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Dry Grain Complex: A Case Study of Chamarajanagar District, Karnataka[1]

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Abstract

The persistence of rural agrarian distress necessitates a greater understanding of regional agroecological food systems. Current agricultural policies are delinked from the requirements of dynamic and evolving local agroecological systems, as well as the interlinked factors of the climate change crisis. The purpose of this study is to explain the 'Dry Grain Complex' (DGC) in Chamarajanagar district, Karnataka, as it functioned (and is now largely marginalised). The study describes this complex within the socio-ecological framework that it operates in, while postulating some key principles that interlink ecologic, economic, and social factors. According to the study, which is based on in-depth qualitative interviews, the DGC has been facing serious erosion of its associated practices as the result of a decline in supporting systems such as family labour, diminishing access to commons, decoupling of livestock from the farm, and lack of seed-saving initiatives. While highlighting the agroecological components of the DGC, the inequitable caste systems incorporated into the practices have also been flagged. Finally, a case is presented to resurrect DGS without its exploitative aspects. Such an experiment may also help us gain a better understanding of the functioning and value of other agricultural systems.

[1] The authors thank Prof. A.R. Vasavi for mentoring Joshua Lobo and helping him to articulate the concept of Dry Complex Complexes as part of the Verghese Kurien Rural Internship Programme. The concepts mentioned here are primarily derived from her extensive work and research in the area of sustainable farming, livelihood and equity issues. Joshua is also grateful to all the team members at Punarchith, especially Mrs. Sundramma, Mr. Muthuraju, Mr. Veerbhadranaika, Chandru, and Mahendra for facilitating enriching field visits.

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1. INTRODUCTION

In India, rural and agriculturist hardship has grown widespread and protracted. Unsustainable cultivation methods and unstable markets that do not favour the small farmer have led to rural poverty. Since the 1970s, agrochemical-dependent and water-intensive Green Revolution farming techniques have been gradually implemented throughout the country. We are now witnessing the economic, social, and ecological consequences of these policies (NRAS 2020). Farmers confront increased hazards that endanger their livelihoods and lives as severe weather events and erratic rainfall related to climate change become more prevalent (KSNDMC Climate Report 2020).

Agricultural systems that rely heavily on chemical inputs are less likely to adapt to environmental changes, particularly climate change. Their dependence on external markets and high-input, technology-based solutions has impaired their capacity to manage risk associated with climate unpredictability. States such as Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Punjab and Haryana, with the highest proportion of agricultural land, particularly those where Green Revolution policies took hold, were characterised by high pesticide use, soil fertility loss, groundwater depletion, high reliance on electricity, and high irrigation dependency for commercial crops, among other characteristics. Commercial agriculture in India, while expecting higher production and short-term profits, is also associated with biodiversity loss, soil health deterioration (Yang,2020), and extensive ecological degradation, including water table lowering and nitrate contamination of groundwater (Veluguri et al., 2019). Despite claims of higher productivity, high yield variety farming has recently been shown to be marginal compared to total farm output of multi-cropping systems using folk crop varieties, when crop diversity and relative inputs are taken into account (Deb, 2005).

The depletion of soil fertility, which requires ever-increasing quantities of fertilisers and pesticides, has rendered agriculture unprofitable, triggering mass migration to urban areas. Those who continue to be in agriculture are forced to compromise their food security by growing non-staple crops that are in demand in the markets but do not assure them regular demand with adequate prices. As a result, extensive dependence on PDS rations has stimulated the penetration of low-quality grains into rural India's diets and culinary traditions. Top-down agricultural policies have largely ignored the potential of diverse and regional agricultural complexes (Vijayshankar, 2016) and their capacity to address both food security and sustainability. High dependence on external inputs such as seeds, fertilisers, irrigation water, combined with a debt burden, has resulted in a loss of agency, "agricultural individualisation," "knowledge dissonance" (Vasavi, 2012), and deskilling (Stone, 2007). Newer local 'merchants of knowledge' (Aga, 2018) have exacerbated farmer vulnerability in many parts of India.

In this context, it helps to take a step back and examine how agricultural systems functioned before the implementation of significant changes in production and marketing systems, as well as how they continue to work in small enclaves across India. 'Traditional' or indigenous knowledge systems have evolved over time to provide efficient resource management,

species adaptation, and potential use of soil and diverse plants with minimal reliance on external inputs (Thrupp, 2000; Altieri, 2002, 2004). Contrary to the widely held belief that India was 'food insecure' at the time of the Green Revolution's implementation, it is now acknowledged that much of India could have fed itself in the 1960s if the cultivation and usage of a diverse range of millets had been factored in (Kumar, 2019).

To illustrate one such indigenous agrarian system, this report analyses a specific kind of agricultural complex through the lens of the social structures, institutions, and community/collective practices that accompanied the development of these methods. The results indicate that each complex is a composite whole comprising of people, ideas, and environment, all of which may be classified as important or key components of the complex. This enables us to determine the degree to which such complexes are unique to certain socio-ecological contexts and the variables that contribute to their degradation. The paper is organised as follows. Section 2 provides an overview of the Dry Grain Complex (DGC) in Chamarajanagar district. Section 3 outlines the study's research methodology. Section 4 discusses Chamarajanagar's geographical setting. Section 5 explores the cultivation practices based on the community's local ecological knowledge. Additionally, it discusses the importance of social practices and rituals in ensuring food security. Section 6 discusses labour relations and agrarian social structures. Section 7 considers the interconnected components of DGC and the causes contributing to its decline. Section 8 and 9 conclude the paper by emphasising the need of reviving DGC's beneficial features without referring to iniquitous caste-based land systems. Finally, the authors argue that traditional agrarian systems need serious engagement to build pathways for food sovereignty, self-reliance, and respect for ecology.

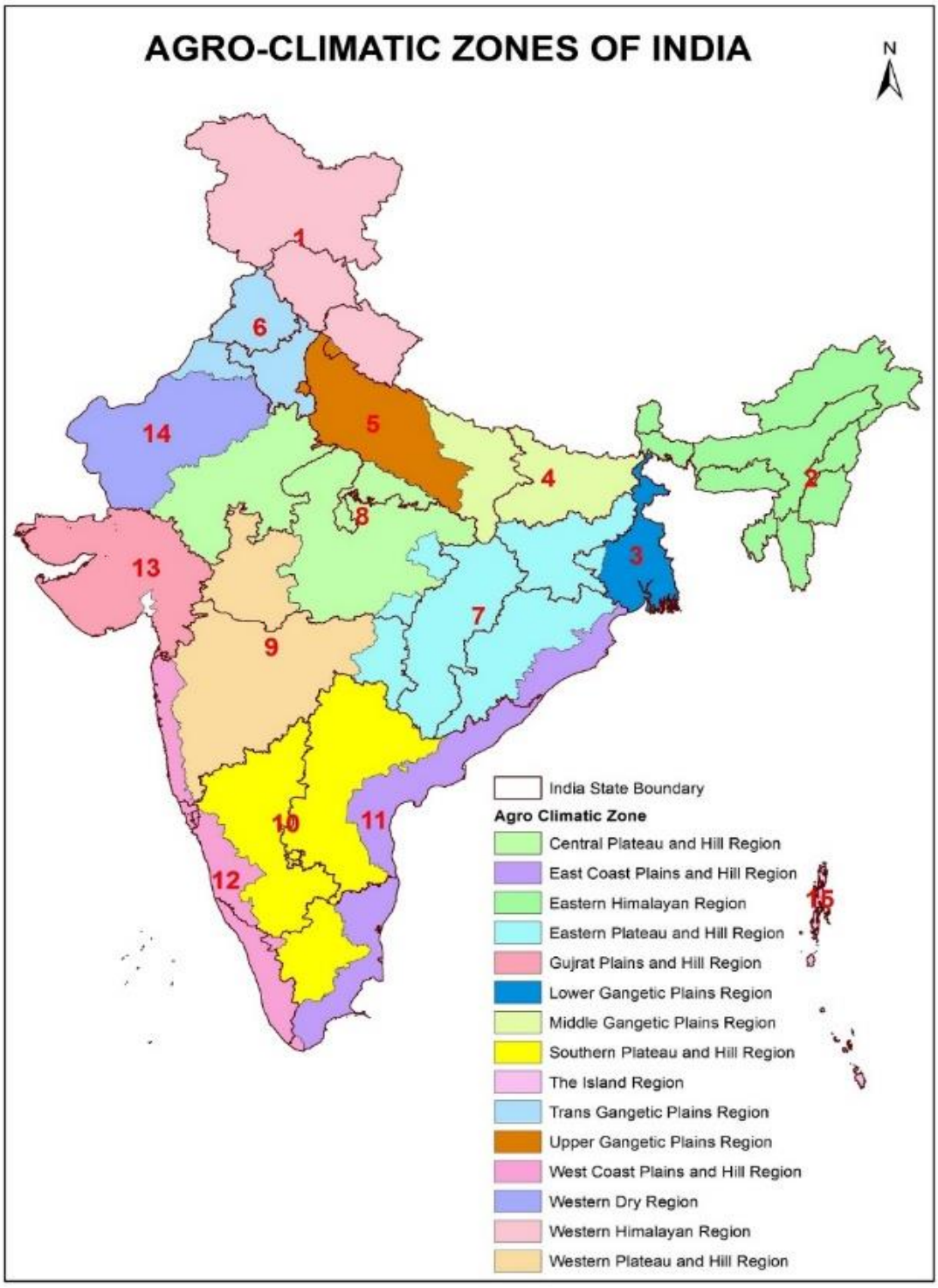
2. THE DRY GRAIN COMPLEX IN CHAMARAJANAGAR DISTRICT

The term 'complex' is used to describe agricultural methods that are influenced by a variety of diverse and interconnected variables, forces, and agencies that are incorporated into broader societal structures that drive their continuance and growth. According to Vasavi (2020) "The DGC must be understood as being representative of the varied and diverse/pluralistic cultivation practices across the country". She characterises the agricultural complex in Chamarajanagar as a 'dry grain complex', in which dry or rain-dependent cultivation practices focussed on growing a combination of pulses, cereals, oil seeds, and vegetables that were adapted to the region's semi-arid agro-climate.

According to the Planning Commission, India is divided into 15 broad Agro-Climatic Zones, each with its own specific mix of terrain, plant and wildlife biodiversity, major climate conditions, and land formations. Nonetheless, owing to the vastly diverse geophysical and local climatic characteristics across the subcontinent, a need for alternate typologies with additional subdivisions and transition zones has been acknowledged (Ahmad et al., 2017). Agriculture is expected to differ across regions owing to variations in the geophysical and climatic characteristics of each region. In other words, local agricultural systems and societies that implement them are known to adapt to their environments in order to effectively utilise available resources. As a result, many agricultural complexes exist across India, each with its

distinct forms and practices. Numerous agricultural complexes span across India, a handful of which have been extensively researched. A few examples are provided below to demonstrate some of the characteristics of a complex.

Figure 1. Agroclimatic Zones of India



A region's ecology serves as the foundation for any local agricultural complex. In other words, what output is enabled or supported by a certain kind of ecology? Climate, local biodiversity, soil content, and farmer selection either limit or enable the growth of certain species or varieties of crops (Lizumi, 2014). In the mountainous area of Chalumthung in Sikkim, each crop is cultivated at a particular altitude. For example, finger millet and wheat are grown at altitudes of at least 900 meters above sea level, while traditional rice varieties that need less fertiliser are planted at the region's higher elevations (Avasthe, 2005). Similarly, in Jharkhand's Chotanagpur plateau with its undulating terrain, Adivasi people choose crops that are best adapted to the shifting climatic conditions of the varied topography (Singh, 2012). For example, in the uplands where irrigation is limited, one of the several varieties of Gora rice, a low yielding, drought resistant, and fast maturing species, is cultivated. Conscious utilisation of the multipurpose species of sacred deciduous forests is essential to the community in terms of wood, non-timber forest products, medicines, and clothing.

Agricultural complexes are known to interact with the rhythms and dynamics of the environment. In the type of shifting agriculture practised in Arunachal Pradesh, forest patches are routinely slashed for cultivation. Trees are selectively felled according to requirement and preserved for their potential to feed animals or serve as a source of fuel during the off season. This traditional practice, over generations, has had no major detrimental ecological effect; rather, the 'patch phase' dynamic is believed to mirror natural processes that assist in overall biodiversity stabilisation (Shimrah 2015). Likewise, 'commons' play a significant role in these environments. Riparian forests are never cut in the shifting agricultural practices of Arunachal Pradesh as they protect villages during peak discharges from snow clad mountains. Mangroves of the lowlands in Kerala are believed to serve as natural barriers against wind and dust, which would otherwise devastate crops such as the adaptable *pokkali* paddy cultivated in the saline *pokkali* region's lowlands (Nair, 1986).

Over decades of land cultivation, knowledge systems for natural resource management are gradually established. Tribal farmers of Tamil Nadu's northeast coast have developed agroforestry methods extensively for this purpose. Casuarina and cashew tree leaves and coppice are utilised as mulching agents and are well-known weed suppressants. Secondly, trees are leveraged to facilitate the development of biodiverse ecosystems. Farm ponds that collect runoff rainwater are ubiquitous. They can irrigate 1-2 acres of farmland throughout the year, functioning as a buffer against delayed rains.

Local agricultural complexes also address community goals such as food security and self-sufficiency. Agriculture's main function in the majority of rural cultures was to provide food for domestic and family self-sufficiency. Surpluses, if any, were allocated to supplement revenue. Agricultural complexes also reflect the extent to which social priorities, ecological specificities, technological developments, power structures, and labour relations are all interlinked (Gadgil and Thapar, 1990). These social objectives, along with social institutions and structures, are critical characteristics of an agricultural complex since they either assist or hinder the complex's propagation. In traditional systems, family members serve as the primary labour force for agriculture, while extra or hired labour is seen as supplemental. In

Rajasthan, for example, large family sizes of 6-8 members will reduce the need for hired labour. Similarly, tribal groups in Jharkhand are likely to manage forest commons quite differently from state-administered pasturelands integral to the pastoralist/farming communities of Rajasthan. The traits and functioning of incumbent societies are critical in defining the characteristics of complexes in this context. As such, it is critical to examine power structures such as land ownership patterns and their relationship to an area's ecosystem, which may reveal class and caste distinctions.

In her comparative study of dry grain farming communities, comprising villages in the arid areas of Hausaland, Nigeria, and South Karnataka, anthropologist Polly Hill (1982) describes a similar production formthat she terms the 'Dry Grain Agricultural Mode of Production'. The Dry Grain Mode of Production, according to her, is only one of many 'modes' that farming communities engage in as a result of local ecologies interacting with the socio-economic forces of a defined area. Through her work, she attempts to explain how key elements such as dry farming methods, low yield staple crops, asymmetric land distribution, and low urban investment combine to enable the existence and continuation of a specific Dry Grain Mode. For example, the study areas were characterised by underemployment, low productivity, and the urban sector's 'withdrawal from the countryside', all of which contributed to dry grain farming becoming being the dominant form of agricultural production due to lower-costs of cultivation, marginal land size, and lack of alternative employment opportunities. On similar lines, we must examine the role of internal and external markets that serve both economic and social objectives by showcasing the ability of agrarian complexes to interact with and adapt to socio-ecological systems of other regions. This would also include newly-developed technologies, professions, and crops that were introduced and flourished in the bargain.

An agricultural complex, hence, embodies a web of interrelated social and ecological phenomena, institutions, ideas, and practices. Interlinked strongly with regional social structures, religious and ethnic customs, agricultural practices can be seen as an extension of local/regional values and cultures. Inversely, as societies adapt to their specific ecological conditions, customs and societies are arranged and given meaning through the methods of cultivation and allied activities that are most appropriate in those ecosystems (Kissa & Matsouki, 2019). Given the context, this paper also attempts to understand (a) How community-based practices and rituals seek to enhance or inhibit ecological and social harmony of the people regulated by it and (b) whether traditional agricultural practices act as safeguards for the marginalised.

3. RESEARCH APPROACH

The study explored different facets of dry land farming and the social arrangements that influence agriculture. A historical account was followed to understand the evolution of an agricultural complex over the years as DGC is no longer as extant today. Government intervention, in the form of high input and technology-based schemes, as well as globalised markets, has transformed the landscape and subsequent practice of various agricultural complexes. Hence, in order to exclude these changes, the historical frame for the entire

region spanning 1800 to the present has been considered. However, because the descriptive material in this study is limited to Chamarajanagar and is derived from individuals' personal testimonies, the time period covered is restricted to the mid-twentieth century (1950s) to the present. The research is exploratory in nature and focusses on agricultural practices as they are perceived by farmers. The region's current agricultural complex is mentioned concerning its relationship with the DGC, which runs parallel to or has merged with it. It should be noted, however, that an inter-temporal comparison between the present and past was not the purpose of this study.

The ecology of the area was described using both current and archival data. The field component of the study was conducted in Chamarajanagar taluk, focussing mainly on Nagavalli and a few villages nearby. It was accomplished in collaboration with Punarchith[5], whose resources and networks were used for this study. The field location was visited for approximately a month between October and November of 2020. It was cut short amidst inconveniences caused by the COVID-19 pandemic. Informants were chosen based on their availability and a broad age criteria indicating that they had sufficient expertise recalling past events. Information was gathered through a mix of in-depth interviews, unstructured interviews, on-site observations, and discussions. In all, four in-depth interviews were conducted, the majority in Nagavalli and one with a resident from a village in Gundlupet taluk. Eight unstructured interviews were conducted as well, two each in Puttanpura and Kokkanahalli in the Chamarajanagar taluk. The informants questioned were mostly OBCs and Schedule Castes, with a few Lingayats (who are the local dominant caste group). The average size of a land holding was about three acres, with each participant cultivating a combination of high yielding hybrid varieties for sale in the market and traditional food crops for personal use.

4. GEOGRAPHICAL CONTEXT OF CHAMARAJANAGAR DISTRICT

Chamarajanagar district is located in Karnataka's south interior region. It is located on the leeward side of the Nilgiris, which explains why the plain area is characterised as a rain shadow and is generally dry. In certain places, the territory is densely forested. The Biligiri Rangaswami Hills (also known as BR hills) are to the southeast of Yelandur taluk, while the Male Mahadeswara Hills are to the east. Both are rich in plant variety. The Punajur State Forest borders the southwest of Chamarajanagar taluk, which is home to the Adivasi hamlets of the Solegas. The Suvarnavathi river flows north across the region, passing through Chamarajanagar, Yelandur, and Kollegal before emptying into the Kaveri. Gundlupet taluk is known for its extreme aridity. According to the CSIR Fourth Paradigm Institute data, the district received an average of 77 cm of rainfall from 1901 to 2014, with no significant change in mean rainfall.[6] However, rainfall is variable and erratic, with a greater frequency of high and moderate rainfall events and a predominance of periods of low intensity rainfall.

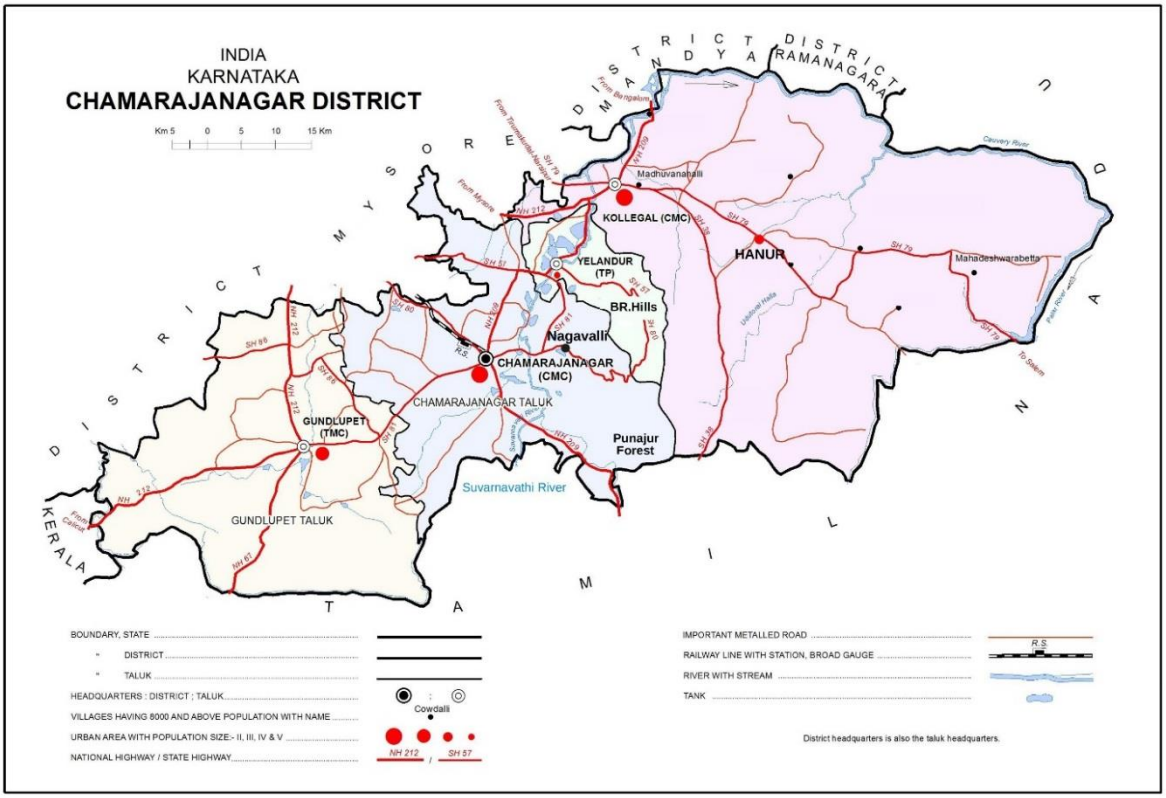
[5] Punarchith ('Re-Think') is a collective that focuses on evolving alternative perspectives and activities related to education, environment, democracy in rural India. Based in Chamarajanagar, Karnataka, it has undertaken initiatives to revive ecologically and economically sustainable agriculture in the district through integrated learning programmes and community out-reach activities.

[6]Data obtained through Punarchith's report 'A Barren Future? Natural Resources, Agriculture and Climate Emergency in Chamarajanagar District'. 2020. (unpublished report)

Between 2001 and 2018, Chamarajanagar taluk had 11 drought years out of the past 18.[7] As a result, the region is well adapted to dry land agriculture.

Considering current cropping patterns, ragi (finger millet), jowar (sorghum), and jolla (maize) constitute the staple crops that are cultivated twice a year. Canal irrigation is critical for paddy cultivation. Most agricultural operations occur during the Kharif season with pulses such as pigeon pea, horse gram, red gram, and cowpea grown extensively. Oil seeds such as groundnut, castor, and niger are important crops as well. Although water intensive crops such as sugarcane and turmeric are mostly grown in the Kharif season, they are also cultivated in the Rabi season[8].

Figure 2. District Map



Source: District Census Handbook, Directorate of Census Operations, Karnataka

The National Agricultural Research Program (NARP) classifies Karnataka into 10 agro-climatic zones. Chamarajanagar district falls in the 'Southern Dry Zone', which is characterised by low and erratic rainfall. The Nilgiris and Western Ghats intercept the south-west monsoons, resulting in low rainfall in Chamarajanagar Taluk, the district's southernmost region.

Alongside the construction of the Suvarnavathi canal network, tube well technology proliferated around the 1990s within the district, resulting in a dramatic shift toward

[7]Source KSNDMC, data obtained through Punarchith (personal communication)
[8] Department of Agriculture for the year 2018-2019 (Retrieved from https://agricoop.gov.in/sites/default/files/agristatglance2018.pdf on 2 April 2021)

cultivating water intensive crops such as sugarcane, banana, and turmeric. A study of the Gundlupet taluk's Berambadi watershed revealed widespread mismanagement and over-exploitation of groundwater, prompting the taluk to be designated a critical zone for ground water depletion. Because of pumping, groundwater has been isolated from the stream bed, rendering the Berambadi stream permanently dry (Buvaneshwari et. al 2017). Ground water levels in the Chamarajanagar taluk and others have dropped sharply from 15-20 ft in 1995 to 70-75 ft in 2017, suggesting an urgent need to transition from water-intensive agriculture to rainfed crops.

5. CULTIVATION PRACTICES BASED ON THE ECOLOGY AND SEASONAL VARIATION

5.1 Season Based Cultivation Sequence

Crops are grown in two main cultivating seasons, *Mungaru* and *Hingaru*, corresponding with the onset of the south-west and north-east monsoons, respectively. Rainfed crops needing higher levels of water are often produced during *Mungaru*, which coincides with the Indian subcontinent's kharif season. Ploughing, sowing, harvesting, and threshing are the four most common activities. The ploughing period is referred to as '*arambha*', a kind of land initiation rite for the year. Cultivation and production cycles, like in other parts of India, overlap and are related to various ceremonial and social activities of agrarian communities. The commencement of the cultivation season coincides with the *Ugadi* festival or the new year in south India. During *arambha*, tools and livestock are consecrated via religious ceremonies for the upcoming season. Some farmers believe that tractor use is harmful to soil quality in the long run, resulting in soil hardening and poor moisture retention. Hence, the land is ploughed manually by bullock-driven ploughs. The land is then covered with an assortment of leaves and harvest remnants, including stalks, husks, and coconut fronds. Mulching facilitates moisture retention and soil fertility. Cow dung or *gobra* is then used as a natural fertiliser, either from the farmers' own cattle or procured in tractor loads. Occasionally, dried lake sediments referred to as *kerre mannu* are also applied, since they are thought to enhance soil fertility significantly

The sowing (*bitne*) process begins after the rains. Prior to the abundance of commercially available hybrid seeds, seed conservation was the only way to ensure continued cultivation in subsequent seasons. Seeds conserved from the previous year's harvest would be stored in clay pots between layers of ash and sealed with mud that hardened after drying. This preserved seed quality over extended periods of time and kept pests at bay. Several crop varieties were cultivated at the DGC. As a result, the variety of seed types and the number of seeds to be inspected for the current season made it a time-consuming procedure that would inevitably necessitate additional labour.

The harvest or *katao*, takes several days, depending on the availability of labour. Families and neighbours gather in their fields to perform *Kui*, chopping and harvesting the produce from their stalks. Folk songs are sung during this labouring process. It starts and ends with celebrations, making it a highly sociable occasion. Grain threshing is a labour-intensive post-

harvest procedure. It involves the installation of a threshing yard, which is an open, flat area with enough processing space. Extended family and neighbouring farms help build the threshing yard. Surfaces are patted down, cleaned, and smoothened to facilitate the dehusking and winnowing process. The threshing yard is adorned with *rangoli* patterns before the threshing, while unhusked grain is stacked (*raashi*) into piles. Much of the crop is processed into sacks for consumption or sale at a later date. The rest is symbolically given to labourers, the elderly, and children. Communal celebrations and cooking typically follow, along with cattle veneration rituals.

5.2 Cropping Strategies and Soil Classification

The choice of crop for the season is based on the year's rainfall. Drought resistant crops like Alsande (cowpea) and Jola (jowar/sorghum) are cultivated when rainfall is scarce. Crops are cultivated in mutually advantageous combinations. Mixed cropping is done either in rows or in sporadic patches. One source mentioned planting groundnut and cow pea in rows next to hyacinth beans (*avare)* or pearl millet (*kombu)* as a beneficial combination. Legumes, millets, and oilseeds rows flank the primary crop that takes up much of the field. If a crop fails in a patch, another one is planted, typically a different species, to fill the void.

Soil is categorised based on its characteristics and terrain. *Yere mannu*, for example, is dark and dry, while *Kempu mannu* or red soil is clayey. Mixed soil has both characteristics. Fertile soils next to water bodies where water intensive crops may be grown are called *thota* lands. Previously, the suitability of a soil for a specific crop was determined through trial and error, based on whether or not the crop thrived in that soil type. Fertility and pest control were regulated utilising local plants and shrubs. For example, the *Beli Gida* and *Senabu* (Crotalaria Juncea) shrubs were applied to maximise the soil's fertility. These naturally existing plants would be allowed to flourish in fields. With the approaching planting season, these patches would be chopped in stages to guarantee an intermittent supply of green manure and moisture retention. Wood-ash, either from water heating or cooking, would be sprinkled over the crop as an effective pest control measure. During the *arambha*, or cultivating phase, plants with insecticidal qualities, such as *yekke soppu* (Calotropis gigantea), would be mulched into the soil. Heavy rains, according to one source, are a good pest management measure as running water cleanses the crops of larger pests.

5.3 Livestock Integrated Farming

Integrated farming is a major component of the DGC. Cows, bullocks, goats, sheep, and free-range poultry are typical household assets. Most participants admitted to having owned a larger quantity of bovine livestock in the past. The reason for such high numbers, according to a resident of Kullur village, located near Punajur State Forest, is that the native breeds of livestock are easier to care for. Breeds like *Hallikar* and *Amrit Mahal* are renowned for their incredible usefulness as animal labourers and for producing a reasonable amount of milk adequate for domestic consumption. These breeds are permitted to graze freely in the forest and return to the shelter in the evening on their own. Because of their heat tolerance, they do not need extensive infrastructure like other milch breeds including the Jersey cow. Jersey

cows require more fodder and are less acclimated to the forest's hazards, according to the participants. Livestock ownership demands adequate acreage for housing and feeding cattle. However, not all villages have active access to forest cover, and farmers need to direct livestock to pasturelands. Aside from milk, by-products like excreta are important for dry grain cultivation. Everyone agreed that cow dung is both adequate and necessary for replenishing soil nutrients. Cow dung manure, or *gobra*, is collected in heaps throughout the year and sold by the tractor load to fetch an additional income. Milk from livestock is primarily consumed by the household, with the surplus sold. Cows and bullocks also serve as extra revenue sources. Many farmers use their bullocks as labour on their own fields and hire them out to village residents during ploughing seasons. Additionally, livestock acts as a buffer against financial crises since it may be easily sold to fetch a high price.

5.4 Water Management

Lakes and farm ponds constitute important water sources. Aside from rainfall, the existence of these water bodies is essential for irrigation. Community-built ponds are lined with impermeable rocks to collect rainwater. During intermittent dry spells, this water stored in tanks can alleviate heat stress and prevent the crop from drying before the rains arrive. Pipes connected to lakes may also irrigate fields. Until the advent of water canals and borewells, the decision to cultivate a water-intensive crop like paddy was based on lake levels or land proximity to rivers. Therefore, water intensive crops were not a feasible option. Water management was deployed solely to supplement rainwater for irrigation, with the remainder used for other purposes. Dug wells, however, were important for domestic water supply.

5.5 Food Security and Associated Cultural Practices

All participants stated that until recently produce from their own fields was the primary source of food security. The harvested crop would last them the entire season or more. Over time, this has evolved into cultivating hybrid varieties provided by agricultural extension institutions while growing indigenous varieties in separate plots for family consumption. Many locals believe that 'Naati' or indigenous and local crop varieties are superior both nutritionally and gastronomically.

Staple cereals are presently restricted to the production of sorghum, maize, and ragi. However, numerous other minor millets were cultivated in the past. They included foxtail millet (*navne*), pearl millet (*kombu*), kodo millet (*aranga*), and little millet (*sama*). Paddy was cultivated if a farmer had access to fertile land with a water source. Legumes were extensively cultivated, forming an important nutritional source. Cowpea, pigeon pea, green gram, black gram, horse gram, and kidney beans were among them. Oil seeds like groundnut and niger seed were widely cultivated. Sunflower, mustard, and sesame were also prominent oil seeds in the Chamarajanagar district. These were used to prepare cooking oil for personal use. Castor seeds were among the important fuel sources. Cereals and oilseeds would be milled into flour and oil and then used to prepare a variety of dishes like *dose*, *idly*, *chutney*, *sarrus*, and porridges.

Crop diversity is a critical component of the dry grain farming complex. Farmers are acquainted with four traditional kinds of finger millet: *kempu* ragi, *punna kempu* ragi, *billi* ragi, and *kari-kaddi* ragi, also known as *kappu* ragi. The kappu or black variety of ragi is drought resistant and can withstand delayed rainfall. However, as one farmer explained, it takes 21 days longer to harvest, maturing slowly. Kari-kaddi ragi or black finger millet has been cultivated for many generations, presumably in keeping with the arid climate of the region. Others are preserved and cultivated for ceremonial or dietary preferences. One participant recalled her family farm growing four distinct cowpea varieties, one of which was designated for festivals. Farmers may minimise climate threat and food security risk by learning to strategise and manipulate diversities in the biogenetic traits of crops. The rural diet includes uncultivated indigenous leafy greens known as *soppu*. Species such as *anne soppu* (Celosia argentea L.), *basale soppu* (Basella alba L.), and *aala soppu* may be found growing alongside cultivated plants or sporadically arising in open tracts of unused land. Conventional vegetables, such as potatoes and cauliflower, have recently been introduced into their diet. They have now integrated them into vegetable gardens that are produced on vacant land near dwellings.

Figure 3.2 Plot of uncultivated land with Anne Soppu growing naturally

Commonly referred to as a *kaithota*, the produce is used exclusively for household food requirements. This practice is still prevalent for vegetables, legumes, and spices. Invariably, the produce from them is shared by two or more families.

The commons were vital to the region's food security. People had unrestricted access to surrounding forests. Residents of Kullur, a hamlet near the Punajur State Forest, elaborated on how game such as deer, wild boar and rabbit were hunted. The meat would be consumed regularly in households and was distributed in the village when abundance prevailed. Dried

and salted, the preserved meat would be consumed over several days. When agriculture failed or was not attempted owing to a shortage of rainfall, dried grains from native bamboo shoots were consumed. Beehives from these forests maintained an intermittent if not regular supply of honey. Lake fish were abundant, forming a staple of their meals.

6. LABOUR RELATIONS AND AGRARIAN SOCIAL STRUCTURES

Dry Grain Farming is usually practised without the help of automated machinery. Farm labour, therefore, forms the sole labour resource. In the absence of sufficient labour, lands are left uncultivated for the season. The work is arduous and painstaking. As a result, this resource is negotiated within society in order to accommodate various interests, thus influencing the socio-political dynamics of the region. The average farmer needs to cater to the requirements of his family, locality, and caste connections while ensuring cost-effectiveness.

The family was, by default, the primary source of labour in most farming households. Agricultural activities would be anchored by sons, daughters, mothers, and fathers. Joint family members, likewise, contributed frequently. Participants lauded *mui*, a term for exchange labour under which a household's farm labour would work in another's fields in return for the same. Labour was exchanged with different households on the basis of *samparka* or social connections. This was true for most landed farmers. Relatives and neighbours usually cooked together and stayed over for days until the work was completed. It is possible that *mui* was restricted within caste groups. The erosion of family-based labour activities may be partially attributed to the marginalisation of skill-based labour and lived experiences of the rural communities within the formal education system, along with neoliberal aspirations of belonging to the global market economy (Kumar, 1996; Vasavi 2015).

Hired labour was employed when family and exchange labour were insufficient. People from the village or neighbouring areas were typically included. Unlike *mui*, employing hired labour was not consistently practised across the caste structure. Hired labourers would typically hail from OBC and SC communities including the *Holeyas, Madigas,* and *Kumbaras.* Women were also employed as labourers. According to the participants, lower caste farmers and landless farm labour would be regularly called upon to work on the vast farms of the dominant Lingayat or Brahmin landholders. They were paid in annas and in grain, either as a portion of the harvest or in cash. Breakfast and refreshments would be provided by the hiring farmer. Workers would be summoned from the fields for lunch at the employer's residence. Hired labour was usually employed during major agricultural phases including *arambha,* harvesting, and threshing.

Labourers under the bonded labour system, colloquially known as *jeetha*, were required to remain on the patron's land for extended periods of time without being permitted to leave. Economically distressed labourers would pledge their services for a period of two to four years in exchange for a cash advance. Additionally, they would get two sets of clothes, an

annual stipend of about ten rupees, a place to reside, and grains for survival. Grains were distributed annually in quintals (colloquially known as *pallia*).

The system's patrons, the Lingayats and Brahmins, were known to own extensive tracts of fertile lands (*thotas*). An SC participant, despite being ancestrally landed, credits the Congress government's involvement and subsequent land reforms in the 1970s for loosening the bonded labour system's grip. According to him, even owning marginal, remote, and unproductive property ensured food security to a large extent throughout the year.

The Gowdas (also a dominant caste), who were the biggest landowners, cultivated cash crops like sugarcane, coconut, banana, and tobacco (*hoge soppu*) on *thota* lands. Because they had already guaranteed their grain supply for the year via dry land farming, the produce from these fields commanded a premium in the markets. They usually stood for elections, dominating the two parties in the village, and were among the few communities with access to higher education. Resources, too, were allocated to the dominant and upper castes. Lakes, for example, were separated by caste. Large lakes were assigned to dominating and high caste groups, while the smaller ones were allotted to lower caste communities. Only if a designated water body had run dry could one withdraw water from another community's lake. Ecological constraints compelled such concessions under rigid caste norms. For instance, the mineral composition of one section of the lake made it ideal for washing clothes. Therefore, all washing of clothes would transpire in a single area regardless of caste. Ownership and quantity of wells relied on a farmer's social and economic assets within the community. Similarly, only a few dominating caste households had access to the multiple electricity-powered wells. A meeting with women grazing cattle from the Puttanpura village revealed that the latter did not work on farms except to care for livestock. The reason for this, according to observers of the discussion, is because Puttanpura is home exclusively to Lingayats, a dominant caste in Karnataka. Due to their greater wealth and ability to employ labour, Lingayat women do not work in the fields. SCs and other lower caste women, on the other hand, need to juggle both household responsibilities and farm activities.

6.1 Market Access

Commercial relations with neighbouring states, too, influenced cultivation choices. The youth of the village would regularly migrate to Kerala for harvesting coffee in estates. Sunflower and groundnut were cultivated for sale in Tamil Nadu. Chandmalige (marigold) flowers, prominent in Hindu festivities, have lately been embraced as a regular crop in certain areas, with farmers unearthing lucrative markets in Kerala. They have also proliferated owing to the proximity of factories that manufacture garlands.

Farmers manufactured a range of products for home consumption that were sourced from their farms and commons. A small percentage of grains and oilseeds would be processed into flour and oil with the assistance of family and exchange labour. Due to the physically demanding nature of the job, the bulk of raw grain such as ragi and rice was transported to mills and returned as flour. Selling produce, such as oil seeds, directly to the mill would provide income. Farmers were often unaware of any mechanism for determining what would

be returned as processed commodities in exchange for the crops processed at these mills. As a result, disproportionate returns would occur. As one participant elucidated, '*we would give ten kgs of grain and get back only four kgs of flour'*. This was after having accounted for the weight loss of the entire grain bulk. Mills were generally seen as unfair institutions. Nonetheless, flour and oil mills were critical from a food security and commercial standpoint. Local agents sold surplus food harvests on behalf of big traders known as *dalals*. The *dalals* could be located in neighbouring states as well. They would visit farms and inquire about the food, its quality, and so on. Price negotiations would take place, and the agent would generally arrange for transport. According to the participants we interviewed, APMCs were not directly accessed...

Cottage or local artisanal industries, supporting the local economy, were not as prevalent. The informants questioned were unable to recall many styles of artisanship that existed in the present or even in the distant past. However, bamboo weavers who create baskets and winnowing fans from locally sourced bamboo and reeds continue to reside in Nagavalli. With the widespread use of plastics in nearby markets, demand for their goods has fallen precipitously. Farmers would engage their labour in brick production as an alternative source of employment when the land was not farmed in anticipation of a drought scenario.

7. FACTORS CONTRIBUTING TO THE STRUCTURE OF DGC AND ITS SUBSEQUENT EROSION

It is a known fact that agricultural income is no longer seen as lucrative, both from a policy and an individual perspective. Increasing costs, aided by declining local output and integration into larger economies, have raised the need for money to satisfy basic consumer needs. The promise of a comfortable life away from the hardships and toil of farming continues to entice rural youth into cities. The current environment discourages what is referred to as 'bisilu' work, or work in the sunlight, in favour of 'neralu' work, or work in the shades or enclosed urban office settings. In fact, just being associated with towns, even for menial occupations, is seen as preferable to taking up farming as a full-time profession.

The erosion of the Dry Grain Complex reflects, in many ways, the decline of small farming itself. Perhaps the foundations of small farming are crumbling. In many ways, it resembles a chain reaction leading to the irreversible decline of the complex. Four key pillars that support the Dry Grain Complex, presently under threat, are described below:

a) Loss of family labour: Family labour on farms has become intermittent. Family downsizing and property fragmentation are other causes. Some are able to organise labour only during peak periods like the ploughing season. Some farmers postpone agriculture for a season due to a lack of able-bodied labourers, while others cease farming entirely by leasing their fields. Furthermore, community-based activities erode with time when social networks are strained by distance and extended absences. A farmer from Kokkanahalli explained that threshing yards created through community efforts are increasingly hard to come by. He now threshes his ragi on the highway asphalt, where automobiles speed past. He added that he hires labour from

within and around the village, an increasingly difficult feat. Therefore, labourers require to be transported from far off villages at his cost..

Figure 4. A farming couple threshing harvest by the roadside. They must wait until all vehicles have passed to avoid the husks blowing into oncoming traffic

b) Uncoupling of livestock from farming: The ability to maintain a sizeable cattle is contingent on the availability of family labour to care for them. Families have little option but to sell them due to the migration of mainly males to cities. As a result, homegrown manure from cattle is no longer accessible, forcing farmers to purchase it or rely on chemical fertilisers. This incentivises the cultivation of hybrid varieties. The farmers expressed an interest in returning to traditional fertilisation methods such as using gobra or cow dung, but were unable to do so due to the sale of their livestock.

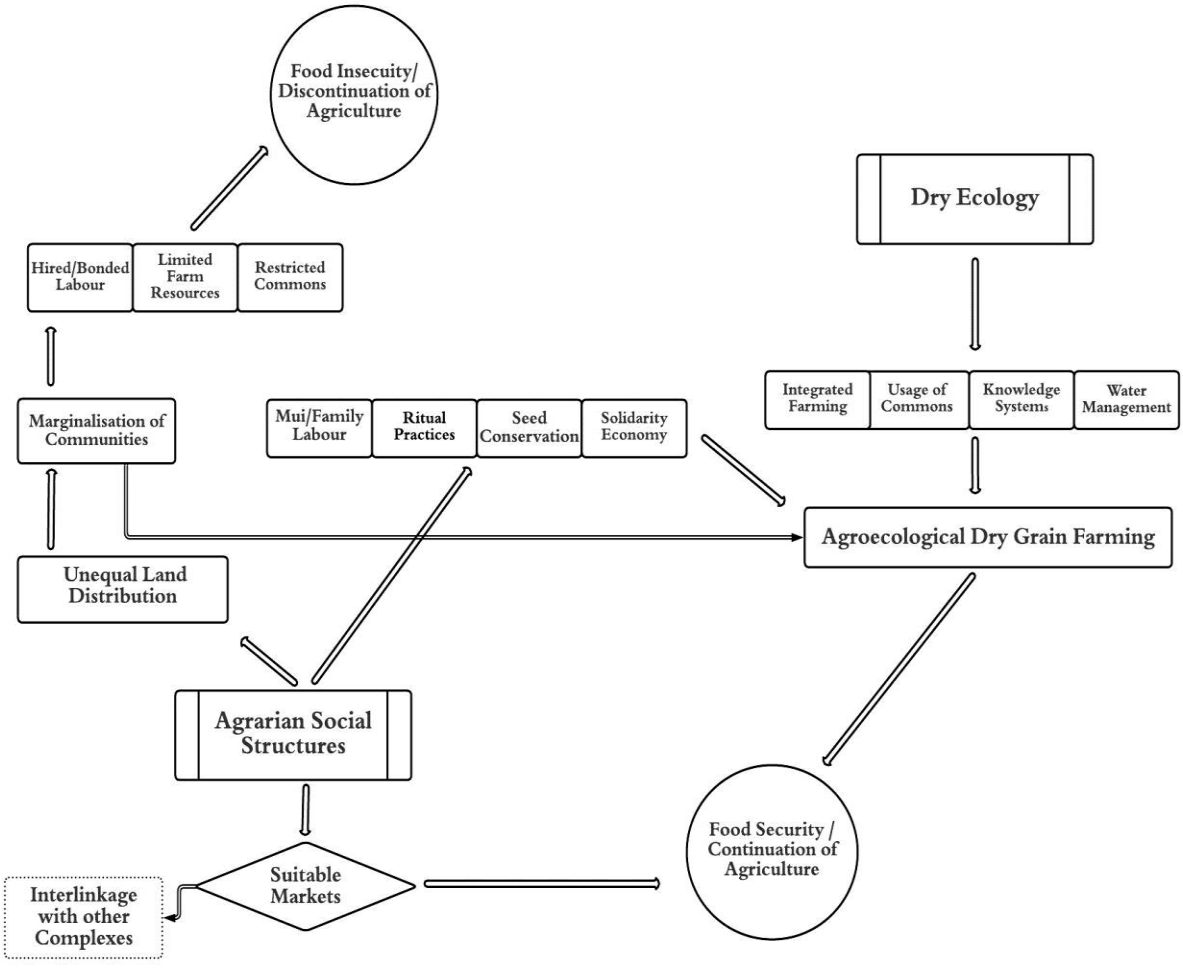
c) c) Lack of access to commons: Fodder, which is difficult to acquire due to the closure of common pastureland, including forests, now has to be purchased. Nutritionally, these limitations have impoverished rural cultures relying on woods for greens, fruits, and meat. There is no collective incentive to maintain or repair lakes when borewells serve as the dominant source of irrigation. In fact, dried lakes may be more beneficial to farmers because of the fertile silt that can be extracted from the bed. The presence and consumption of wild uncultivated greens such as *jawana soppu* and *hooli soppu* have also declined. Rural diets now include conventional vegetables and greens like spinach. Farmers and their families now subsist on ‘society’ food, which refers to food from ration shops where rice grains and legumes are of questionable quality. Crops that would normally be cultivated on their own land are acquired from marketplaces in the absence of rain.

d) Diminished seed conservation practices: The advent of ‘packet seeds’ or hybrid seeds from extension institutions has progressively eroded the tradition of preserving and

exchanging seeds. What was once a co-operative practice in which farmers stored and shared seeds is now virtually non-existent. This has resulted in the extinction of indigenous cultivars and total reliance on extensions institutions for seeds. The high input requirements of many crop cultivars reinforce farmers' reliance on fertiliser and irrigation companies in drought-prone regions.

The figure below summarises various components of the DGC. It includes two major components: the distinct ecology of the area and the seasonal continuity of agriculture. On the other hand, the socio-ecology of agrarian structures generates both sustaining and regressive processes within the complex through community organisation and cultural norms.

Figure 5. 3 Components of DGC



8. DGC: CAN ECOLOGICAL PRACTICES BE PRESERVED WHILE REMOVING CASTE-BASED EXPLOITATION?

It is evident that the DGC starts from a precarious position in terms of a region's ecological conditions. The region is hot and semi-arid, with moderate to low rainfall and soil morphology that varies in soil fertility. Thus, the creation of a knowledge system unique to

the environment and biodiversity was required in order to exploit the land to its full potential, using every component of the ecosystem. The usage of indigenous crop varieties in mixed cropping patterns would have preserved the natural biodiversity of the region, including local plant, insect, microbial, and animal life. This biodiversity, in turn, strengthened the nutritional content of the soil and increased its resilience to disease via linked biophysical processes. Farmers used all available biomass on their plots/farms due to the scarcity of resources and limited land. This comprised crop residue, agroforestry by-products, and livestock waste. Because this was not a wealthy economy, a diverse agroecosystem was required to satisfy basic consumption needs. Crop diversity was maintained through conscious efforts at seed conservation and mixed cropping to actively aid disease resistance and soil health. Hence, ecological diversity is not only present in the environment but is also ingrained in the community's practices.

The practices described under DGC may be classified as one of the forms of agro-ecology. Altieri (2002) defines agroecology as "the application of ecological concepts and principles to the design and management of sustainable agroecosystems". Based on the 2019 HLPE study and the FAO's expansion of the principles of agroecology, we may observe the following features: minimal input reliance, recycling of biomass, soil health, maintenance and enhancement of biodiversity, economic diversification, integration of social values and local diets, and co-creation of knowledge covering horizontal knowledge and innovation sharing. Dry grain farming, as practised in this complex, does not require depletion of groundwater, nor does it encounter vicious cycles of crop production and resource exhaustion as intensive monocropping farms do. However, we argue that DGC extends beyond a merely environmental understanding of agroecology in the West to include related cultural practices. Instead of pushing for a blanket 'agro-ecological agriculture' in the context of climate change, it is important to acknowledge the validity of various regional 'agricultural complexes' and tweak them according to local circumstances and requirements.

The socio-cultural dimensions of the DGC and other forms of agro-ecological practices must all be recognised. All significant agricultural events occurred in conjunction with festivals that included rituals and social activities that farmers believed were integral to cultivation. From our description, elements of production like implements and livestock as well as production sites, that is, the land itself, were held in high regard and credited with supplying life-sustaining nourishment. As with the practice of *mui*, small communities negotiated labour based on mutual need and support. The emergence of what may be described as a solidarity economy is apparent when in the face of resource constraints, collective social goals take precedence over individual profit. Land, labour, capital, and end products are not considered distinct; rather, they are interwoven into processes that guarantee agriculture's current existence and continuance, with a strong emphasis on life and community.

Figure 6. Her children having migrated to the city, an elderly farmer harvests her fields by herself

Simultaneously, caste norms combined with political restrictions have created inequitable social arrangements and land access. Fertile lands were cornered by dominant and upper caste groups. While these major landholders switched to wet farming and were able to capitalise on the Green Revolution's high productivity paradigm, small and disadvantaged farmers were stuck with the default method of conventional agriculture. Hill (1982) observed a cycle of inequity in the dry farming communities of Hausaland and South Karnataka as a result of inequitable landholding size. This, she noted, resulted in significant income disparities between large and marginal landholders. Large landholders were able to diversify their operations away from the exclusive cultivation of food grains by leveraging urban sector investments as well as educational and political possibilities due to relatively larger quantities of output. Marginally landed farmers, on the other hand, relied on their land's produce for basic consumption, working as casual labour at times with little opportunity for social or economic mobility. In the current scenario, one class of farmers is continuously attempting to move beyond dry grain farming in order to implement input-heavy, wet cultivation with higher yields, while the other class clings to it for survival. This vulnerability is accentuated in the case of labourers employed under the bonded labour system or *jeeta*, which, unlike hired labour, was focussed on repaying debts to landowners as opposed to earning a living (Gurumurthy, 1977). Because of the interdependence of labour and credit, these farmers were unable to devote much time to their own fields. As mentioned previously, DGC is a labour-

intensive practice, with the family serving as the primary source of labour. Production levels are hindered or abandoned since fewer members are available to cultivate existing land in activities such as land preparation and harvesting. As a result, their food and basic consumption are becoming more reliant on wage labour (Naranjo 2011).

9. CONCLUSIONS

Dry grain farming, which is often practised in places that rely heavily on rainfall, may appear to be associated with low production and non-capitalised agricultural systems. Consequently, dry agriculture is often seen as an inferior mode of cultivation with low yield capabilities; it is believed that its implementation results in economic vulnerability (Handy, 2009). However, the reverse is true: dry grain farming can be suitably altered to act as a safeguard against ecological depletion and also ensure the viability of small and marginal farmers. Through its adaptability and modest input needs, the DGC has aided marginalised small farmers and landless labourers. The DGC continues to exist today, assisting farmers when modern agricultural methods cease to be profitable. Hill (1982) likened the dry cultivation practices in south Karnataka to those in the Hausa area of Nigeria, expanding on the degree to which low but guaranteed output was critical to these fragile ecological regions. Similarly, marginal land plays a vital role in guaranteeing food security for small landowners in Chamarajanagar.

Although derived mostly from a field study in which participants rebuilt or recalled the area's dry cultivation patterns, the DGC is still partly alive today and practised alongside input-intensive agriculture in contemporary forms. It is important to note that DGC has undesirable characteristics in the form of caste relations that largely define iniquitous land arrangements and labour relations. However, we must assess what beliefs and practices are practical and appropriate to our present circumstances. As we have seen, traditional agrarian systems are not merely built on isolated agricultural techniques but are linked to complex social structures that constantly interact within an ecological context. These social structures, especially those relating to the use of labour and distribution or access to the produce, cannot be recovered in their original shape, which may be for the best. However, we may draw lessons from some of its ethical ethos and the social objectives it seeks to achieve including food security, self – reliance, and environmental stewardship.

Finally, a concentrated emphasis on local agrarian complexes requires systemic support at many levels. It is worth considering how to improve links between local production and consumption. How can public institutions support decentralised forms of distribution and village-based value-addition units? And finally, what farming and marketing processes would enable farmers to form collectives to facilitate climate responsive practices including bundings, farm ponds, and mixed cultivation? Such initiatives must be developed and conceptualised promptly to address present climate crises and environmental degradation.

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