ragi), groundnut, pulses, fruit, vegetables, oilseed, and other commercial crops (Sandhu et al., 2023). Since the 1990s, agriculture in Andhra Pradesh has been characterised as being in an '*advanced state of crisis*' due to multiple contemporary factors (Ramachandran et al., 2010).

The crisis is said to have started in the 1980s, when the state government heavily subsidised groundnut cultivation to achieve oil self-sufficiency under the Green Revolution-based model. This incentivised most farmers to switch to cultivating this monoculture. In the dry area of Rayalaseema with its lack of surface water for irrigation, this translated into the proliferation of tubewells for extraction of groundwater (Ramachandran et al., 2010). By the 1990s the initial gains from the Green Revolution had dissipated, bringing to light the increasing costs of cultivation and severe depletion of natural resources (M. Reddy, 2015). In Rayalaseema, as in several other regions, the loans required for installing tubewells became a primary cause for indebtedness among small and marginal peasants (Ramachandran et al., 2010). In a state where around 85% of the farmers

are small and marginal, this resulted in waves of distress outmigration, a situation that worsened in years of climate shocks such as droughts (Krishnan et al., 2023).

In addition, neoliberal policies were introduced in agriculture by the 1990s. This led to the withdrawal of the institutional support infrastructure and a reduction in public investment in the agriculture sector. Moreover, there was a significant stagnation and decline in the growth rate of agricultural output from 1990 onwards (Ramachandran et al., 2010). Rayalaseema was a region with the sharpest decline in this growth rate alongside Telangana, and this disproportionately affected the small and marginal farmers, the tenant farmers, and landless labourers. An unfortunate consequence of the precarity of the sector during those times was the increase in the number of farmer suicides. 931 farmer suicides were reported in the Rayalaseema region between 1998 and 2006.

Such policy shifts in the agricultural sector need to be contextualised within the broader development trajectory of the state.

### 4.2 The Andhra Pradesh modernisation project

The development vision of the state of Andhra Pradesh, since its founding in 1956, has evolved sporadically, concomitant with the changing political priorities of those in power. We shall look at this history in phases, marked by tipping points or departures from the mainstream narrative.

For most of Andhra Pradesh's history, the state policy has been driven by clientelistic politics. One of the first instances of this, despite the efforts of the then Chief Minister P.V. Narasimha Rao, was the failure of the much-needed *land reforms in the 1970s*. It was largely attributed to a lack of political will in the overwhelmingly upper caste senior Congress party leadership, and the political power wielded by the landed elites (Mukherji et al., 2018). *Post 1983, the era of welfare politics* began under the aegis of the new *Telugu Desam Party* (TDP) government led by N.T. Rama Rao. He deflected the focus from the structural issue of land reform to championing the immediate needs of the poor, like subsidising food and clothing (Mukherji et al., 2018). This was, however, driven by electoral logic. The rice subsidy of Rs.2 per kilogram became a widely successful populist measure that was seen as a gesture of generosity of the ruling party

towards the rural poor. Additionally, the growth in agricultural output in 1982-83 and the following drought in 1984-87 were also the enabling factors in the implementation of this food policy. (Olsen, 198). However, just like its predecessor, despite the 'welfare' narrative, the TDP regime's policies resulted in further marginalisation of the rural poor whom they had claimed to represent. For instance, they brutally suppressed workers' movements for minimum wages and for land reforms, which were desperately needed in the agricultural sector (Mooij & Overseas Development Institute, 2002).

Furthermore, these redistributive measures created financial obligations for the state, resulting in cumbersome budget deficits. This phase of fiscal profligacy would give way to the *fiscal conservatism* of the 1990s (Mukherji et al., 2018). The so-called 'welfare state' regime was soon replaced by 'facilitative state' and 'corporate capture' as structural adjustment programmes and market-based reforms paved the way for privatisation of agriculture, leading to a multitude of agrarian crises (Ramdas & Pimbert, 2024). In this era of fiscal prudence, the idea of promoting 'a business-friendly environment' and empowerment using limited resources is championed by leaders like Chandrababu Naidu (Mukherji et al., 2018). An example of policy development from this phase are the Self-Help Groups (SHGs), which began as small-scale thrift and credit groups but got institutionalised in 2000 as the Society for Elimination of Rural Poverty (SERP) with the help of UNDP and the World Bank. They were promoted as agents of social change that would foster empowerment among women, especially those from poor households (Mukherji et al., 2018). These SHGs followed a federated structure and eventually took on roles additional to thrift and credit like marketing of agricultural products, procurement of livestock through SHG-bank linkages for developing the dairy sector, disbursement of pensions and non-pesticide management (NPM) in agriculture (Ramesh, 2007). Thus, dominated by fiscal concerns, the state's prerogative shifted from subsidising food to subsidising credit through these microfinance institutions (Mukherji et al., 2018). These SHGs would eventually become the cornerstone of the implementation of the APNCF experiment in 2016.

The next major shift in this development trajectory came in *2004-05*, when the Congress Party came back into power with Yeduguri Sandinti Rajasekhara Reddy (YSR) as the CM. Driven by electoral concerns as well as the growing rural distress,

implementation of *the right to work* through the *MGNREGS* in 2005 became a key non-market intervention towards poverty alleviation (Mukherji et al., 2018). With the right political support and infrastructure capacity as enablers, this policy became a game changer for the rural Andhra landscape in terms of reducing poverty. Naturally, it also led to the re-election of the Congress party in 2009.

In the realm of agriculture, the period from 2003-13 saw post Green Revolution development of new technologies like Bt cotton and improvement in irrigation infrastructure. Between 1965 and 2012, the gross irrigated area as a percentage of gross cropped area increased from 37% to 47%. There was also a shift in the source of irrigation from canals and tanks towards wells, even more so in the water scarce Rayalaseema region (A. A. Reddy et al., 2020). These developments would eventually lead to groundwater overexploitation and further marginalisation of the most vulnerable. It was during this period that the initial waves of distress outmigration began.

The *bifurcation of Andhra Pradesh and creation of Telangana in 2014* was the next big watershed moment. TDP came back into power, andthe new AP CM, Mr. Chandrababu Naidu, projected his 'Vision 2029' (Sunrise Andhra Pradesh) that would carry forward his capitalist macro-economic policies from 20 years ago. This vision aimed to make AP a leading global investment destination to fast-track economic growth (Ramdas & Pimbert, 2024). For agriculture, the focus was to reduce the share of employment in it from 55% in 2014–15 to 40% by 2029 and integration of domestic production with global agri-business value chains (Ramdas & Pimbert, 2024). The institutional and research and extension infrastructure in agriculture continued to promote crop diversification towards high yielding varieties and high value cash crops like cotton, maize, palm oil, horticulture (A. A. Reddy et al., 2020). By then, water availability had become a major concern for drought prone regions like Rayalaseema, so the government promoted micro irrigation technologies and watershed development alongside the ongoing irrigation projects.

During the period 2000-14, resource-poor farmers had fallen into a vicious cycle of deepening their wells, which was capital intensive and plunged them further into debt traps (A. A. Reddy et al., 2020). The increasing indebtedness among farmers had led to promises of loan waivers during the 2014 election.

Simultaneously, concerns over the acute vulnerability of agriculture to climate variability and growing discontent with the chemical intensive Green Revolution model had created a space for alternative approaches. It was in this context that in 2016, the mission to promote Natural Farming emerged. Its trajectory, however, took an independent path in 2019, as the Department of Agriculture was divided to create a separate department for natural farming under the administration of the new CM Jagan Mohan Reddy. This bifurcation still exists with the mainstream agriculture department, continuing their activities and original mandate independent of the natural farming programme (Thallam & Patel, 2025).

In 2019, the administration under Jagan as the CM focused on a welfare agenda for the poor and minorities through various Direct Benefit Transfer (DBT) and non-DBT schemes. He changed the development paradigm from material to human development by rolling back many of the previous government's infrastructure and renewable energy investment plans (Shepherd 2024). He redirected substantial funds towards government school education, agrarian measures like Rythu Bharosa Kendras for making inputs and extension accessible to farmers and health and housing reforms at the village level (Times of India 2024). However, delay in completion of large projects (Polavaram), anti-incumbency, and the rise of a powerful BJP-TDP alliance cost him the next election (Swarajya 2024).

With the 2024 elections, a new government came to power under TDP. At present, Chandrababu Naidu's vision for Andhra Pradesh is: Swarna Andhra by 2047. Once again, his primary focus is on industrial and agricultural growth and 'technology driven governance'. This vision emphasises job creation, attracting foreign investments, establishing innovation hubs, bolstering the food processing industry and investment in IT (Times of India 2024). For Rayalaseema region, the present government's commitment to development and modernisation has been limited to two things: finishing pending irrigation projects to make the region green and promoting horticulture as the primary economic driver. These plans, however, do not take into account the agroecology of the Rayalaseema region. Past experiences have shown the limited potential of surface irrigation as it is capital and energy intensive. Moreover, horticulture crops are extremely input intensive and require market linkages. A systematic approach to rejuvenate the ecology of the region should be the priority.

This is only a broad overview of how the development story of Andhra Pradesh has evolved in close association with the political and ideological priorities of each government. The development has largely been uneven between the more affluent coastal Andhra Pradesh and the backward Rayalaseema region. It has also been disproportionate in terms of the population groups that have benefitted. We shall explore these two nuances in the context of our case study region. The disproportionate injustices experienced by the vulnerable in the Rayalaseema region as compared to the rest of Andhra Pradesh are a result of a combination of factors: the uneven economic development of Rayalaseema; a history of factionalism and caste injustices to name a few. We discuss them in detail in Section 4.4.

## 4.3 Rayalaseema region in Andhra Pradesh: geographic, climatic, socio-economic and agricultural contexts

Located in south and south-western part of Andhra Pradesh, the Rayalaseema region spans an area of 67,298 sq. km and borders the state of Karnataka to the west, Telangana to the north and Tamil Nadu to the South (Chendrayudu & Chandrasekarayya, 2020). Previously comprising four districts (prior to reorganisation in 2022): Anantapur, Kurnool, Chittoor and Kadapa, Rayalaseema is the most backward region in Andhra Pradesh. The major contributing factors have been its geographical location in the rain-shadow region and lack of natural resources. The average rainfall for this region ranges between 300 mm to 700mm which is extremely low when compared to coastal Andhra Pradesh (more than 1000 mm) (Pragathi & Anitha, 2019). There are few water bodies or perennial rivers that have water all year round (Salmi, 2023). Consequently, groundwater has been the primary source of agricultural and municipal water supply in the region, leading to its massive overexploitation. Studies conducted for the district of Anantapur have shown that more than half of the borewells in the district had falling water levels and out of the 63 mandals (blocks), 19 had groundwater utilisation of more than 100% (Dash et al., 2021). Similarly in Kurnool, a recent study highlighted that up to 95% of the drilled wells do not yield any water anymore (Salmi, 2023).

Figure 3: Farm Field

The climate of the Rayalaseema region is largely semi-arid with Anantapur and Kurnool falling in the scarce rainfall agroclimatic zone. The mean maximum temperature in the region ranges from 30-40°C from December to May and the region overall gets only 300-500mm of rainfall during the south-west monsoon season (SAPCC, 2016). A significant portion of its annual rainfall (30-60%) occurs during the northeast monsoon season. Due to its geographic location, Rayalaseema has been consistently drought prone. In fact, Andhra Pradesh is one of the three states in India with the largest drought prone area (Makino, 2019). Meteorological studies of past seasonal rainfall trends have shown that since the 1980s, the region has been experiencing periodic droughts and erratic rainfall (Salmi 2023). Figure 4 shows the observed drought affected years between 1980-2020. The information has been sourced from the State of Agriculture report for Andhra Pradesh, and a preliminary analysis of state government notifications from 2015-2025 (Chithra & Hareesh, 2025). Even in 2023, the state government declared 28 mandals in Anantapur and 24 mandals in Kurnool as severely drought hit (Hoskote, 2023).

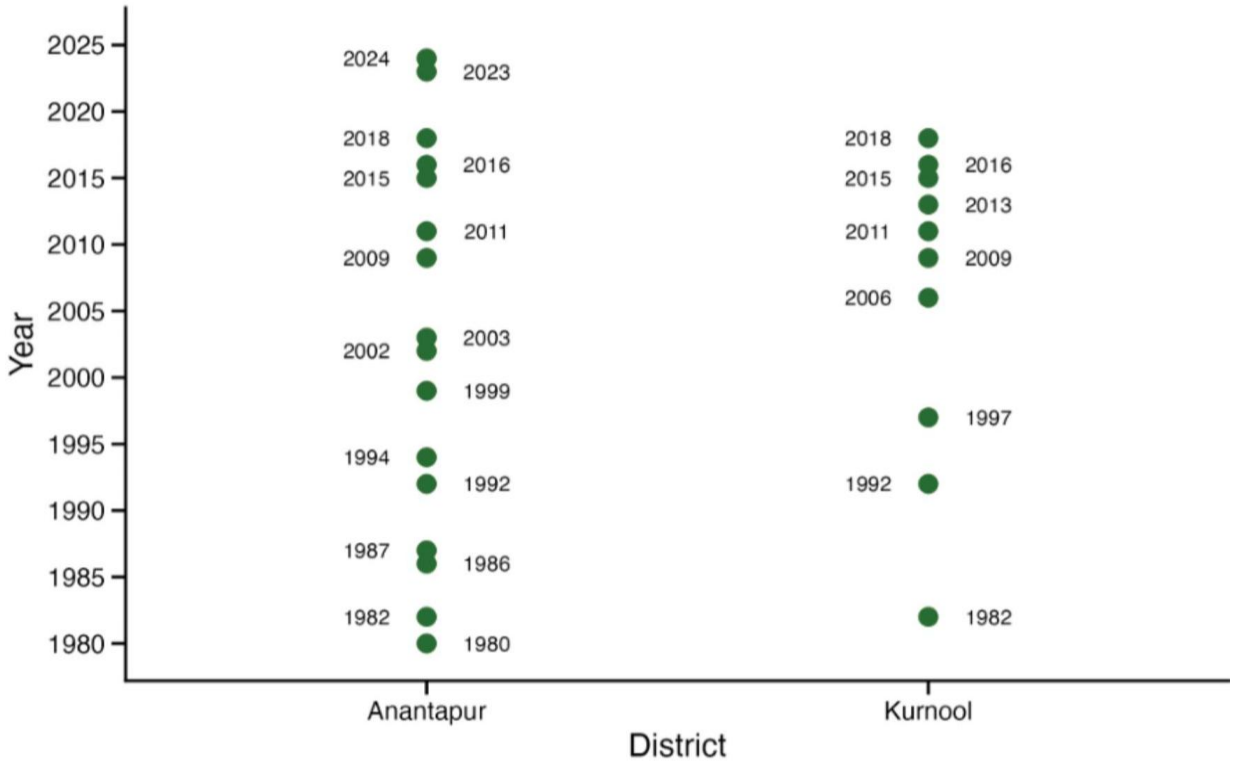



Figure 4: Timeline of Drought Affected Years (1980-2025)

While rainfall is projected to decrease in future, its distribution and erratic pattern are bigger causes for concern (SAPCC 2012). A study by CStep on Andhra Pradesh district-wise climate projections shows that heavy rainfall events are projected to increase for all Andhra Pradesh districts, and the rainfall-deficient years are projected to decrease during 2021-2050 for both Representative Concentration Pathways (RCP) 4.5 and 8.5, as compared to the historical period (1990-2019) (CSTEP, 2022). On the other hand, an assessment of meteorological drought in Andhra Pradesh under future climate scenarios shows that, the severity and number of the most severe droughts will increase manifold during 2021-2100 under RCP 4.5 and 8.5 scenarios as compared to the historical period 1980-2015 (Chithra & Hareesh, 2025).

Studies on district-wise vulnerability assessment have always ranked Anantapur and Kurnool among the highest in terms of their exposure and sensitivity and lowest in terms of adaptive capacity to climate change impacts (Rama Rao et al., 2017).

These slow onset climate change impacts severely affect ecosystem-based livelihoods like agriculture, which is the main occupation of the population of this

region. Historical analyses have shown that periodic droughts and erratic rainfall have resulted in massive crop losses for farmers. In fact, an assessment of the Anantapur district by NABARD has indicated recurring droughts have caused crop production to be successful only once every four to five years. This situation has only been made worse by overexploitation of the already limited groundwater resources plunging the cultivators into indebtedness (Salmi, 2023). Lastly, temperature fluctuations and heatwaves can also severely impact agricultural productivity.

For the Rayalaseema region, 74.2% of its cultivated area is under dryland agriculture with Anantapur and Kurnool districts being the topmost (Pragathi & Anitha, 2019). Moreover, 65% of this net sown area is rainfed and only 20% of the total cultivated area is irrigated (MN, 2020). Hence, agriculture is highly vulnerable to climate change impacts due to dependence on monsoons as also indicated earlier. According to the 2011 Census of India, 70.5% of the population in Andhra Pradesh resides in rural areas. The literacy rate for the state (67.35%) is lower than all India literacy rate (72.98%) (NABARD, 2023). According to the 2023 state socio-economic survey, 48.4% of the AP population is in the labour force with it being higher in rural areas at 51.6% as compared to urban areas at 41.9%. As far as poverty is concerned, the poverty ratio for the year 2011-12 was at 9.20% (Planning Department, 2023).

When it comes to the predominant livelihood, i.e. agriculture, the average size of landholdings has declined since the last census from 1.06 ha in 2010-11 to 0.94 ha in 2015-16 while the overall number of holdings has increased. Additionally, more than 88 percent of these landholdings are held by small and marginal farmers (Planning Department, 2023). Consequently, the price support mechanisms and the technological innovations of the 1980s, there was a major push towards the cultivation of oilseeds and pulses in Rayalaseema (A. A. Reddy, 2010). Compared to the rest of Andhra Pradesh, this region has been lagging over the past few decades on all aspects of agrarian economy: gross cropped area, net irrigated area, farm mechanisation, access to technologies and credit (A. A. Reddy, 2010). This is primarily a result of the region's lower resource endowment and other socio-political factors that we discuss in the next section.

## 4.4 A socio-political history of Rayalaseema

The story of Rayalaseema's uneven economic development is rooted in its socio-political history. The demand for Rayalaseema to be at par with coastal Andhra can be traced back to the Sri Bagh pact on 16th November 1937 during the movement for a separate Andhra. On this day, political representatives of the two regions came together to address the developmental issues of Rayalaseema. A plan for decentralised development was laid out, which included the setting up of universities, irrigation projects, and administrative and judicial headquarters (The New Indian Express 2022). Years later, when the state of undivided Andhra Pradesh was formed in 1956, Hyderabad became the capital and promises made during the Sri Bagh pact were eventually forgotten. Rayalaseema's industrial and agricultural development ebbed despite having its own Chief Ministers for 25 of the 55 years (The New Indian Express 2022) Telangana also bore the cost of the highly uneven and growing political and economic power of coastal Andhra till its movement for bifurcation succeeded in 2016. Even then, instead of Kurnool, Amravati in the already developed delta region was chosen as the new capital for Andhra Pradesh.

While the Telangana movement also emerged out of years of neglect and the stifling of development in that region, a similar movement for a separate Rayalaseema never really got off the ground. One possible reason could be a long history of feudalism and violence that dates to the 19th century[3]. As the Vijayanagar empire was on the verge of collapse during that period, military chieftains called Polegars emerged who exercised immense power and dominance in the villages of Rayalaseema. Even though the British managed to exterminate them, this armed factionalism continued, the remnants of which exist even today. A strong correlation is observed between the prevalence of these factions and the backwardness and poverty of the region. The so-called armies of these factional/feudal lords were peasants from lower castes, who pledged their loyalty to the respective sides. Most of the factional terror and violence in Anantapur and Kurnool districts were a result of hereditary conflicts between these feudal lords (Reddy families mostly) and with some other castes. Over the years, conflicts between 'village landlords' morphed into political rivalries as the

[3] Modus Operandi of Factionalism in Rayalaseem (Shodganga)

leaders entered politics. In fact, even today, these factionists have a chokehold over all the systems and structures of development and progress in Rayalaseema. From getting contracts for government projects to accessing welfare schemes, everything is accessible to the ones in power and to their followers.

This endemic factionalism has been built on the foundations of deeply embedded caste and patriarchal structures that form the rural fabric of this region. That is evident from the largely unchanging landholding patterns in Andhra Pradesh despite the implementation of land reforms. Even in 2003, according to the data by an NSSO survey, 37% of the total land was owned by just 3% of the households in rural Andhra Pradesh. On the other hand, 53% of all rural households only had a homestead in their name and no other land. Juxtaposed to this consolidation of land among a very small percentage of large upper caste farmers, is the increasing trend of fragmentation of landholdings in general. The average size of landholdings has declined since the last census, while the overall number of holdings has increased.

### 4.5 Migration in Rayalaseema's history

If we look at the history of mobility in the Rayalaseema region, seasonal migration during the post-monsoon season has become a crucial source of income, especially for small and marginal farmers and landless labourers (Ramachandran & Susarla, 2010). The oldest records in districts like Kurnool can trace distress migration of drought affected populations as far back as the colonial regime in the 17th and 18th centuries (Salmi, 2023). However, the recent mobility patterns emerged much later. Being resource scarce, initially the area had largely been characterised by subsistence agriculture with many farming households practicing the traditional multi-cropping system called Navdhanya, alongside livestock rearing and other allied activities. As indicated in section 4.1, the implementation of the Green Revolution model and heavy subsidies on groundnut cultivation in the 1980s marked the beginning of the era of cash crops and monoculture. With monocropping there were shorter cropping seasons, triggering farmer outmigration for supplementing income.

The initial income gains from switching to this model also began to decline with increasing costs of external inputs that were needed to compensate for ecological

depletion of the soil (M. Reddy, 2015). In a region where around 85% of the farmers were small and marginal, this translated into a high rate of indebtedness and waves of distress outmigration which would worsen in years of climate shocks like droughts (Krishnan et al., 2023). Even in no-drought years, the so called 'price droughts' due to lack of remunerative prices further impoverished these marginal farmers pushing them towards an 'occupational downward mobility' from 'wage employing farmers to wage seeking labour' (M. Reddy, 2015). Over time, well established migration corridors have emerged. In Kurnool for instance, the post monsoon season witnesses multiple 'drought trains' that transport these marginal farmers and labourers to cities like Guntur, Tirupati or even other states like Karnataka, Kerala and Maharashtra (Krishnan et al., 2023). In many cases, households also engage in temporary migration of some of their members to the Gulf countries like Kuwait, Qatar and Dubai to work as agricultral labour, shepherds, drivers and so on. (Pragathi & Anitha, 2019).

# 05

# The Andhra Pradesh Community Managed Natural Farming

# 5 The Andhra Pradesh community managed natural farming

Earlier known as the Zero Budget Natural Farming, it was launched by the state government in 2016 as a more sustainable alternative to the input intensive capitalist agriculture. As mentioned in the concept note of Rythu Sadhikara Samstha (RySS), the public company responsible for implementation of this intervention, APCNF is oriented towards dealing with growing farmer distress, consumer food and health crisis, natural resource degradation, global warming and climate injustice (Dorin, 2021). It has been referred to as the largest transition towards agroecology in the world (Sandhu et al., 2023).

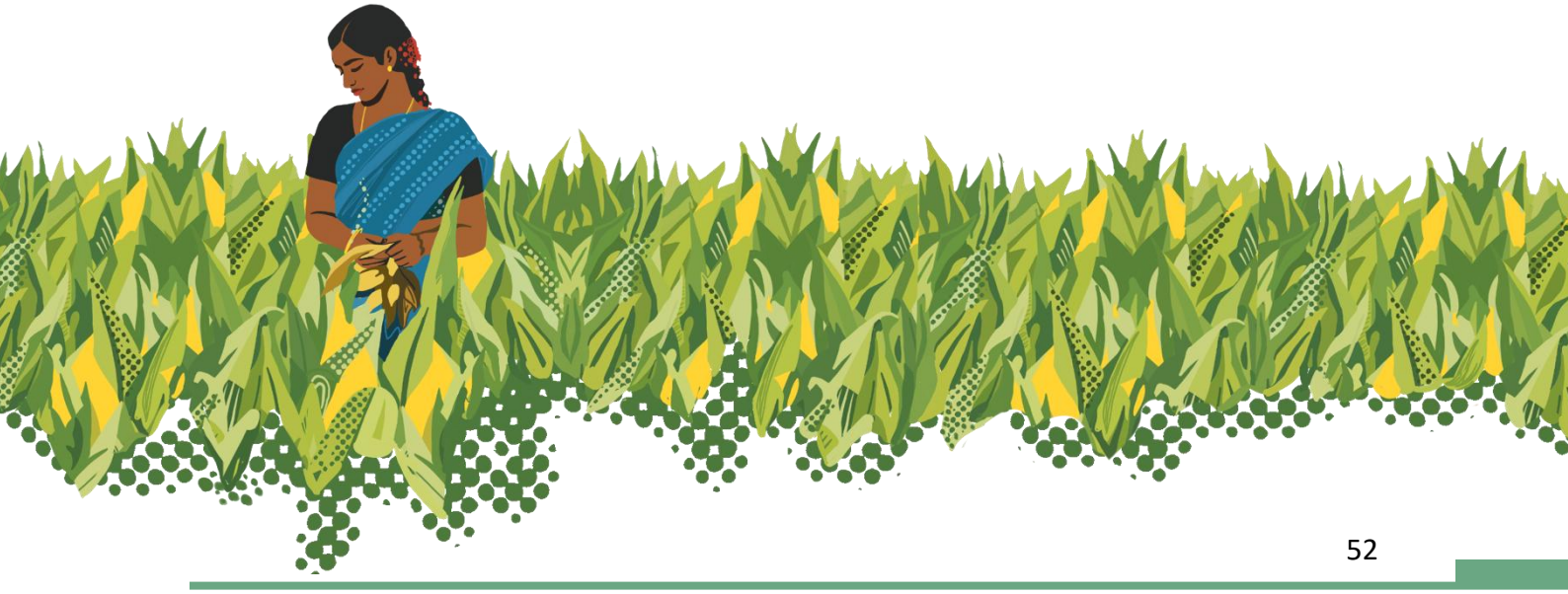
The seed of this initiative can be traced back to the 1980s when it was developed and popularised by a farmer and scientist, Subhash Palekar. It is based on four key principles of seed treatment- liquid and soil inoculants to improve fertility, mulching, and soil aeration (Bharucha et al., 2020). Additionally, it also focuses on minimal ploughing and promotes the usage of indigenous agrobiodiversity for crop production. APCNF's primary aim is to reduce the net cost of production to zero by minimising all kinds of external inputs, so that 'any cost incurred is offset by a diversified source of income' (Bharucha et al., 2020). The natural inputs promoted under APCNF are 'cow dung, cow urine, handfuls of soil, jaggery, pulses, flour, and botanicals for bio pesticides that are used for seed treatments and soil inoculations,' and can be sourced locally (Sandhu et al., 2023). Beside that, within APCNF, there is a push for diverse cropping practices like intercropping and border cropping, so that each farm has a portfolio of 15-20 crops and trees that are grown throughout the year (Sandhu et al., 2023). The interventionists call it a 'transformational technology' that seeks to provide sustainable incomes, more abundant and nutritious food, and builds climate resilience (Dorin, 2021).

The larger objective of this initiative is to train and convert all the 6 million farmers in Andhra Pradesh across 8 million hectares of land to natural farming by 2031. So far, it has been taken up by only 10.5% of the farmers (Sandhu et al., 2023). Natural farming was formally introduced in 2016, and 630,000 small scale farmers in Andhra had been partially or totally practicing it by 2020-21 (Sandhu et al., 2023). Studies have shown that a successfully adopted APCNF model resulted in higher crop yields, higher farmer incomes, and lower costs of cultivation. Even in response to climate shocks like cyclones, flooding and droughts, APCNF crops

have shown better health and resilience (Bharucha et al., 2020; Dorin, 2021). While the APCNF model was piloted in every district in Andhra Pradesh, Kurnool district has the maximum number of farmers who have taken up this farming practice (Rao, 2021).

Development of a wide-ranging and multi-layered community-based extension system was one of the necessary prerequisites for promoting APCNF. The women led Self Help Groups (SHGs) established under the Society for Elimination of Rural Poverty in 2000 are at the centre of this network. An NPM management programme launched through the SHGs in 2004 is seen as a precursor to APCNF (Thallam & Patel, 2025). The SHG federation has become instrumental in disseminating APCNF principles across farming communities within the state. The farmers too, are trained as Community Resource Persons (CRPs) to facilitate the knowledge transfer and promote stakeholder participation. Furthermore, Community Managed Seed Systems have been developed as an important organisational component of APCNF. (Bharucha et al., 2020; Dorin, 2021).

Some of the main challenges to adoption of this model have been the increased labour requirement (it is projected that 19% of additional labour will be required if the state completely switches to NF), lack of access to agricultural extension, equipment for input preparation and low availability of raw material. (Sandhu et al., 2023; Thallam & Patel, 2025).



# 06

# Methods and Empirical Approach

# 6 Methods and empirical approach

The case study has been conducted in the Anantapur and Kurnool districts within the Rayalaseema region of Andhra Pradesh. We use resilience as an explanatory tool to understand the choice of migration as a response strategy to deal with declining agricultural incomes in the context of climate change and the ongoing agricultural transition towards natural farming. This case study was designed using a mixed methods approach for data collection and analysis.

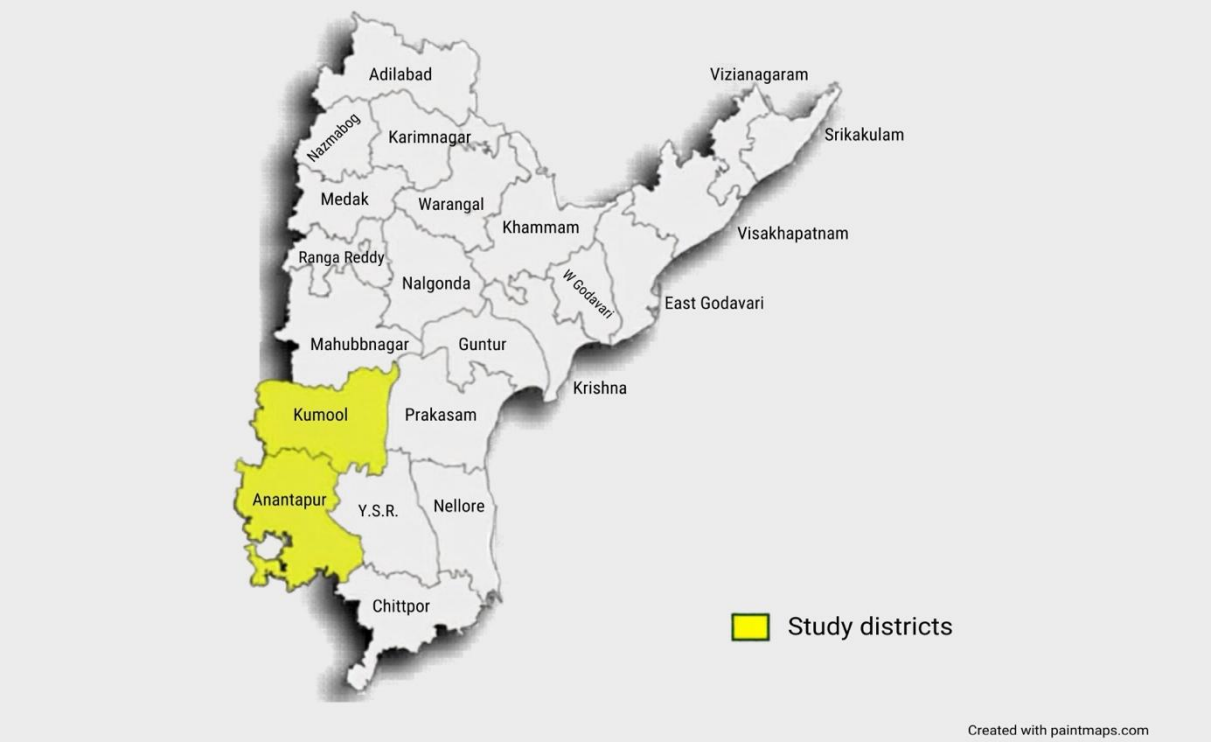



Figure 5: Study area (Map of Andhra Pradesh)

The data were collected during 2023-24 through household surveys and semi structured interviews. We surveyed 200 households (both migrant and non-migrant) across the two districts:

- Anantapur: 100 household surveys and 5 semi-structured interviews across 16 villages in 6 different mandals (Rapthadu, Kundurpi, Atmakur, Kudair, Dharmavaram, Bathalpalli, Amadagur).

- Kurnool: 100 household surveys and 5 semi-structured interviews across 16 villages in 8 mandals (Mahanandi, Orvakal, Tuggali, Peddakadubur, Peapully, Kosigi, C. Belegal, Gudur).

The sampling of the mandals in each district was purposive and involved stakeholder consultations as well as a preliminary analysis of the state government mandal-wise drought notifications from 2015-2023. The selection of villages was done based on the presence of both natural and chemical farmers. The household survey questionnaire was designed to collect data on key demographic variables, indicators of individual resilience capacities as well as information pertaining to migration- pattern, destination, remittances etc.

The 10 semi-structured interviews were conducted with members of civil society organisations, local experts on the subject and officials involved in the implementation of the APCNF experiment. We also conducted 22 in-depth interviews and 8 group interviews with migrants from Andhra Pradesh (some at the origin and some at the destination). The two places of destination that we visited were Kochi and Bangalore. The questions during these interviews revolved around the state of agriculture at the origin, the reasons behind their household's decision to migrate, the pattern of migration, perception of climate change, experiences at the destination and knowledge or adoption of natural farming.

### 6.1 Measurement of key variables:

a) Resilience and its capacities: An index was constructed for each of the resilience capacities (refer to Section 3.3 on conceptualisation and operationalisation): Buffer Capacity, Self Organisation, Capacity to Adapt and Learn. The survey responses were coded and then standardised for each of the indices, and the final household resilience score was obtained through multiplicative aggregation.
b) Type of Farming: Based on the level of adoption of natural farming, a categorical variable with three main levels has been created: Chemical, Mixed and Natural.
c) Type of Migration: Here the type of migration is defined in terms of its temporality. Our data collection revealed three main categories of migrants:

- Permanent: Here permanent migration refers to aspirational economic migration of certain members of the household and is mostly rural-urban in nature.
- Seasonal: This type of migration refers to a seasonal or circular pattern of movement of household members between the origin and destination usually during the dry season and can be rural-rural or rural urban.
- Return: This category of migration refers to entire households that permanently migrated to an urban destination in the past but eventually returned to the origin after a couple of years due to various push-pull factors.

d) Occurrence of Seasonal Migration: A binary variable to capture whether any member of the household engages in or has engaged in the past in seasonal migration.

The quantitative analysis involved descriptive and inferential statistics. For the qualitative analysis, the transcripts and open-ended survey responses were coded using NVivo software to develop relevant themes.

# 07

# Findings

# 7 Findings

This section is organised into four sub-sections. We first describe the observed agriculture system characteristics for each district in our study. Then, we move on to a discussion on the drivers of migration before delving into the first research question. Here, we investigate the relationship between household resilience and the decision to migrate by employing our resilience framework to understand which households migrate within and across each farming system and what drives them. Next, we deal with the section research question on the impact of structural vulnerabilities on migration as a phenomenon. At the end, we bring the discussion to a close by reflecting on the migration experience and the continuum of outcomes it leads to as well as the policy implications of the study.

## 7.1 Agriculture in Anantapur and Kurnool: chemical vs natural farming

As mentioned in the previous sections, Anantapur and Kurnool are considered to be the most backward districts in Andhra Pradesh (Thallam & Patel, 2025). Agriculture in these districts is largely rainfed and follows the conventional input intensive chemical-based model. There are, however, differences in the type of crops cultivated within and between the districts based on geography and access to resources. In Anantapur, there is an acute scarcity of water with the groundwater table sometimes going as deep as 1000ft (~300 m) in the mandals of Amadagur and Kudair. Main cash crops grown by chemical farmers in this district are groundnut, tomato, chili and castor. Most of these farmers practice monocultures, growing only one crop per season. Kurnool on the other hand, has better access to surface irrigation through lift irrigation projects (mainly the KC Canal and Telugu Ganga) or Tungabhadra River water supply. Still, Peapully, Tuggali and Kosigi mandals were relatively more water scarce with the groundwater table depth ranging from 700-1000ft (200-300m). Main crops grown by chemical farmers in this district are tobacco, cotton and chilli. Throughout our study, the small and marginal farmers, especially those that do rainfed farming, reported experiencing losses from agriculture almost every year due to droughts, changing rainfall patterns, water scarcity and fluctuating market prices.

Farmers practicing natural farming in either district have a more diversified portfolio of crops that include pulses, vegetables and horticulture crops. While

most natural farmers were 'mixed' as they also used chemical inputs, the ones practicing 100 percent natural farming reported a significant reduction in investments and improvement in soil fertility. The increase in yields, however, has been slow and marginal as compared to chemical farming. In both the districts, villages in mandals with more water scarcity had high rates of seasonal outmigration of small and marginal farmers and landless labourers. This is not surprising, as research done in Indian and West African contexts has also shown that sedentary households in areas vulnerable to periodic droughts engage in different migration strategies during dry seasons to manage their household well-being (Kothari, 2002; McLeman, 2014; Upadhyay & Mohan, 2017). But whether these strategies are resilient or maladaptive, and who migrates, and why are the questions that we need to explore.

*Figure 7. A group of women doing weeing while a man sprays chemicals. in the background (Kaluchatla, Kurnool)*

*Figure 6. Kashayam (An input for natural farming using leaves from medicinal plants*

## 7.2 Drivers of migration

The complex relationship between migration and slow-onset climate change events such as droughts and unseasonal rainfall in rural areas, is mediated by multiple variables (Deshingkar, 2012; Leighton, 2011). In literature, the evidence of the impact of droughts on the decision to migrate is conflicting and is based on the type of migration and context-specific vulnerabilities. Empirical studies from across the world have established that droughts lead to an increase in seasonal, rural to rural, interstate migration (Dallmann & Millock, 2017; Piguet et al., 2011).

The frequency and magnitude of these climate shocks can affect the preexisting social, economic, political drivers in the agricultural system - crop yields, livestock, agricultural income, availability of labour, water stress and state policy.

In our in-depth interviews with seasonal migrants, **five** key factors were identified as the drivers behind their household's decision to engage in seasonal migration: *declining agricultural livelihoods, search for better employment opportunities, changing rainfall patterns, increasing indebtedness and education and marriage of the younger generations*. As can be seen in Figure 5 (a heatmap generated in NVivo), the maximum coding references are for declining agricultural livelihoods as the primary driver behind the decision to migrate. Declining water availability for cultivation is one of the biggest challenges to agricultural livelihoods in the region. This unfortunate reality is the result of decades of overexploitation of groundwater resources. Besides that, increasing investments in agriculture and decreasing profits have made agriculture unfeasible for most households. In extreme cases, households have left farming altogether because of its non-remunerative nature. A quote from one of the migrants we interviewed accurately depicts these challenges *(a 55-year-old, landless, male migrant from Kosigi, Kurnool):*

*'We had 2 acres of land, out of which 1 acre was rainfed and 1 acre was irrigated by a borewell. We used to cultivate paddy in the irrigated patch. 10 years ago, we had to sell 1 acre due to debts that piled up because of droughts, unseasonal rainfall and low market prices. Then, we took 8 acres of land on tenancy 3 years ago, to cultivate onion, chilli and cotton. The cost of this lease land was Rs. 1.8L. However, we got severe losses in Rabi and barely managed to get the investment back in Kharif. In order to settle this and other pending debts, we had to sell off the remaining 1acre of our land.'*

| Codes | Caste = OC (n=4) | Caste = ST (n=5) | Caste = SC (n=4) | Caste = BC (n=5) | Total (n=18) |
|---|---|---|---|---|---|
| Declining Agriculture | 4 | 11 | 10 | 9 | **34** |
| Employment | 1 | 8 | 5 | 4 | **18** |
| Changing climate patterns | 2 | 5 | 1 | 5 | **13** |
| Debts | 0 | 5 | 1 | 1 | **7** |
| Children's welfare | 1 | 0 | 1 | 0 | **2** |
| **Total** | **8** | **29** | **18** | **19** | **74** |

Figure 8: Drivers of migration (number of references by each caste group)

The second most often cited driver of seasonal migration was employment. Three main dimensions of it emerged during the individual and group interviews. First, there was a lack of local opportunities available. This was attributed to reduced farm labour requirement, as fewer people cultivate in both seasons now due to declining agriculture. Moreover, respondents pointed out that the mechanisation of agriculture has also reduced the dependence on wage labour leading to less work availability. They stressed that besides farm work, NREGS was the only other alternative. However, it could not be the primary source of income due to the 100 days limit and lack of proper implementation of this programme at the ground level. The next dimension of this driver is wage differentials. Even those who find local employment in farm work showed a preference for migrating to destinations with much higher daily wage rates. The wage rates in villages throughout the study area ranged between Rs. 400-600 per day for men and Rs 240-400 per day for women. At the destination (Kochi or Bangalore), on the other hand, seasonal migrants earn up to Rs.800-1000 per day for both men and women. Lastly, as agriculture becomes increasingly unreliable, the need for alternative livelihoods also drives seasonal migration in search of employment. Most references to this dimension were made by small and marginal farmers or landless labourers who are worst impacted by declining agricultural livelihoods in the wake of persistent droughts and unseasonal rainfall.

Next in line, changing climate and rainfall patterns were independently mentioned as drivers of seasonal migration. This is interesting especially, because much of the migration literature has observed that rarely do migrants identify climate related events as direct drivers of migration. Within our sample, the perception and knowledge of changing climate patterns and their impacts on cultivation amongst the respondents were relatively strong. In one of the group interviews, a migrant stated:

'*The primary cause for our migration is drought…because of less rainfall we do not get good yields and face losses year after year. Since 1996, steady decline in rainfall started and because of that, many people have stopped cultivating over the years,and the migration has been increasing*'.

Some of the older migrants specifically mentioned that the rains no longer conform to the 'karthi' system. It is a traditional Telugu seasonal calendar which the farmers use to plan their cultivation.

The other two drivers that emerged from the interviews were increasing indebtedness and providing for the education and marriage of children. According to the All-India Debt and Investment Survey Report that came out in 2022, rural households in Andhra Pradesh had the highest incidence of indebtedness at 63% (CSE., 2022). Therefore, indebtedness as a driver of seasonal migration is not surprising. Tales told by the migrants of debt burdens at exorbitant interest rates, were the darkest reminders of their vulnerability. One of the migrants expressed:

*'Currently, I have a debt of around ₹3-4 lakhs at 24% per annum interest rate. There's hardly a farmer without debt. Moneylenders harass us. As soon as we return from the city with money, they come and stand in front of our homes demanding repayment.'(P2)*

Our discussion of these drivers has revealed that they rarely act in isolation but are rather interdependent with climate change acting as a magnifier. For instance, changing rainfall patterns affect agricultural livelihoods which may not only increase indebtedness but also reduce the employment opportunities available locally. Moreover, different households in the same farming system might have varying levels of vulnerability that would determine their response to these drivers. A comprehensive understanding of these household vulnerabilities and capabilities will allow us to discern which households decide to migrate when impacted by these drivers and their interactions.

## 7.3 Who migrates and why ?

### The relationship between resilience and the choice of seasonal migration as a coping strategy

Our case study uses a resilience framework in which each of the resilience capacities: buffer capacity, self-organisation and the capacity to adapt and learn, can be used to measure a household's ability to deal with exogenous shocks like climate change. With seasonal migration being established as a major risk management strategy of households during times of stress, *we hypothesise that households with a lower level of resilience are more inclined to engage in seasonal migration to cope with climate shocks like droughts and unseasonal rainfall.* Furthermore, we have already established that climate shocks multiply the

preexisting drivers of migration. Hence, each of these drivers, or a combination of them, can impact one or more resilience capacities of the household which in turn, will hypothetically influence the decision to migrate.

A visual representation of the association between resilience capacities and the occurrence of seasonal migration can be seen in Figure 9. It shows that the households that do not migrate seasonally have higher resilience capacities in general than those that do. The difference is most significant (p-value: <0.001) for Self-Organisation. This relationship is further explored by conducting a *point biserial correlation* between the resilience capacities and occurrence of seasonal migration. The results are shown in Table 3. In each case, the correlation was negative and again self-organisation showed the strongest statistically significant correlation with occurrence of seasonal migration as compared to the other two capacities. Let us dig deeper into each of these associations.

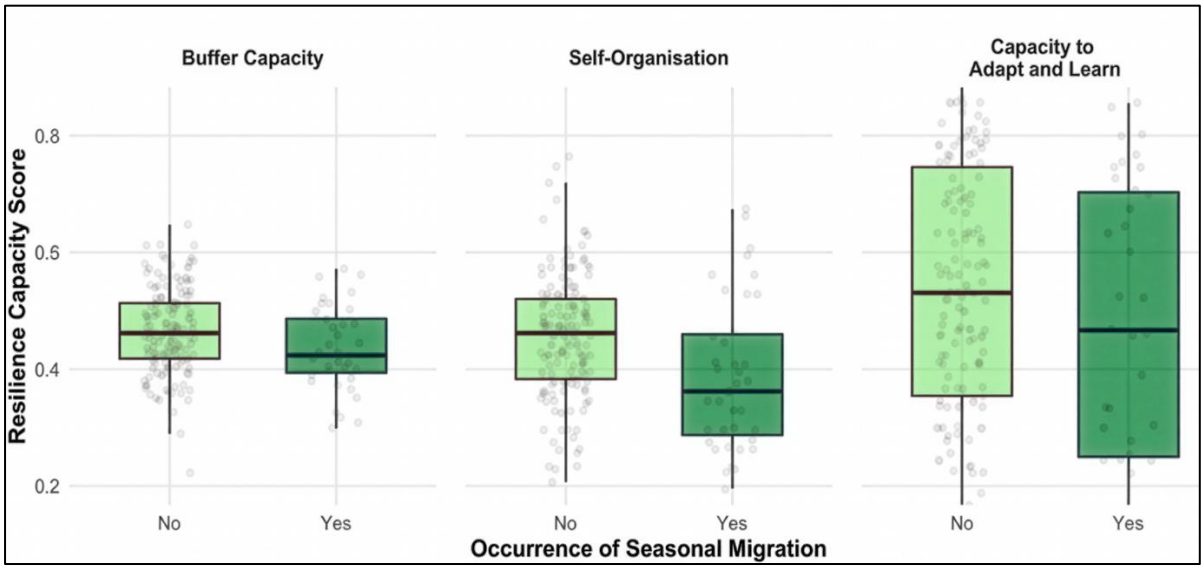



Figure 9: Boxplot of Comparison of Resilience Capacities between households based on occurrence of seasonal migration

***Buffer capacity***: It measures a household's robustness in absorbing shocks by looking at two dimensions: First, the livelihood capitals (human, natural, physical, financial) which are a combination of different household assets, and capabilities ranging from the level of education, health status, participation in agricultural production, to ownership of land and other assets. A key component of natural capital, that is access to water resources for cultivation, was pointed out as a

major factor by the interviewees in determining which households in a village migrate. One of the respondents can be quoted here:

***'Only people with borewells stay back in the village and cultivate in both seasons. We depend on rainwater (rainfed cultivation), so we must migrate if it doesn't rain' (P3).***

On another occasion, respondents from Kaluchatla, a village in the Peapully mandal of Kurnool district, mentioned that in the entire village, only 3-4 people owned borewells, so they stay and cultivate while the rest migrate during summers as there isn't even enough drinking water available. This corresponds to our resilience hypothesis since households practicing rainfed cultivation would have a lower buffer capacity than those with access to irrigation. Similarly, small and marginal households would have a lower buffer capacity simply based on land size. Not surprisingly, 69% of seasonal migrants in our sample were small and marginal farmers.

The second dimension of buffer capacity, functional and response diversity, essentially refers to having a diversity of inputs, income sources, credit sources etc. Most of the seasonal migrants interviewed, did not engage in allied activities like livestock rearing and their only source of income in the village besides agriculture, was wage labour and NREGS. As described in a previous section, lack of local employment opportunities due to declining agriculture was cited as one of the significant drivers of seasonal outmigration. In such a scenario, the impact of climate change on agriculture would further erode the buffer capacity of these households. Furthermore, it makes intuitive sense that households with lesser diversity of response mechanisms to deal with climate shocks at the origin will be more likely to depend on short-term migration to temporarily increase their buffer capacity. We further deconstruct the vulnerabilities that influence buffer capacity, when we look at caste-based differences that embed the rural social structures in Section 7.5.

**Table 2: Point Biserial Correlation of Resilience with the Occurrence of Seasonal Migration**

| Resilience Capacity | Correlation | P value | 95% CI.Lower | 95% CI.Upper |
|---|---|---|---|---|
| Buffer Capacity | -0.1718 | 0.014980000 | -0.3033 | -0.0339 |
| Self-Organisation | -0.3219 | 0.000003344 | -0.4410 | -0.1917 |
| Capacity to Adapt and Learn | -0.1657 | 0.019000000 | -0.2976 | -0.0276 |

***Self-Organization***: Key dimensions of this capacity include participation in informal institutions, direct trade relations without dependence on middlemen, local consumption of production, selling to more than one supplier etc. Amongst the three capacities, self-organization showed the strongest negative correlation with the occurrence of seasonal migration (Table 2).Its mean value is also significantly lesser for households that migrate seasonally as compared to those that don't (p-value: <0.001). A higher score for this resilience capacity means having multiple connections with other actors in local agrarian economy which create the necessary support system to deal with adverse impacts of droughts and unseasonal rainfall. Therefore, the need to resort to seasonal migration for households with a higher level of this resilience capacity would be considerably lesser (Figure 9).

For instance, throughout our sample, households with a low level of participation in informal institutions were also the ones that migrated. These institutions can be women-led Self-Help Groups or village level collectives created by civil society actors. A seasonal migrant from scheduled caste in the Peapully mandal of Kurnool district claimed that ***'my wife was removed from the village SHG since we migrate and cannot attend monthly meetings' (P4).***

In another case, the migrant family had themselves relinquished their SHG membership in the past as they couldn't afford to make monthly payments for the thrift system. It was observed that most seasonal migrants travel in groups and have their own long standing social networks that facilitate their migration

process. However, exclusion from these grassroots institutions reduces their access to the knowledge that is exchanged about new agricultural policies, practices, technologies as well as the financial support provided by them. This further erodes their resilience capacity over time causing them to continue the same mobility pattern.

The case of Anantapur district becomes interesting here. Due to its socio-economic backwardness and drought vulnerability, this district has historically been a budding ground for multiple civil society actors to emerge. At present, there exists a tight knit network of multiple NGOs like the Rural Development Trust, Rural and Environment Development Society, Timbaktu Collective and Accion Fraterna, catering to different aspects of the rural economy. These organisations have high grassroots connectivity and have played a crucial role in the upliftment and poverty alleviation of the socio-economically marginalised sections of the society. In case of RDT for instance, Sasya Mithra Groups (SMGs) comprising women have been created at the village level through which different interventions are promoted and implemented. One of our female survey respondents from Kammur village in Kudair mandal, said that ***'RDT has done a lot for the SC people in our village. They constructed schools, spread awareness about bank services, schemes. Formed groups. Women's condition has greatly improved' (P5).***

Moreover, these organisations often collaborate with each other to complement interventions, and this has resulted in households being associated with more than one NGO at the same time. In such cases, both men and women from lower caste households participate in multiple groups, which significantly strengthens their support system. Very few of such households were seen to engage in seasonal migration. Hence, participation in institutions emerged to be a major point of difference between the households that migrate seasonally and those that don't.

With respect to the connectedness of the system, even though most farmers collaborate with one another, many references were made by small and marginal, lower caste farmers to the refusal of larger farmers in the village to collaborate with them in agriculture. Herein, caste related power dynamics were seen to play a big role. These marginalised households also had a higher incidence of seasonal

migration. Therefore, it can be said that since more successful farmers do not share their knowledge and experiences with the struggling ones, the latter have a relatively lower resilience, making them more likely to migrate seasonally.

***Capacity to adapt and learn***: The key dimensions under this capacity are knowledge of threats and opportunities, honouring legacies and reflexive and shared learning. As can be seen in Table 2, capacity to adapt and learn also shows a negative correlation with the occurrence of seasonal migration just like buffer capacity and self-organisation. While in Figure 9 we see that households that engaged in seasonal migration had a lower score for this capacity than those who didn't, the relationship is only borderline significant (p-value: 0.114). This could indicate that the decision to migrate is largely influenced by the buffer capacity and self-organisation.
For this capacity, in case of the knowledge of threats, the migrants' perception of the threat of climate change to agriculture was significant and they attributed it to be a key driver behind their decision to migrate. On the contrary, some medium and large farmers (with access to irrigation) for whom agriculture was profitable claimed to not be impacted by droughts or unseasonal rainfall.

The major difference in this capacity, however, came from the ability to collectively adapt better to future threats based on past experiences with droughts. Households that engaged in modification of the sowing date of crops to align with the changing monsoon patterns and implemented soil water conservation measures like constructing farm ponds, using drip irrigation etc had a higher score for this capacity. These were predominantly non-migrant households. On the other hand, the lower capacity to adapt and learn associated with seasonal migrant households can be attributed to their limited knowledge of opportunities due lack of participation in informal institutions like SHGs or village level groups created by NGOs like RDT in Anantapur. This reduced their access to information and shared learning on drought management in agriculture. Even the accessibility and utilisation of extension services like Rythu Bharosa Kendras, and farmer field schools play a key role in building this capacity. Households that migrate, predominantly small and marginal farmers, especially those belonging to the lower castes showed a lack of awareness regarding these extension services.

## 7.4 Seasonal Migration across farming systems: a comparison of APCNF and conventional farming

So far, we have only observed associations between the household level resilience and the occurrence of seasonal migration. However, as discussed in our theoretical framework, the household resilience is also determined by its farming system context which essentially refers to all the other actors and stakeholders in the system besides the farming households, its set of institutions and the agroecological context (ecology, public infrastructure and services). Our case study uses this farming system approach to compare the APCNF transition experiment with the conventional input-intensive Green Revolution based chemical farming. It is the latter that our current agricultural public institutions and support systems serve but the APCNF experiment has also created a small ecosystem of its own by using preexisting institutional networks while also adding some specific actors and institutions. The households interviewed in our study practised either chemical, natural, or mixed farming. When we compared the resilience of households across these three systems, the following relationship was observed as shown in Figure 10.

As we can see, the overall resilience of households practicing chemical farming is lower than those doing natural farming or mixed (the five outliers in the graph were retained as they reflect atypical household resilience profiles and fall within the theoretical bounds of the resilience index (0-1)).
Within the APCNF model, diversity is one of the key principles that they focus on. This has resulted in a package of practices like the ATM model (Any time money) in which farmers are encouraged to cultivate a variety of vegetables and pulses all year round to ensure a constant stream of income. There is also the Five Layer Model for cultivating more than one horticulture crop at the same time. Thus, the level of functional diversity is high. In terms of the number of crop varieties cultivated, progressive natural farmers produce as high as 44 crop varieties in a year. At any point in time, these farmers plant 10-12 different crops on an average, on 2 acres of land. The main crops are either cotton (mostly Kurnool) or groundnut (Anantapur) planted with border crops such as maize, jowar, bajra, and intercrops such as pulses, vegetables, and millets.

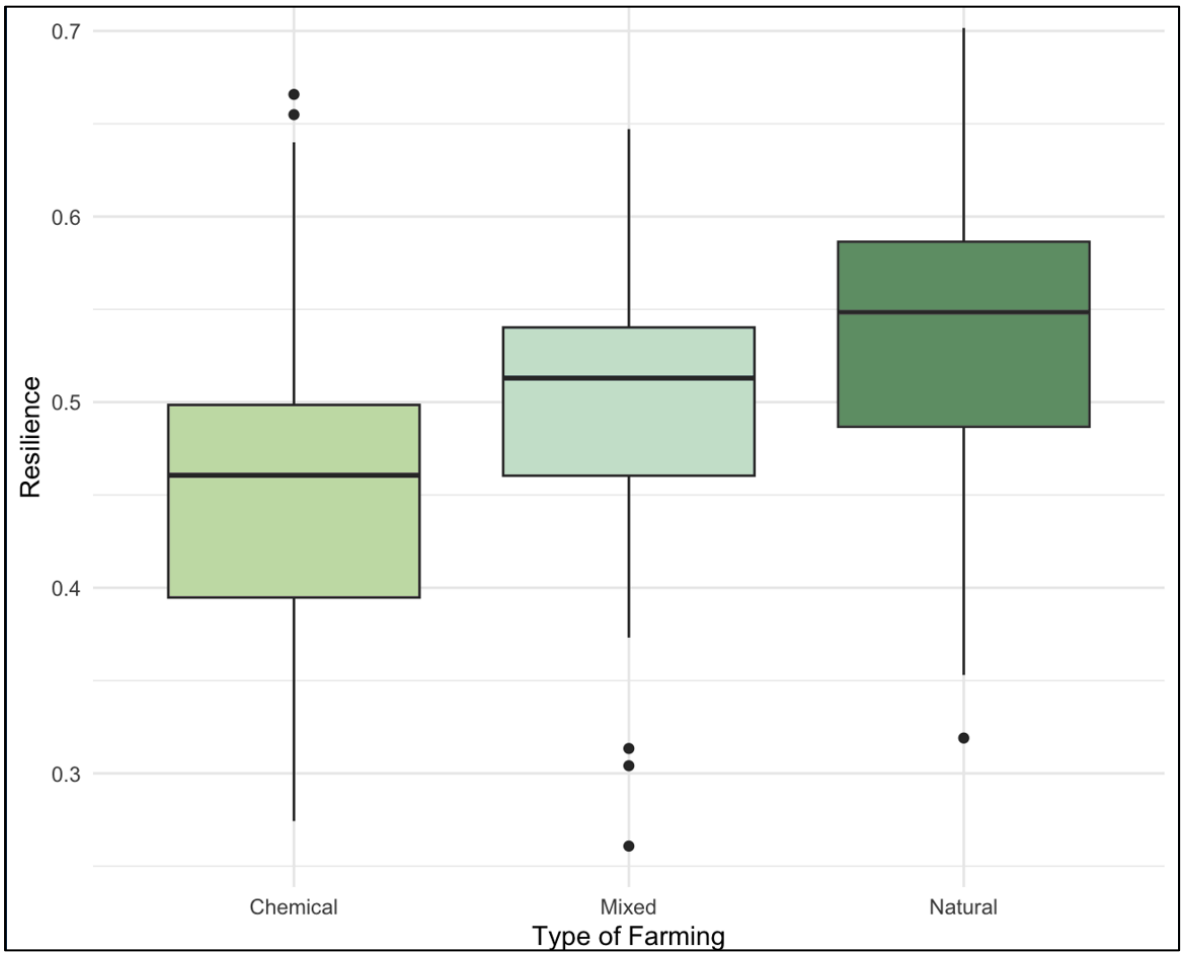



Figure 10: Boxplot of Resilience across three farming types

There is also a high diversity of self-prepared natural inputs like kashayam, asthram, beejamrutham and jeevamrutham. Many also use yellow plates and pheromone traps to ward off insects.All these activities contribute to a *higher buffer capacity* as compared to conventional farming that is characterised by monocultures and standard chemical inputs. Mixed farmers either practise natural farming only on a single patch of their land or use a combination of both natural and chemical inputs, and thus, their buffer capacity lies in between the two.

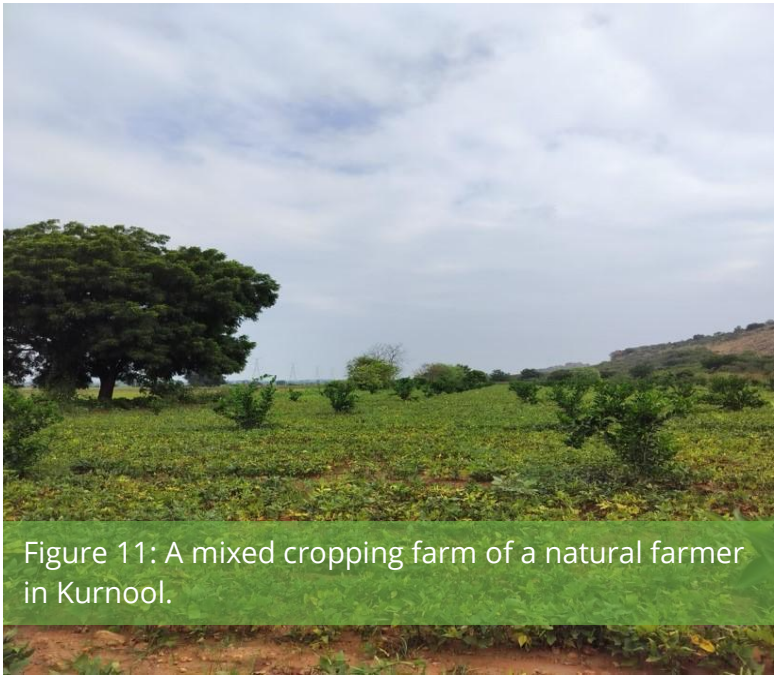


Figure 11: A mixed cropping farm of a natural farmer in Kurnool.

Our discussion in the previous section has shown that the *capacity for self-organisation* has significant negative correlation with occurrence of seasonal migration. Previously, we have mentioned that for the APCNF transition, SHGs have been chosen as the primary body for the dissemination and promotion of its practices. The SHGs have a federated structure in which 20-25 SHGs within a village representing 200-250 women come together to form a village organisation (VO) by nominating representatives. For the dissemination of APCNF model, a community resource person (CRP) assigned to each village, meets with the VO to schedule meetings with individual SHGs for promoting natural farming. Hence, households that are associated with these informal institutions are more likely to adopt natural farming practices.

Furthermore, APCNF has promoted the use of localised inputs and local consumption of cultivated produce (by encouraging food crops) which again contribute to a higher capacity for self-organisation as compared to chemical farmers.

With respect to the *capacity to adapt and learn*, APCNF has promoted shared learning about practices like Pre-Monsoon Dry Sowing (PMDS) that involves sowing 10-15 different varieties of millets and pulses after seed treatment, in dry soils during the month of April. This method significantly reduces the impact of increased rainfall variability and droughts while regulating soil moisture and fertility. However, the rate of adoption of PMDS has been low and more prevalent among medium and large farmers (Mishra, 2025).

**Table 3: Descriptive statistics for Type of Farming**

| | Overall N = 200[1] | Seasonal Migration (No) N = 161[1] | Seasonal Migration (Yes) N = 39[1] | p-value[2] |
|---|---|---|---|---|
| **Type of farming** | | | | 0.0308 |
| Chemical | 102 (50%) | 75 (46%) | 27 (69%) | |
| Mixed | 50 (25%) | 44 (27%) | 6 (15%) | |
| Natural | 51 (25%) | 5 (27%) | 6 (15%) | |
| [1]Number of HHs (%) | | | | |
| [2]Pearson's Chi-squared test | | | | |

Through these results, we infer that households practicing natural farming, or a combination of natural and chemical farming had higher levels of resilience as compared to chemical farming. However, we also need to observe the relationship between occurrence of seasonal migration and the type of farming system a household is associated with. Table 3 lists the number of households practicing one of the three types of farming and whether they engage (or have engaged in the past) in seasonal migration or not. A simple *chi-square test* between the two (Table. 3) showed a significant p-value (0.031) and the test statistic $X^2$: 6.9605. This means that the occurrence of seasonal migration significantly varies according to the type of farming as well. In Table 3, we can also see that roughly 69% of the seasonal migrants in our sample are chemical farmers, whereas only 15% are natural farmers. This makes sense since the occurrence of seasonal migration was found to be more prevalent among less resilient households.

## 7.5 Will switching to APCNF reduce overall seasonal migration?

Based on this association we might hypothesise that large scale adoption of natural farming practices might lead to a reduction in overall seasonal migration in the future by increasing household resilience. However, field observations have

shown that this is not such a straight-forward case, and is socially differentiated. In our sample, only six households practice natural farming and are also engaged in seasonal migration (Table 3). All six households engaged in seasonal migration *before* taking up natural farming. But the fact that out of 51 households in the entire sample who practise natural farming only six have a past migration history shows that people taking up natural farming must generally have a higher level of resilience compared to other households in the system. The rate of adoption of APCNF has been low overall, and in villages with very high seasonal out-migration rates, farmers were not aware of the existence of APCNF or other such initiatives.

This is because households that have been engaging in seasonal migration every year had a lower level of this resilience capacity to begin with, and it further reduced over time. This happens when the already migrating households get stuck in a *vulnerability trap* as the act of migration itself reduces their access to these institutions where they might learn about new practices like APNCF which can potentially improve their resilience in the long run. This creates a challenge for the interventionists to create more innovative models of dissemination that do not exclude the households that are already below the threshold level of resilience necessary to access information on newer technologies and interventions.

### 7.6 Impact of structural vulnerabilities on the seasonal migration experience

Recent empirical literature has laid a great emphasis on the role of agency in the decision to migrate. This agency is ultimately an outcome of interaction between social hierarchies, power dynamics, gender and caste structures (Cundill et al., 2021). These structural vulnerabilities 'mediate the migration experience' by impacting not just household resilience but also the pattern and outcome of migration (Singh, 2019; Singh & Basu, 2020). Amongst them, caste and gender are the most pervasive to Indian rural agrarian landscape. If we look at the caste distribution of the seasonal migrants in our sample (Figure 12), we can see that the majority (74%) of them belong to the Scheduled Castes and Scheduled Tribes. Members of the lower castes have historically been exposed to socio-economic injustices that have resulted in their being the most vulnerable and marginalised sections of the society. Studies on farmer migration in India have also

demonstrated that caste inequities increase the vulnerability and exposure of households to climate risks (Singh & Basu, 2020). From our own case study, we see that they can affect resilience through lower asset ownership, reduced access to information and technologies, lack of access to informal institutions, and other public infrastructure and services. Not surprisingly therefore, most of the seasonal migrants are small and marginal farmers (Figure 12).

We can further deconstruct the impact of these structural vulnerabilities on the decision to migrate by going back to the drivers of migration. In Fig. 8, we have seen that for the SC and ST migrants, major drivers of migration were declining agriculture and lack of opportunities available locally. Being predominantly small and marginal farmers, the lower caste groups must rely on daily wage labour

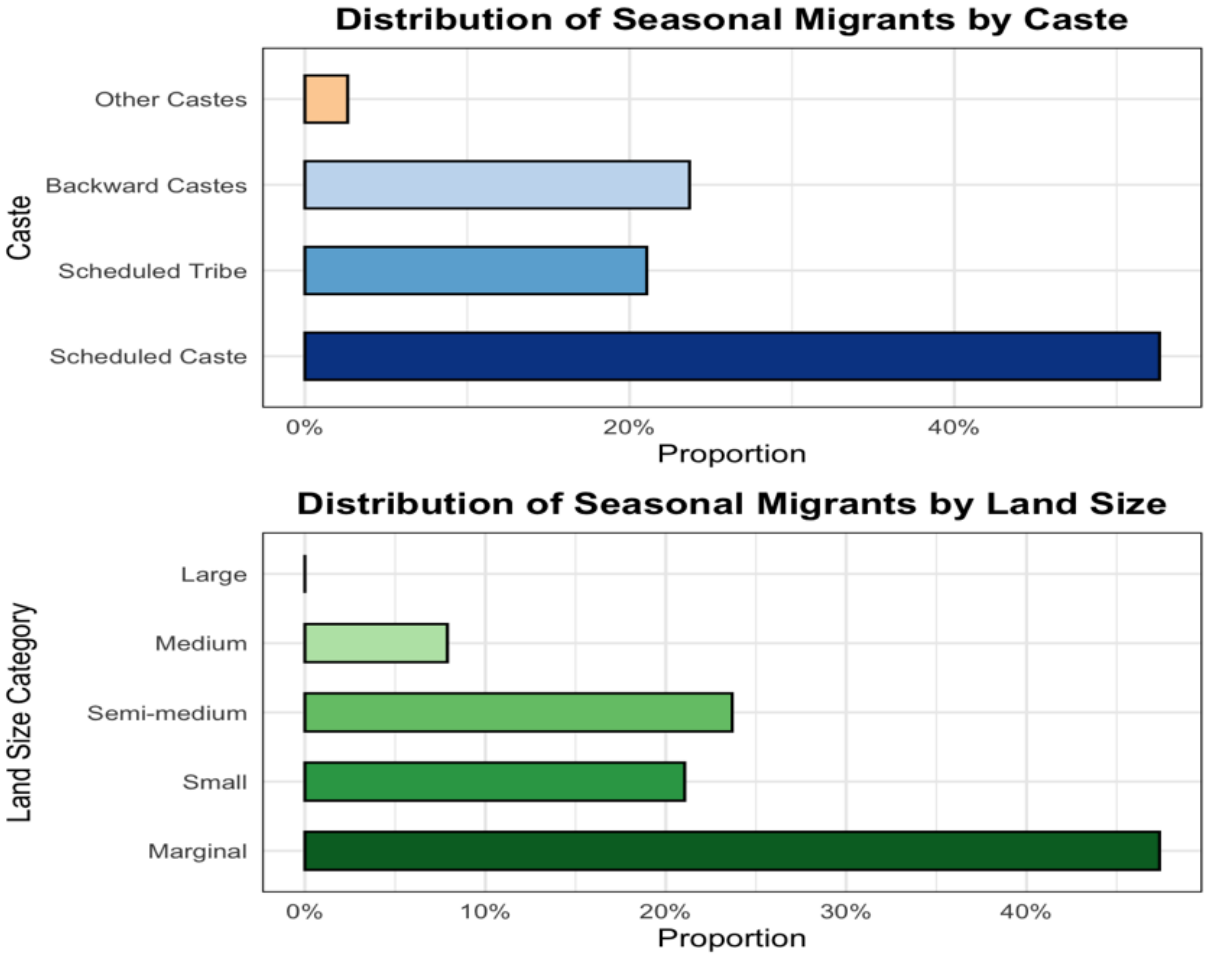



Figure 12. Distribution of seasonal migrants by caste and land size

besides agriculture to support their household income. Declining agricultural

livelihoods due to climate change impacts and its non-remunerative nature are causing more farmers to leave cultivation or reduce the extent of it. This in turn reduces the local labour requirements in agriculture, making it imperative for those who depend on it to search for alternate livelihoods. Increasing mechanisation of agriculture has further pushed these people at the margins, and livelihood guarantee schemes like MGNREGS are not enough for survival due to poor implementation. One of the interviewees from a seasonally migrating ST family (Surya Thanda, Tuggali mandal) in Kurnool district articulated these issues for their context:

***'There are no borewells and very little employment in the village. Around 50% of the people in our village migrate. Migration is increasing because there's no work, no rain, and no crop. During the rainy season, we get some farm work, but for the rest of the year, there's barely any. In three months (Kharif season), we might find work for just one'(P6).***

# 08

# Pattern of Migration

## 8 Pattern of Migration

Our case study focuses specifically on seasonal migration as a coping strategy adopted by less resilient households. With respect to its *temporality*, seasonal migration from both Anantapur and Kurnool generally occurs for up to six months in a year, primarily during the summer season. This is because most seasonal migrants are rainfed farmers or landless labourers who don't cultivate or get work during the dry months. They generally leave in January or February and migrate till June, only coming back to cultivate or work during the rainy season. For instance, here is the migration cycle of an SC migrant household from Kosigi, Kurnool that lost their land due to unpaid debts and only rely on wage labour:

***'We leave in January and come back before the monsoon. We stay in the village during Kharif for agricultural labour. This is primarily because it is hard to find work in the rainy season at the places we usually migrate to. In our village, we get work from sowing till the weeding stage. After that, we leave again. This year, we went to Telangana, in January for 3 months and then went to Guntur. In the cotton farms, we usually stay for 1-2 months, while in the chili farms, we stay for 3-4 months. In a drought year, we migrate even during Kharif as there is no work available locally. We rarely come back to the village to attend festivals. Mostly we stay outside only.' (P7)***

There are also a few instances (n=15) of seasonal migration for only a month or less. In all these cases, the household members temporarily migrated to absorb the shock of a severe drought year. One such case was of an SC tenant farmer from the Kadirampalli village of Kundurpi mandal in Anantapur. He practices a combination of chemical and natural farming and migrated for one month in 2023:

***'I experienced severe losses last year (2023) due to drought and nobody would lend me money in the village. So, I migrated to Pagoda for 2-3 weeks for construction and agricultural work. I will migrate again in the future if a similar situation arises.'(P8)***

Moving on to the *spatial pattern of seasonal migration*, it was seen to vary between Anantapur and Kurnool and was mediated by structures of caste and gender. In

choosing the destination, be it urban or rural, the presence of local social networks was identified as crucial, especially by the lower caste groups. Households that have been migrating for a long time (some of them started migrating 30 years ago) have well established networks at the destination with potential employers and they help others within their social network at the origin in migrating with them.

For scheduled and backward castes in the case of Anantapur, inter-state migration seemed to emerge as a norm. Proximity and better connectivity to Bangalore makes it a popular destination for seasonal and economic migration. In most cases, the seasonal migrants were predominantly male family members who go to Bangalore to work in construction, garment industry and matchbox factories. With families back home, they frequently return to their villages once a month for banking related work or other household chores. In the case of Kurnool district, the scheduled and backward castes largely undertake both intra-state and inter-state migration with Guntur and Telangana being the most popular destinations. In this case, both male and female family members are seen to migrate, especially because agricultural work is involved.

The Scheduled Tribe communities in Anantapur, on the other hand, prefer migrating to Kerala. Known for their nomadic lifestyle, the ST communities show a preference for long distance migration. Even today, their habitations, called 'thandas', are usually located on the outskirts of the main village and have limited access to basic infrastructure and services. This is evidence of their systematic marginalisation throughout history. Being predominantly landless laborers, the ST communities have a decades long history of undertaking seasonal migration for livelihood diversification. However, as mentioned earlier, the adverse impacts of climate change have exacerbated their vulnerabilities and severely impacted local livelihoods. Consequently, every successive generation is being pushed into the same or in some cases more intensified seasonal mobility patterns for survival.

Figure 13: The junction in Ernakulam, Kerala where seasonal migrants from Anantapur stay and work.

A similar, yet different pattern was observed in the case of Kurnool district. While the seasonal migrants from ST communities also migrate to destinations different from those preferred by other castes, it is mostly intra-state migration to cities like Kadapa, Railway Kodur, Rajampeta etc. Another common thread in the choice of destination among this caste group was the type of work involved. The ST seasonal migrants for both districts were seen to prefer non-agricultural work (predominantly construction). In the case of Anantapur, ST migrants who usually migrate to Kochi, mostly get jobs in construction, carpentry, municipal work or as domestic helps. Other caste migrants on the other hand, went for both agricultural and non-agricultural jobs depending on the destination. In Kurnool, the distinction was more apparent with the non-ST migrants overwhelmingly migrating to destinations with agricultural work.

## 8.1 Rethinking the binaries of migration outcomes: From coping to adaptation

Recent discourse on migration as adaptation has challenged its conceptualisation as binaries between permanent-temporary or maladaptive-adaptive mobilities. Such perspectives are driven by a 'remittance euphoria' and rely on economic well-being as the key determinant of migration outcomes (Singh & Basu, 2020). Even within this paradigm, empirical research has revealed conflicting evidence. Our case study attempts to develop a more nuanced understanding of the impact of remittances by looking at them through the intersectionality lens.

Amongst the households that engaged in seasonal migration, those that were able to utilise their remittances for productive investments in agriculture were predominantly small and marginal farmers of the Backward Castes (a few from

the Scheduled Castes as well). On the other hand, households that are barely surviving on remittances that are only enough to pay off debts and incur basic household expenditures were largely landless labourers or marginal farmers from the Scheduled Tribes and Scheduled Castes. In the former scenario, remittances could increase the long-term resilience of the household while in the latter, it might not be the case.

Beyond that, the level of household resilience prior to migration can determine how the remittances might feed back into it. For instance, households with better livelihood assets and capitals might find skilled jobs at the destination leading to higher remittances and further increase in buffer capacity (E.g. P11). This hypothesis will better be explored through a longitudinal study but the following experiences of migrants from different socio-economic profiles do suggest an association.

***'We earn Rs. 15-20k per month combined (him and wife). The money earned is barely enough to pay off debts. Sometimes we come back if we can't find work for many days. The workload is a lot and hard, but we have to migrate to pay off debts.'*** (P9: A male ST migrant from Kurnool, migrates to Telangana, Chennai. Family owns 1 acre of land)

***'We earn Rs. 50-60k (3 people) in 2 months which is only sufficient for debt payment. Once we come back moneylenders start hounding us for payment of instalments.'*** (P10: A female SC migrant from Kurnool migrates to Guntur. Family has 1 acre of owned land and 2.5 acres on tenancy.)

***'My family's household income is mostly dependent on the remittances that I send and less on agriculture. I send more than 80% of my monthly income home. Before migration, ₹25,000 would have been the income for the whole year from agriculture but now I am able to earn that much every month.'*** (P11: An SC seasonal migrant from Anantapur, works as a driver in Bangalore, family has 5 acres of land)

Besides economic well-being, there is a broader range of outcomes at the household and system level that need to be considered as well. Rural migrants driven by agrarian distress have often fallen through the cracks of the system with

declining livelihoods in the agricultural sector not adequately being compensated with alternate opportunities in the rest of the economy. In urban spaces like Bangalore, studies have documented the emergence of informal squatter settlements of these rural migrants which are '*highly unequal spaces economically, spatially, socially and culturally*' (Michael et al., 2019). Our group interviews with seasonal migrants revealed how their vulnerabilities travel with them to the destination, be it rural or urban. In Kerala for instance, many of them are pushed into precarious livelihoods like sewage work for the males or prostitution and even red-light trafficking for the females. Seasonal migrants in Bangalore made repeated references to lack of safety for women workers, and ill-treatment and harassment of even males. Those who migrate for agricultural work to Guntur and Telangana also trade one set of vulnerabilities for the other.

***'It is hell there, the shelter is not enough, there are no toilets. People come and hit us, scold us. They treat us badly. Nobody cares about us. Our living conditions are equivalent to sleeping on platforms. Even though we have a house and land in the village nobody cares, and we are disrespected.'*** *(G2, about Bangalore)*

Figure 14: A blue tent settlement of migrants from Anantapur in Kengeri, Bangalore

***'We usually live in tents. Seven or eight of them are constructed on a single patch of land. The only access to electricity is one pole in the middle with a bulb and a switchboard. People usually cook together near this light, on open fire. Sometimes we work till midnight, even after dinner. Once there were heavy rains so we couldn't leave the tent or cook. We ate nothing for 3 days except raw grains to survive'*** *(P12, about Guntur)*

Lastly, migration also has implications for collective local adaptation at the origin. Multigenerational seasonal migration by the deprived castes has resulted in upward social mobility and increased agency within their socio-political context. Engaging in migration has broken the deeply entrenched bonds of the rural poor with the landowning elites that were based on dependence of the former on the latter for their survival. Cracks in the wall of upper caste power are visible especially in their displeasure and distaste towards migrants. The following statement by an upper caste landlord from Anantapur reflects this insecurity (P12).

***'Initially it was only the barbers who migrated to Bangalore, but then the others saw them and went as well. Many of these people became house helps in the city because it was easier work and they eventually got used to the city life. There are some people from the village who also go to Kerala for begging. But they won't accept it out loud. They have earned so much by begging that they have now started lending money. These wage labourers have become financially better off whereas the farmers are losing money.'***

## 8.2 Conclusion and implications for policymaking

Throughout this report we have dwelled on how a household's decision to engage in seasonal migration is a complex decision mediated by its resilience, the type of farming system it is based in, and its navigation of historically entrenched caste hierarchies. We confirmed our hypothesis that households with lower resilience are more likely to engage in seasonal migration to cope with climate shocks like droughts and seasonal rainfall. These less resilient households were predominantly chemical farmers, and statistically significant correlations were observed between the resilience capacities and types of farming. Households practising natural farming showed an overall higher level of resilience compared to those practising chemical or mixed farming. Finally, a significant correlation between the type of migration and the type of farming practised by households further established that less resilient households that were more likely to engage in seasonal migration, were also more likely chemical farmers.

Our attempt to unpack these relationships revealed the ubiquitousness of structural vulnerabilities like caste that are deeply embedded in rural social and

economic relationships. Buffer capacity, for instance, relies on the ownership of assets. Consolidation of landholdings among a small percentage of upper caste farmers has resulted in more than 50 percent households in Andhra Pradesh having only a homestead to their name (NSSO 2003). Since the seasonal migrants in our sample were from households with lower buffer capacity, it was not surprising that 74% of them were from the Scheduled Castes and Scheduled Tribes. Also, almost all of them were small and marginal farmers.

For these less resilient farming households, seasonal migration has been a coping strategy to deal with an increasing agrarian distress due to not just climate shocks but also fluctuating market prices, rising input costs and so on. However, our discussions on spatio-temporal aspects of such a migration revealed that these mobility patterns are not standardised and predictable but rather determined by geographical and demographic factors along with caste inequities.

We, therefore, subscribe to Jelena Salmi's (2023) framing of seasonal migration as **'intermittent mobility'** that '*situates leaving and returning within the context of vulnerable, natural-resource dependent livelihoods characterized by socio-economically, environmentally, and politically produced stable instability'.*

Reconceptualising seasonal migration as 'intermittent mobility' has wide ranging implications for policy making. Government response to seasonal migration has largely been driven by its conventional framing as 'distress migration'. Hence, most policy attempts have focused on curbing migration at the origin itself. But their success has been limited. In Andhra Pradesh, the policies for local employment generation through NREGS, drought management in agriculture, and other pro-farmer and pro-poor reforms have attempted to make local livelihoods more sustainable (Salmi, 2023). However, many of these policies have either been poorly implemented, or have further marginalised the most vulnerable. For instance, policies that promoted borewell irrigation resulted in further depletion of the groundwater table, making it more capital intensive to access water (Fosli 2014).

The APCNF transition too has been popularised as a step towards rejuvenating the agrarian economy. In fact, one of its objectives is to reduce the incidence of distress migration from agricultural households by optimally utilising family

labour and improving household income (Galab & Rao, 2024). However, our study's analysis has revealed that in villages with high rates of seasonal outmigration, the adoption of natural farming was very low due to the low self-organisation capacity of households. Successive years of engaging in seasonal migration has resulted in systematic withdrawal of households from informal institutions like the SHGs or those set up by civil society organisations. With SHGs being at the core of the APCNF dissemination model, participation in these networks is vital for its adoption. Even though there are door to door campaigns conducted, the intermittent mobility of seasonal migrants reduces their level of exposure to these newer practices, technologies and methods.

Additionally, although APCNF is under the aegis of the state department of agriculture, the latter continues to promote conventional farming technologies and practices. The constant tension between the old and the new adds another layer of difficulty to the problem of dissemination and adoption of APCNF. Especially because less resilient households that engage in seasonal migration are the ones disadvantaged by the current agricultural regime.

Considering these challenges, the APNCF transition needs to improvise on innovative and flexible approaches to adoption of natural farming. First and foremost, exclusive reliance on the SHGs for promotion of natural farming needs to give way to a network of institutions which could be co-created with the civil society organisations already established in the region and targeted towards areas with limited representation. While the APNCF initiative collaborated with multiple NGOs at its initial stages, a co-creation of grassroots institutions will be a constructive step towards increasing the programme outreach.

Secondly, one of the major bottlenecks to scaling out of the APCNF initiative has been a lack of availability of local raw material for natural inputs. As the agrarian economy has become more mechanised, with the concentration of resources along caste power structures, allied sectors like livestock rearing have been disappearing. Due to limited availability, raw materials like animal waste have become increasingly expensive and can only be afforded by more affluent farmers. Promotion of livestock rearing among the non-landowning stakeholders like the tenant farmers and wage labourers by creating local cooperatives would

provide additional sources of income for these actors, thereby increasing their resilience to cope with future shocks.

Finally, for any transition experiment to be deemed sustainable, it must be socially just, and also inclusive of the concerned stakeholders in the decision-making processes (Bennett et al., 2019). To answer whether the APCNF transition in the Rayalaseema region of Andhra Pradesh has been a 'just transition,' a multidimensional justice framework needs to be employed. We used the three interlinked dimensions of justice that are most frequently applied in transitions research: recognition, distributive and procedural (Kaljonen et al., 2023). Recognition justice aims to ensure that diverse socio-cultural values are respected, and the needs and concerns of all social groups are considered. This dimension takes cognizance of historical injustices that have disadvantaged the vulnerable groups (Kaljonen et al., 2023). Procedural justice focuses on representative participation in decision making and policy processes, ensuring that everyone's voice is heard in a transparent and equitable manner (Kaljonen et al., 2023; Stark et al., 2023). Lastly, distributive justice pertains to how benefits and harms, material and immaterial resources related to the environment, livelihoods and so on are distributed. Broadly, it looks at the potential winners and losers in a transition (Kaljonen et al., 2023).

In the context of APCNF, as far as *recognition justice* is concerned, there has been an attempt to identify and target the vulnerable and historically marginalised communities. For instance, in the Rapthadu block of Anantapur district, a hamlet of 43 scheduled tribe households has been adopted as a 'model village' for promoting natural farming. Even though several such model villages exist, there is still a section of vulnerable groups, particularly the seasonal migrants who are also small and marginal farmers that needs to be recognised as an important target population.

With respect to *procedural justice*, the APCNF initiative has made significant progress in the representation and involvement of women farmers in the training and adoption process. As mentioned above, this initiative has been disseminated through the women SHG network. While the incorporation of women farmers has been a point of major success for this initiative, the same cannot be claimed with

certainty for lower caste households, especially from areas that are remote and have high rates of outmigration.

Looking at distributive justice of the APCNF transition requires a more nuanced approach. Broadly, the adoption of natural farming practices has led to both material and immaterial benefits ranging from reduced cost of production, better quality yields and improved food security to rejuvenated soil health, better health outcomes for the households and so on. However, when we look at the 'winners' and 'losers' of this transition, there are people or actors spread across the spectrum. To begin with, our interactions with the APCNF field staff and the progressive farmers revealed that training people in the natural farming package of practices was a knowledge-intensive exercise. Hence, younger and more educated farmers were most amenable to learning and implementing new techniques. We observed that the older and less educated farmers, having used conventional input-intensive farming methods for decades, were more opposed to trying new natural farming techniques. Their apprehension was not only about the success and feasibility of natural farming but also about having to learn new methods and practices. Furthermore, APCNF is a labour-intensive practice as it requires manual preparation of natural inputs. A GIST Impact report of APCNF in 2023 revealed that APCNF farms were 21% more labour-intensive than conventional farms (Sandhu et al., 2023). While the medium and large farmers are more financially capable of hiring wage labour for these tasks, the small and marginal farmers often lose out. They are either unwilling to switch to farming practices that are more labour intensive, or if they do, there is a high chance that the burden of additional labour falls on women of the households.

Therefore, overall, it can be said that while this transition is on the path to be socially just and sustainable, there is significant scope for improving outcomes pertaining to all three dimensions of justice. The first step in this direction would be to penetrate areas with higher resource scarcity and less resilient households, which typically would also be seasonal migration hotspots.

The eventual objective is to not stop seasonal migration from happening altogether. As we saw in the previous section, there is a whole continuum of outcomes from this activity. For many socio-economically marginalised households, the act of migration has enhanced their economic well-being through

remittances, leading to upward social mobility. In such cases, resilience could improve over time resulting in a better ability to cope with future shocks, climate or otherwise. On the other hand, as we observed in the case of APNCF, repeated seasonal migration over the years led to the withdrawal of households from social networks that reduced their exposure to new information and practices.

Ultimately, what matters is that the act of migration pushes them further along the continuum towards more resilient outcomes. For that feedback mechanism to happen, building resilience of these households at the origin is a necessary precursor.

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