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THE IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS LIVELIHOOD

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CHAPTER – I

INTRODUCTION AND CONCEPTUAL FRAMEWORK

1.1 INTRODUCTION

"The backbone of any country is its farmers. Their hard work and dedication ensure food security and economic stability."

- Dr. A.P.J. Abdul Kalam

Agriculture remains the backbone of many economies, particularly in developing nations, where a significant portion of the population relies on farming for sustenance and income. Farmers are in grave danger due to environmental shocks because their livelihood is so dependent on agriculture for the country's economy and food supply. However, farmers are increasingly vulnerable to environmental shocks, such as droughts, floods, cyclones, extreme temperatures, and pest infestations. These shocks disrupt agricultural production, affect food security, and threaten the livelihoods of farming communities (FAO, 2021). Farmers play a vital role in sustaining agriculture, which is the backbone of food security, rural livelihoods, and national economies. As primary food producers, farmers ensure the availability of essential crops and livestock products that feed millions of people globally. They are stewards of the land, preserving biodiversity, maintaining soil health, and managing natural resources for sustainable agricultural practices. Small-scale and subsistence farmers, in particular, contribute significantly to the global food supply while supporting local economies. Beyond production, farmers act as custodians of traditional agricultural knowledge and practices, often passed down through generations. Despite their critical contributions, farmers face numerous challenges, including limited access to resources, fluctuating market prices, environmental shocks, and inadequate support systems. Addressing these challenges is essential to empower farmers, enhance agricultural productivity, and ensure the sustainability of global food systems. Recognizing and supporting the role of farmers is key to fostering resilient and equitable agricultural development.

Environmental shocks have direct and indirect consequences on farmers. Directly, they cause crop failures, soil degradation, water scarcity, and livestock loss, leading to reduced agricultural output and income instability. Indirectly, they contribute to increased debt burdens, rural-to-urban migration, social distress, and economic uncertainty (IPCC, 2022). In many developing countries, inadequate access to crop insurance, government support, and adaptive farming techniques worsens the impact, leading to declining rural livelihoods and food insecurity (UNDP, 2020). Smallholder farmers, who often lack financial resilience and access to advanced agricultural technologies, are disproportionately affected by these shocks (World Bank, 2020). The impact of environmental shocks is further aggravated by climate change, which intensifies the frequency and severity of extreme weather events. Unpredictable rainfall patterns and rising temperatures disrupt traditional farming cycles, making adaptation increasingly difficult (UNEP, 2021). Additionally, inadequate institutional support, limited access to financial aid, and weak disaster preparedness mechanisms hinder farmers' ability to recover from environmental shocks (UNDP, 2022).

Understanding the dimensions of environmental shocks and their socio-economic effects on farmers is crucial for developing resilient agricultural systems and sustainable adaptation strategies. Policies that promote climate-resilient crops, efficient irrigation systems, early warning mechanisms, and financial assistance can help mitigate the adverse effects of environmental shocks on farmers' livelihoods (FAO, 2023). Moreover, the cascading effects of environmental shocks extend beyond immediate agricultural losses, affecting the broader rural economy and social fabric. When farmers face repeated climate-related disasters, they often resort to distress coping mechanisms such as selling livestock, reducing food consumption, or migrating to urban areas in search of alternative employment (FAO, 2022). This displacement not only disrupts rural communities but also increases urban poverty and unemployment. Additionally, smallholder farmers, who contribute significantly to food security, struggle to recover due to limited access to financial aid, credit, and risk management tools (World Bank, 2023). Without adequate support systems, these shocks perpetuate cycles of poverty, inequality, and reduced agricultural investment, making it imperative for policymakers to implement climate-resilient farming strategies and strengthen institutional support for affected farmers.

1.2 AGRICULTURE AND FARMERS

Agriculture is the backbone of rural economies, providing food, employment, and economic stability to millions of farmers worldwide. Agriculture is a fundamental sector that sustains global food production and livelihoods, particularly in rural areas where farming is the primary source of income. It encompasses diverse activities, including crop cultivation, livestock management, agro forestry, and fisheries, each playing a crucial role in ensuring food security and economic stability (FAO, 2016). However, farmers worldwide face multiple challenges, such as climate change, erratic weather patterns, soil degradation, water scarcity, and declining biodiversity, all of which threaten agricultural productivity (IPCC, 2019). Smallholder farmers, who make up a significant portion of the agricultural workforce, often lack access to modern technology, quality seeds, irrigation facilities, and financial services, further exacerbating rural poverty (Barrett, 2008). In addition to environmental constraints, market fluctuations, price volatility, and unfair trade practices make farming a financially unstable occupation (World Bank, 2021).

Government interventions, including subsidies, crop insurance, minimum support prices, and rural development programs, are critical in safeguarding farmers' incomes and promoting

agricultural sustainability (OECD, 2020). Technological innovations such as precision farming, genetically modified crops, climate-smart agriculture, and digital platforms for market access have the potential to transform farming practices, improving efficiency, resilience, and profitability (Pingali, 2012). Moreover, sustainable agricultural practices, including organic farming, agro ecology, and conservation agriculture, have gained global attention as viable solutions to enhance soil health and biodiversity while ensuring long-term productivity (Pretty et al., 2018).
Beyond economic and environmental factors, social and institutional support systems, including farmer cooperatives, access to education, and gender-inclusive policies, play a vital role in strengthening agricultural livelihoods (Ellis, 2000). Women, who constitute a significant proportion of the agricultural workforce, often face structural barriers such as land ownership restrictions and limited access to financial resources, further exacerbating gender disparities in rural development (Agarwal, 2014). Addressing these challenges requires a holistic approach that integrates sustainable policies, investment in rural infrastructure, climate adaptation strategies, and inclusive agricultural reforms to ensure a resilient and thriving agricultural sector.

1.2.1. IMPORTANCE OF AGRICULTURE

Agriculture plays a crucial role in the economic and social development of rural areas, serving as the primary source of income, employment, and food security. In many developing countries, rural economies are predominantly agricultural, with a significant portion of the population engaged in farming, livestock rearing, and allied activities. The sector not only provides livelihoods but also supports industries such as food processing, transportation, and trade. One of the key contributions of agriculture to rural economies is employment generation. Small and marginal farmers, along with agricultural laborers, depend on farming for their survival. Additionally, agriculture supports rural non-farm activities like agro-based industries, dairy farming, and handicrafts, further boosting economic stability. Moreover, agriculture ensures food security by supplying essential crops and livestock products, reducing dependence on imports, and stabilizing food prices. The sector also plays a critical role in maintaining ecological balance by promoting sustainable land use, water conservation, and biodiversity preservation.

Beyond economic benefits, agriculture fosters rural development by improving infrastructure, education, and healthcare facilities through increased income and government support. Investments in modern farming techniques, irrigation, and agro-processing industries can transform rural economies, enhancing productivity and resilience to environmental shocks. As a result, strengthening agriculture remains essential for reducing poverty, promoting inclusive growth, and ensuring long-term sustainability in rural regions.

1.3 FARMERS LIVELIHOOD

The livelihood of farmers is the foundation of food production, rural economies, and national development. It encompasses various economic, social, and environmental factors that determine the well-being of those engaged in agriculture. More than 60% of India's population depends directly or indirectly on agriculture for their livelihood. However, farmers face numerous challenges, including climate change, fluctuating market prices, land degradation, and access to technology and financial resources. Ensuring sustainable and secure livelihoods for farmers is crucial for food security, poverty reduction, and overall economic stability. Farmers' livelihood refer to the means and resources that enable farmers to sustain their daily lives, meet their economic needs, and secure their well-being. It encompasses various aspects, including income generation, access to natural resources, availability of farming inputs, and social and economic stability. A farmer’s livelihood is shaped by multiple factors such as land ownership, agricultural productivity, market access, climatic conditions, government policies, and financial security.

A sustainable livelihood for farmers involves the ability to produce sufficient food and generate a stable income while adapting to environmental changes and economic challenges. It also includes access to education, healthcare, and social support systems, which contribute to an improved quality of life. However, factors like environmental shocks, market fluctuations, and lack of technological advancements can threaten the sustainability of farmers’ livelihoods, making resilience-building strategies essential for long-term agricultural sustainability.

1.3.1. IMPORTANCE OF FARMERS' LIVELIHOOD

Food Security & Nutrition:

- Farmers produce the food that feeds the world. A stable and prosperous farming sector ensures a reliable food supply.
- Without proper income, farmers may abandon agriculture, leading to food shortages and price hikes.

Economic Growth & Employment:

- Agriculture contributes significantly to the GDP, especially in agrarian economies like India.
- A strong agricultural sector creates employment in farming, food processing, transportation, and related industries.

Rural Development & Poverty Reduction:

- Farming communities are the backbone of rural areas, contributing to infrastructure, education, and healthcare development.
- Strengthening farmers' livelihoods helps reduce migration to cities and improves living standards in villages.

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Environmental Sustainability:

- Farmers are key to maintaining biodiversity, protecting soil health, and managing natural resources.
- Sustainable farming practices help combat climate change and ensure long-term agricultural productivity.

1.3.2. FACTORS AFFECTING FARMERS LIVELIHOOD

Farmers livelihoods are influenced by a variety of factors that determine their income, productivity, and overall well-being. These factors can be broadly categorized into environmental, economic, technological, social, and policy-related aspects. Understanding these influences is essential for developing strategies to enhance farmers' resilience and sustainability.

1. **Environmental Factors**

Climate Change and Weather Variability**:** Unpredictable weather patterns, including droughts, floods, and extreme temperatures, negatively impact crop yields and livestock health (FAO, 2016).

Soil Degradation and Land Productivity: Soil erosion, nutrient depletion, and deforestation reduce agricultural productivity and force farmers to rely on chemical inputs, increasing production costs.

Water Availability and Irrigation: Water scarcity and inefficient irrigation methods affect crop growth, particularly in arid and semi-arid regions (IPCC, 2019).

Pest and Disease Outbreaks: Invasive pests and crop diseases reduce yields, leading to financial losses and food insecurity.

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2. Economic Factors

Market Access and Price Volatility: Farmers often struggle with unstable crop prices due to supply-demand fluctuations, international trade policies, and middlemen exploitation (Barrett, 2008).

Access to Credit and Financial Services: Limited access to loans, high-interest rates, and lack of collateral prevent smallholder farmers from investing in better seeds, equipment, and fertilizers.

Cost of Inputs: The rising cost of seeds, fertilizers, pesticides, and farm machinery reduces profit margins for farmers, making agriculture less sustainable.

Rural Infrastructure: Poor road networks, lack of storage facilities, and inadequate transportation systems lead to post-harvest losses and inefficiencies in the supply chain (World Bank, 2021).

3. Technological Factors

Adoption of Modern Farming Techniques: The use of precision agriculture, digital tools, and mechanization can improve productivity, but many farmers lack access to these technologies due to high costs and lack of training (Pingali, 2012).

Research and Development: Limited agricultural research and slow dissemination of improved farming methods hinder productivity growth in many developing regions.

Extension Services and Knowledge Transfer: Weak agricultural extension services prevent farmers from accessing crucial information about sustainable farming practices and technological innovations.

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4. Social and Institutional Factors

Land Ownership and Tenure Security: Insecure land tenure discourages long-term investment in farming and limits access to credit facilities (Ellis, 2000).

Education and Skill Development: Farmers with limited education and technical knowledge struggle to adopt improved agricultural practices and market opportunities.

Gender Inequality in Agriculture: Women, who constitute a significant proportion of the agricultural workforce, often face challenges such as lack of land rights, limited access to finance, and exclusion from decision-making processes (Agarwal, 2014).

Rural-to-Urban Migration: Youth migration to cities in search of better economic opportunities reduces the agricultural labor force, affecting productivity and food security.

5. Policy and Governance Factors

Agricultural Policies and Subsidies: Government policies on subsidies, minimum support prices, and input assistance play a crucial role in shaping farmers' profitability and stability (OECD, 2020).

Trade Policies and Globalization: International trade agreements, import/export restrictions, and competition from large agribusinesses affect local farmers' market competitiveness.

Access to Social Protection and Insurance: Crop insurance, weather-based insurance schemes, and rural development programs can help farmers mitigate risks associated with natural disasters and market uncertainties.

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1.3.3. STRATEGIES FOR ENHANCING FARMERS LIVELIHOOD

- ✓ Adoption of climate-resilient farming practices
- ✓ Developing Rural Infrastructure
- ✓ Ensuring Land Tenure Security
- ✓ Promoting digital technology in agriculture
- ✓ Capacity Building and Skill Development
- ✓ Diversification of Income Sources
- ✓ Efficient Water Management
- ✓ Sustainable Soil and Land Management
- ✓ Research and Innovation in Agriculture
- ✓ Promoting Organic and Niche Farming
- ✓ Promoting Agroforestry and Sustainable Land Use
- ✓ Encouraging Farmer Producer Organizations (FPOs)
- ✓ Increasing access to financial services and insurance
- ✓ Leveraging Public-Private Partnerships (PPP)
- ✓ Enhancing Women's Participation in Agriculture
- ✓ Strengthening farmer cooperatives and market linkages
- ✓ Improving Agricultural Extension Services
- ✓ Strengthening Government Policies and Support Systems

1.4. ENVIRONMENTAL SHOCKS

"The future of food security depends on the resilience of farmers to climate change and environmental shocks."

- United Nations (UN)

Environmental shocks are sudden, significant changes to the environment that can impact people. These changes can be natural disasters or man-made events. They are such as storms, floods, droughts, earthquakes, forest fires, and accidents.

Figure 1.1 represents the high impact of environmental shocks

Environmental shocks, particularly the high impact natural disasters, such as floods, hurricanes, droughts, earthquakes etc. affect an average of 224 million people worldwide per year (Samhsa, 2018). According to EM-DAT (2020), 6,681 environmental disasters over the last twenty years between 2000 and 2019 have claimed approximately 1.23 million lives, an average of 60,000 per annum, and affected a total of over 4 billion people (many on more than one occasion). In contrast, 3.2 billion people were affected and 995,330 people died by 3,656 environmental disasters (47% due to drought or flood) between period 1980-1999 with economic losses totaled US$ 1.63 trillion. The number of people affected by disasters, including injuries and disruption of livelihoods, especially in agriculture, and the associated economic damage are growing. In the meantime, effects of climate change are being evident in the increased frequency of extreme weather events including heat waves, droughts, flooding, winter storms, hurricanes and wildfires (Currie & Deschênes, 2016).

Environmental shocks have significantly impacted agricultural farmers, severely affecting their livelihoods. Disasters such as floods, droughts, hurricanes, and heat waves directly disrupt farming activities, leading to:

- *Crop Failure:* Droughts and floods reduce agricultural productivity, affecting food security.
- *Livestock Losses:* Extreme weather events cause the death of livestock, reducing farmers' income.
- *Soil Degradation:* Floods and hurricanes erode fertile soil, reducing long-term agricultural potential.
- *Economic Losses:* Farmers face financial distress due to crop destruction and rising input costs.
- *Displacement:* Severe disasters force farmers to migrate, impacting rural economies.

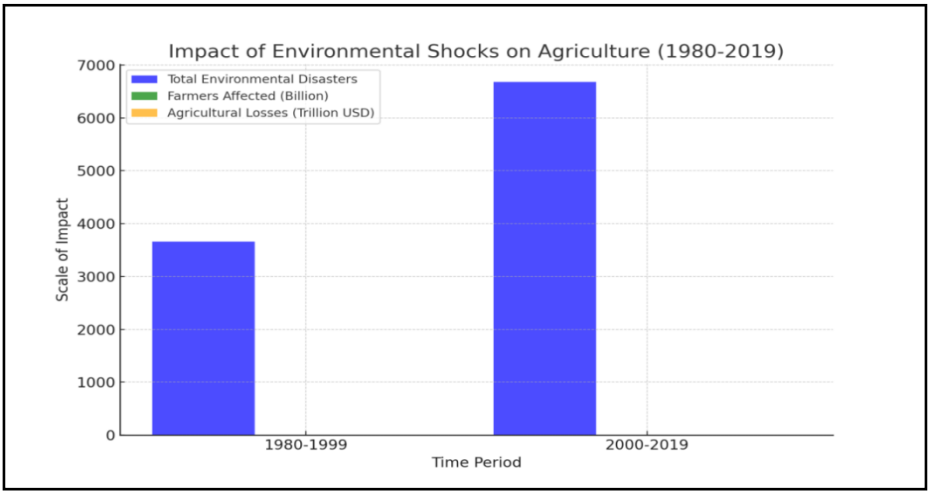

Figure 1.2 representing the impact of environmental shocks over the two periods and the environmental shocks with their impact on agricultural farmers i.e. the number of farmers affected and the agricultural loses.

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1.5. IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS IN TAMIL NADU

Tamil Nadu, a state heavily dependent on agriculture, has been significantly affected by environmental shocks such as droughts, cyclones, and erratic monsoons. These extreme weather events disrupt farming activities, leading to crop failures, soil degradation, and water shortages, which severely impact farmers' livelihoods (Tamil Nadu State Action Plan on Climate Change, 2021). For instance, the severe drought of 2016-2017, one of the worst in 140 years, resulted in drastic declines in agricultural productivity, with many farmers facing financial distress and debt accumulation (Goswami, 2018). Additionally, cyclones like Gaja (2018) and Nivar (2020) caused extensive damage to crops, livestock, and infrastructure, pushing farmers further into economic hardship. The unpredictable nature of monsoon rains has also led to inconsistent water availability, making irrigation-dependent farming increasingly challenging (IMD, 2022).

Beyond economic losses, environmental shocks have also contributed to severe social and psychological distress among Tamil Nadu’s farming communities. The uncertainty of income and increasing debt burdens have led to rising farmer suicides, with reports indicating that Tamil Nadu has one of the highest numbers of farmer suicides in India (NCRB, 2021). Migration to urban areas in search of alternative livelihoods has increased, leading to the gradual decline of traditional farming practices (MSSRF, 2020). Small and marginal farmers, who form the majority of Tamil Nadu's agricultural workforce, are the most vulnerable due to their dependence on monsoon-fed farming and lack of access to modern irrigation facilities. To mitigate these challenges, policy measures such as crop insurance schemes, sustainable water management, and climate-resilient farming practices are essential. Without urgent interventions, the increasing frequency of environmental shocks will continue to threaten the agricultural sector and the well-being of farmers in Tamil Nadu (Government of Tamil Nadu, 2022).

The following graph showing how environmental shocks (such as droughts, cyclones, and erratic monsoons, etc..,) have impacted Tamil Nadu farmers over time. The graph can include:

1. The number of major environmental disasters (droughts, cyclones, floods, etc.), in Tamil Nadu.
2. The number of farmers affected by these disasters.
3. Economic losses in the agricultural sector due to these shocks.

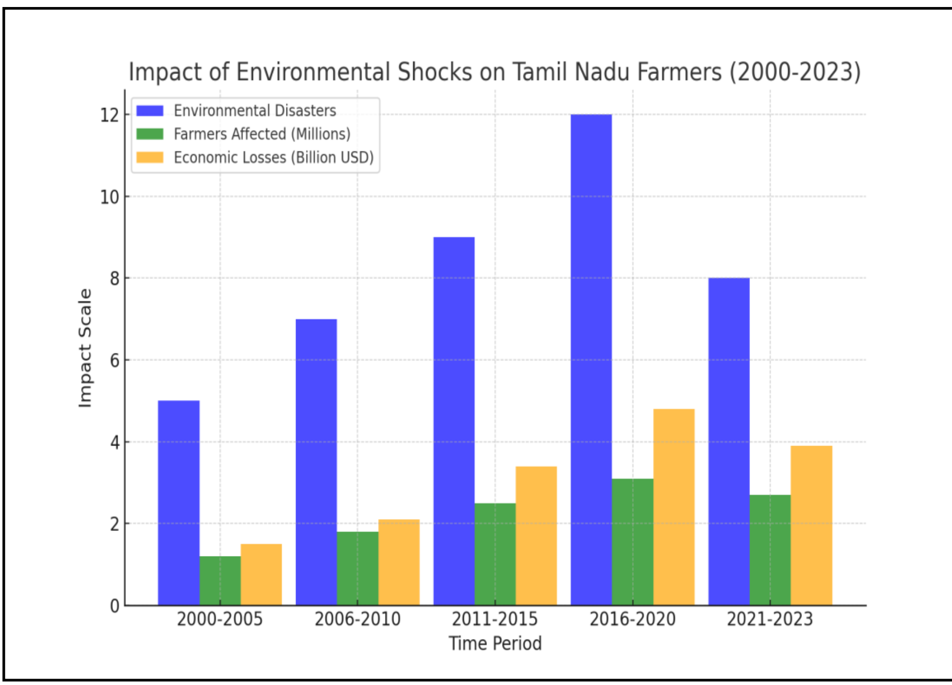

Figure 1.3 representing the impact of environmental shocks on Tamil Nadu farmers and the number of farmers affected and the economical loses in the agriculture sector.

1.6. UNDERSTANDING ENVIRONMENTAL SHOCKS AND THEIR CONSEQUENCES

Environmental shocks can be classified into two main types:
Acute Shocks – These are sudden events like floods, hurricanes, or wildfires that cause immediate destruction to crops, livestock, and infrastructure (FAO, 2021).
Chronic Shocks – These are long-term environmental changes, such as rising temperatures, decreasing soil fertility, and water scarcity, which gradually erode agricultural productivity (IPCC, 2022).

The impact of these shocks on farmers is multidimensional, affecting various aspects of their livelihood:

- ***Economic Impact:*** Loss of crops and livestock leads to financial instability, pushing farmers into poverty and debt cycles (Dercon, 2004).
- ***Food Security:*** Reduced agricultural output leads to higher food prices and malnutrition, affecting not just farmers but entire communities (FAO, 2018).
- ***Migration & Displacement:*** Many farmers are forced to abandon agriculture and migrate to urban areas in search of alternative livelihoods (Hansen et al., 2020).
- ***Health & Well-being:*** Increased exposure to extreme weather events raises health risks, including heat stress and waterborne diseases (WHO, 2019).

1.7. CASE STUDIES: REAL-WORLD IMPACTS OF ENVIRONMENTAL SHOCKS

- **The Indian Agrarian Crisis (2016-2020):** Consecutive droughts in states like Maharashtra and Karnataka severely affected small-scale farmers, leading to increased suicides due to financial distress (Mishra, 2021).

- **The 2019 Mozambique Cyclone Idai:** Destroyed over 700,000 hectares of farmland, leaving thousands of farmers without food or income (World Bank, 2020).
- **The Australian Bushfires (2019-2020):** Devastated millions of acres of farmland, causing billions in losses and forcing farmers to reconsider their future in agriculture (CSIRO, 2021).

1.7.1. CASE STUDIES: INDIA AND TAMIL NADU - IMPACTS OF ENVIRONMENTAL SHOCKS

The 2015 Chennai Floods (Tamil Nadu, India)

- Heavy rainfall caused by the Northeast Monsoon led to severe flooding in Chennai and nearby agricultural regions.
- Thousands of acres of farmland were submerged, destroying crops like paddy, sugarcane, and vegetables.
- Many farmers suffered heavy financial losses due to a lack of crop insurance and post-harvest storage facilities (IMD, 2016).

The 2016 Tamil Nadu Drought

- One of the worst droughts in decades, caused by monsoon failure, leading to severe water scarcity for irrigation.
- Farmers in the Cauvery Delta region suffered as groundwater levels dropped drastically.
- Crop failures led to widespread farmer protests demanding loan waivers and better water management policies (The Hindu, 2017).

Cyclone Gaja (2018) – Tamil Nadu

- Affected over 3.4 lakh hectares of agricultural land in districts like Nagapattinam, Thiruvarur, and Thanjavur.
- Coconut plantations were heavily damaged, leading to long-term economic hardship for farmers.
- Infrastructure destruction (roads, irrigation systems) disrupted farming activities (NDMA, 2019).

The 2019 Bihar and Assam Floods (India)

- Unprecedented floods submerged farmlands, leading to crop loss and food insecurity.
- Farmers were forced to migrate in search of alternate livelihoods due to repeated climate shocks (NDTV, 2019).

The 2021 Maharashtra Unseasonal Rains

- Unseasonal rainfall during the harvest period damaged standing crops like cotton, soybean, and onions.
- Farmers faced financial distress due to poor compensation and inadequate insurance coverage (ICAR, 2021).

Cyclone Mandous (December 2022)

- In December 2022, Cyclone Mandous made landfall near Mamallapuram, Tamil Nadu, bringing heavy rainfall and strong winds. The cyclone caused extensive damage to agriculture, particularly affecting paddy fields, horticultural crops, and orchards.
- The heavy rains led to water logging in low-lying areas, resulting in crop inundation and loss.
- Additionally, approximately 400 trees were uprooted in Chennai due to wind speeds reaching 70 km/h.
- The cyclone also led to minor damage to power and communication lines, further disrupting agricultural activities.

Cyclone Michaung (December 2023)

- Cyclone Michaung struck the eastern coast of India in December 2023, severely impacting Tamil Nadu's agricultural sector.
- The cyclone brought heavy rainfall and strong winds, leading to widespread flooding in districts such as Chengalpattu, Chennai, Thiruvallur, and Kancheepuram.
- The inundation caused significant damage to paddy crops, horticultural plantations, and orchards. Many farmers faced total crop losses due to waterlogged fields and soil erosion.

The disruption of local markets and supply chains further exacerbated the economic strain on farming communities.

Cyclone Fengal (November 2024)

- In November 2024, Cyclone Fengal affected Tamil Nadu, bringing heavy rains and strong winds that led to severe flooding in several districts.
- The agricultural sectors suffered as approximately 800 acres of farmland in Nagapattinam were submerged, leading to significant crop losses.
- The cyclone also caused damage to infrastructure, including roads and irrigation systems, hindering post-disaster recovery efforts for farmers.

These events underscore the vulnerability of Tamil Nadu's agrarian communities to environmental shocks, highlighting the need for robust disaster management strategies and support systems to enhance the resilience of agricultural farmers.

1.7.2. DROUGHT IN TAMIL NADU

The 2016–2017 drought in Tamil Nadu was a natural disaster that affected farmers in the region. It resulted from the lowest rainfall in Tamil Nadu in the past 140 years during the Northeast monsoon season, leaving farmers with minimal rainfall.

Tragically, the drought led to numerous suicides among farmer households (Newsweek, 2018)

- **Northeast monsoon**

  In Tamil Nadu, the average annual rainfall had gradually decreased 62% in 2016. The Northeast monsoon season had subdued Tamil Nadu with the worse rainfall ever, just scattering rain in some areas. The highest deficit of normal rainfall in Indian states in 2016 is recorded in Tamil Nadu with 82% deficit. (Skymet Weather, 2016).

- **Charred crops in Tamil Nadu**

  Agriculture in Tamil Nadu has faced a thunder like hit since the low rainfall had left the crops and agricultural lands with no water for irrigation purposes. Also the Kaveri water issue became a huge headache for the farmers in Tamil Nadu, as no water is obtained from the tributaries of Kaveri river where it is the only source of irrigation for the Tamil Nadu farmers. The crops had severely charred in lakhs of hectares. It is said that the harvest in the year will be the worst ever in Tamil Nadu. (Waghmare & Abhishek, 2017).

- **Farmers death due to depression**

  Since the agricultural growth of crops had decreased and charred due to less water for irrigation, the farmers in Tamil Nadu requested the state to be announced as affected by drought. The protest was started by a group of farmers led by 72-year old farmer P. Ayyakannu on March 14, 2017 at the Jantar Mantar in Delhi and went on for months. Many fasting strike and mass movements were held due to the delay of announcing Tamil Nadu as affected by drought. Farmers fell in deep depression because of indebtedness and charred crops in their fields. Tamil Nadu farmers fell ill and dead each day due to heart attack.

- **Tamil Nadu announced drought-hit**

  On 10 January 2017, Chief Minister O. Panneer selvam announced that Tamil Nadu will be announced as drought-hit state. Since entire Tamil Nadu was devastated by the drought because of low rainfall, huge expenses will be incurred in protecting the people and central financial assistance will be sought because of this, he said. He further said that Rs.5465 per acre will be provided for farmers who suffered 33% loss sowing paddy and other irrigational crops and Rs.7287 per acre for long term crops. (India today, 2017)

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- **Farmers protest in Delhi**

  As announced by the TN Government the relief funds are not distributed evenly and not abandoning the loans of the farmers they got from the cooperative banks, they got frustrated. Since the Central and State government betrayed the Tamil Nadu farmers, they started to protest against the central Government in Jantar Mantar, New Delhi.(2017 Tamil Nadu farmers' protest)

1.7.3. ENVIRONMENTAL SHOCKS & AGRICULTURAL LIVELIHOOD IN TIRUNELVELI DISTRICT

Between 2022 and 2024, agricultural farmers in Tirunelveli district, Tamil Nadu, faced several significant environmental shocks that adversely affected their livelihoods:

- **2023–2024 Excessive Rainfall:** In contrast, the district recorded a 413% surplus rainfall during the northeast monsoon of 2023. This excessive precipitation caused flooding, damaging 7,975 hectares of crops, including paddy, grams, millets, and various horticultural produce. The mid-December downpour was particularly devastating, leading to breaches in numerous tanks and irrigation channels. (thehindu.com)
- **2022–2023 Monsoon Failures:** Successive failures of the southwest and northeast monsoons since January 2022 led to a severe drought-like situation in Tirunelveli. By October 2023, the district had received only 270.90 mm of rainfall, a 41.15% decrease from the five-year average. This drastic reduction in precipitation resulted in depleted reservoir levels and significant crop losses, prompting farmers to urge the government to declare the district drought-hit. (thehindu.com)

These environmental shocks underscore the vulnerability of agriculture in Tirunelveli to climatic extremes, ranging from severe droughts to excessive rainfall, each posing distinct challenges to the farming community.

1.8. DIMENSIONS OF ENVIRONMENTAL SHOCKS AFFECTING FARMERS' LIVELIHOOD

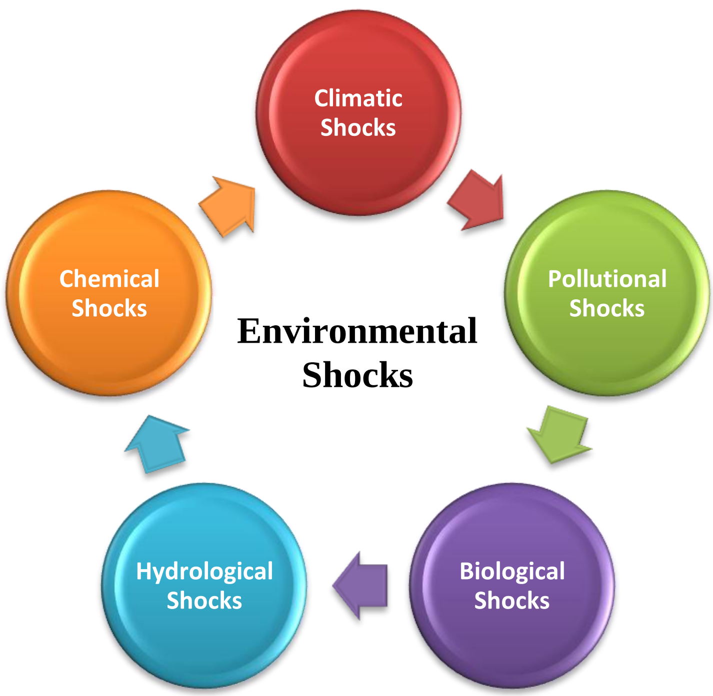

Figure 1.4 Dimensions of Environmental Shocks

Farmers face multiple environmental shocks that threaten agricultural productivity and rural sustainability. These shocks can be categorized into five key dimensions: Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks, and Chemical Shocks. Each of these factors has direct and indirect consequences on farming communities. Environmental shocks refer to sudden and extreme changes in environmental conditions that disrupt ecosystems, human societies, and economic activities. These shocks can be caused by natural disasters, climate variability, or human-induced environmental changes. They significantly impact agriculture, water resources, infrastructure, and livelihoods, particularly for vulnerable populations like farmers. The frequency and intensity of these environmental shocks have increased due to climate change and unsustainable land-use practices. Addressing these challenges requires adaptive strategies such as climate-resilient agriculture, early warning systems, and sustainable environmental policies. Without proper mitigation and adaptation efforts, environmental shocks will continue to threaten livelihoods, food security, and economic stability worldwide.

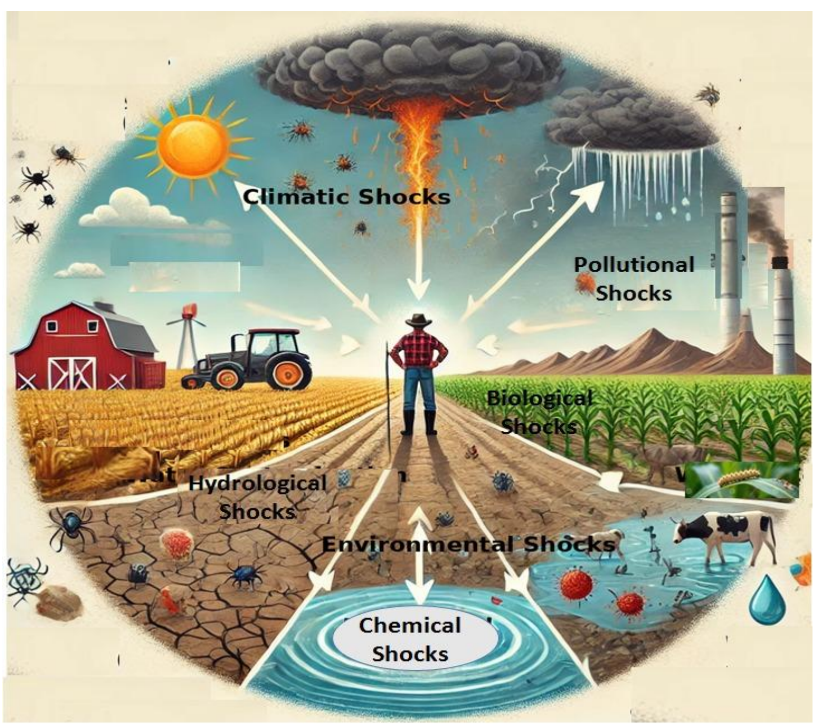

Figure 1.5 Environmental Shocks and their Consequences

1. Climatic Shocks

- Climatic shocks result from extreme weather conditions and long-term climate change, affecting crop yields and livestock survival.
- Droughts: Prolonged dry periods reduce soil moisture, affecting water availability for crops and livestock.
- Heatwaves: High temperatures stress plants and animals, leading to lower productivity.
- Cold Waves & Frosts: Unseasonal frost can damage crops, particularly fruits and vegetables.
- Cyclones & Storms: High winds and heavy rainfall destroy crops, homes, and infrastructure.

2. Pollutional Shocks

Pollutional shocks arise from environmental contaminants that degrade soil, water, and air quality, impacting agricultural productivity.

- Air Pollution: Industrial emissions and vehicular pollution affect plant growth and reduce photosynthesis efficiency.
- Water Pollution: Agrochemical runoff, industrial waste, and plastic pollution contaminate irrigation water, harming soil fertility and crop health.
- Soil Contamination: Excessive pesticide and chemical fertilizer use leads to soil degradation, affecting long-term productivity.

3. Biological Shocks

Biological shocks involve diseases affecting plants, livestock, and human populations in farming communities. Pest outbreaks and wildlife conflicts disrupt agriculture by damaging crops and livestock.

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- Crop Diseases: Fungal infections (e.g., wheat rust, rice blast) reduce yields.
- Livestock Diseases: Foot-and-mouth disease, avian flu, and other infections lower livestock productivity and lead to economic losses.
- Pandemics: Outbreaks like COVID-19 disrupt agricultural labor supply and market access, causing income losses.
- Invasive Pests: Fall armyworms and whiteflies attack major crops, affecting yields.
- Wildlife Conflicts: Animals like elephants, boars, and deer damage crops, leading to financial losses for farmers.

4. Hydrological Shocks

Hydrological shocks are related to water scarcity or excess water, impacting agricultural sustainability.

- Floods: Excessive rainfall leads to crop submersion, loss of nutrients, and soil erosion.
- Water Scarcity: Overuse of groundwater and declining rainfall patterns reduce water availability for irrigation.
- Glacial Melting & Sea Level Rise: Rising sea levels cause saltwater intrusion into farmlands, reducing soil fertility.

5. Chemical Shocks

Chemical Shocks refer to sudden or prolonged exposure to harmful chemicals that negatively impact the environment, agriculture, and human health. Some common causes include:

- Pipeline Leakages: Accidental leaks from chemical plants, oil refineries, or pesticide storage facilities contaminate soil and water, harming crops and ecosystems.
- Improper Disposal of Chemicals: Dumping industrial waste, pesticides, or fertilizers into water bodies and open lands leads to long-term soil and water contamination.

- Agrochemical Overuse: Excessive use of pesticides, herbicides, and fertilizers depletes soil nutrients, reduces microbial activity, and creates toxic residues in food.
- Industrial Accidents: Chemical plant explosions or spills release hazardous substances into the air and water, causing immediate and long-term environmental damage.
- Groundwater Contamination: Toxic chemicals seep into underground water sources, making them unsafe for irrigation and drinking.
- Toxic Gas Leaks: Accidental release of gases like ammonia or chlorine from industrial plants can harm nearby agricultural fields and human settlements.

1.9. IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS' LIVELIHOOD

- **Income Losses:** Crop failures and livestock deaths reduce farmers' earnings, pushing many into poverty.
- **Food Insecurity:** Lower agricultural output leads to higher food prices and reduced food availability, affecting both farmers and consumers.
- **Forced Migration:** Repeated environmental shocks push farmers to migrate to urban areas in search of alternative livelihoods.
- **Increased Debt Burden:** Farmers take loans to recover from environmental losses, but successive shocks make repayment difficult, leading to financial distress.
- **Health Risks:** Extreme weather events and pollution increase health risks for farming communities, reducing their productivity and quality of life.

1.10. STRATEGIES TO MITIGATE ENVIRONMENTAL SHOCKS

Climate-Resilient Agriculture: Adoption of drought-resistant crop varieties, agro forestry, and conservation agriculture can help farmers adapt to climate change (Pingali, 2012).

- **Improved Water Management:** Efficient irrigation systems like drip irrigation and rainwater harvesting can help mitigate water scarcity.
- **Disaster Risk Management:** Early warning systems, crop insurance, and government relief programs can provide financial security to farmers affected by environmental shocks.
- **Diversification of Income Sources:** Encouraging farmers to engage in alternative income activities, such as agro-processing and livestock farming, can reduce dependency on climate-sensitive crops.
- **Strengthening Policies and Institutions:** Governments should implement policies that promote sustainable land use, disaster preparedness, and climate adaptation strategies (OECD, 2020).

1.11. SIGNIFICANCE OF THE STUDY

The significance of studying the Impact of Environmental Shocks on Farmers' Livelihood lies in understanding the pivotal role that farmers play in shaping the agricultural economy and ensuring food security. The agricultural sector in India has been grappling with a myriad of challenges, notably environmental and market-induced adversities that jeopardize the livelihoods of farmers. Between 1996 and 2021, the nation witnessed approximately 0.35 million farmer suicides, underscoring the severe distress within this community. Tamil Nadu, in particular, has reported elevated rates of such tragedies, reflecting the acute pressures faced by its agrarian populace. In the fiscal year 2023-2024, Mysuru district in Karnataka reported 73 farmer suicides, predominantly in tobacco-growing regions like Hunsur, Periyapatna, and Saligrama. This alarming statistic highlights the pervasive mental health crisis among farmers, often exacerbated by financial burdens and crop failures.

Tirunelveli district in Tamil Nadu has not been immune to such challenges. During the Northeast Monsoon of December 2023, the district experienced unprecedented rainfall, with certain areas recording up to 636 mm in a single day. This deluge led to catastrophic flooding, resulting in significant loss of life, livestock, and extensive damage to agricultural lands. The excessive rainfall in December 2023 had devastating effects on agriculture in Tirunelveli. Farmers in regions like Kalakad, Sattupathu reported the destruction of paddy crops across approximately 350 acres due to breached canals and inadequate infrastructure maintenance. Many of these farmers, already reeling from previous losses, faced compounded financial hardships, leading to increased stress and mental health issues. Their livelihoods have been severely affected, leaving them struggling to recover from repeated environmental shocks. With mounting debts and limited access to financial relief, many farmers find themselves trapped in a cycle of economic instability, making it increasingly difficult to sustain their agricultural activities and support their families.

The significance of studying the impact of environmental shocks on farmers' livelihood is multifaceted. Firstly, it sheds light on the direct correlation between climatic adversities and the mental health of farmers, emphasizing the need for timely psychological support and intervention. Secondly, such research underscores the importance of infrastructural resilience, advocating for the maintenance and enhancement of irrigation systems to mitigate flood risks. Lastly, understanding these dynamics can inform policy decisions, leading to the development of comprehensive support systems that address both the economic and psychological well-being of farming communities.

By studying this group, the investigators aim to fill significant research gaps and provide data that can inform policies and interventions tailored to improve the well-being of Farmers

Livelihood. Environmental shocks such as droughts, floods, and erratic rainfall patterns have far-reaching consequences on crop productivity, income stability, and rural development. By analyzing these impacts, policymakers and researchers can identify vulnerabilities and develop adaptive strategies to enhance resilience among farming communities. Furthermore, this study helps in formulating sustainable agricultural policies, improving disaster preparedness, and implementing financial support mechanisms that safeguard farmers against recurring environmental adversities.

1.12 STATEMENT OF THE PROBLEM

Agriculture is highly sensitive to environmental conditions, and farmers, especially in developing nations, face substantial risks due to environmental shocks such as droughts, floods, and extreme weather events. These shocks often result in severe socio-economic consequences, particularly for smallholder farmers who have limited access to resources and adaptive technologies (World Bank, 2020). Environmental shocks such as droughts, floods, cyclones, pest infestations, and extreme temperature fluctuations pose serious threats to farmers' livelihood, affecting their agricultural productivity, income stability, and overall well-being. Understanding the impact of these shocks is crucial for developing effective strategies to enhance farmers' resilience and ensure sustainable agricultural development. This study is significant as it provides valuable insights into the adaptive capacity of farmers, highlighting the factors that influence their ability to cope with climate-related challenges. The findings will provide valuable insights for policymakers, agricultural extension services, and NGOs working to improve the livelihoods of farmers and reduce the long-term impacts of environmental shocks on farming communities. In this study, the researchers have made an attempt to find out the **Impact of Environmental Shocks on Farmers' Livelihood.**

1.13. TITLE OF THE STUDY

It is entitled as **"THE IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS' LIVELIHOOD."**

1.14 OPERATIONAL DEFINITIONS OF KEY TERMS

Farmers

Farmers are individuals engaged in agricultural activities, including crop cultivation, livestock rearing, and related farming practices, to produce food and other agricultural products for sustenance and commercial purposes.

Farmers' Livelihood

Farmers' livelihood refers to the means and resources through which farmers sustain their lives and economic well-being, including income from agricultural activities, access to land and water, farming equipment, market opportunities, and resilience to external factors affecting their productivity.

Environmental Shocks

Environmental shocks are sudden and extreme natural or climatic events, such as droughts, floods, cyclones, and erratic rainfall that disrupt ecosystems, agricultural activities, and the socio-economic stability of farming communities.

Impact

Impact refers to the direct and indirect effects of environmental shocks on farmers' livelihoods, including changes in agricultural productivity, economic stability, food security, mental health, and long-term adaptation strategies.

1.15. OBJECTIVES OF THE STUDY

1. To find out the level of impact of environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks and Chemical Shocks on Farmers livelihood.
2. To find out if there exists any significant difference in the impact of environmental shocks and its dimensions on Farmers livelihood with respect to the background variables such as gender, type of family, and membership in farmers' organization.
3. To find out if there exists any significant difference among the impact of environmental shocks and its dimensions on Farmers livelihood with respect to the background variables such Type of farming, type of land, land ownership status, farm mechanization, recovery time after shock, and educational status.
4. To find out if there exists any significant association between the impact of environmental shocks and its dimensions on Farmers livelihood and the background variables such as age, experience in farming, water sources for farming, access to weather information, Annual Income and type of crisis experienced..
5. To find out the influence of environmental shocks on Farmers livelihood.

1.16. HYPOTHESES

1. There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Gender.
2. There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to type of family.

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3. There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to membership in farmers' organization.
4. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Type of farming.
5. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to type of land.
6. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to land ownership status.
7. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to farm mechanization.
8. There is no significant difference among the impact of Environmental shocks on Farmers livelihood and its dimensions with respect to recovery time after shock.
9. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to educational status.
10. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and age.
11. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and experience in farming
12. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and water sources for farming
13. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and access to weather information

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14. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and Annual Income
15. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and type of crisis experienced
16. There is no significant influence of Environmental shocks on Farmers livelihood.

1.17. LIMITATIONS

Limitations are those conditions beyond the control of the researches that may place restrictions on the conclusions of the study and their application to other situations. As far as the study is concerned the investigators find certain limitations. They are

- The investigators have limited to test 5% level of significance
- The investigators expect the sampling error
- The investigators had limited resources and time**,** restricting the sample size and scope of the study.

1.18. DELIMITATIONS

Delimitations are the boundaries of the study. Owing to the constraint of the time the investigators fixed certain boundaries for the study. They are

- The present study has been delimited to certain demographic variables namely gender, type of family, membership in farmers' organization, Type of farming, type of land, land ownership status, farm mechanization, recovery time after shock, educational status, age, experience in farming, water sources for farming, access to weather information, Income and type of crisis experienced

- The investigators have taken samples from Tirunelveli District.
- The investigators have selected only 350 farmers as samples for this research.

1.19. CHAPTERISATION

Chapter-I of this study contains a brief Introduction, Agriculture, Importance of Agriculture, farmers livelihood, Factors affecting farmers livelihood, strategies for enhancing farmers livelihood, Environmental Shocks, impact of environmental shocks on farmers in Tamil Nadu, understanding environmental shocks and their consequences, case studies: real-world impacts of environmental shocks, case studies: India and Tamil Nadu - impacts of environmental shocks, environmental shocks & agricultural livelihoods in Tirunelveli district, dimensions of environmental shocks affecting farmers' livelihood, strategies to mitigate environmental shocks, and a note about the need and significance of the study, objectives, hypotheses, limitations, and delimitations.

Chapter-II contains review of the studies related to the present investigation, done in India and in other countries related impact of environmental shocks on farmers' livelihood.

Chapter-III talks about the Methodology. Method used to collect the data, variables, and tools employed, sample and Statistical techniques for the analysis were discussed in this chapter.

Chapter-IV contains the analysis and interpretation of the data.

Chapter-V contains the summary of procedure with, major findings and educational implications. It also includes recommendations and suggestions for the future research.

1.20. CONCLUSION

Environmental shocks have become a major threat to farmers' livelihoods, pushing many into economic and social vulnerability. The increasing frequency and intensity of climate-related disasters such as droughts, floods, cyclones, and erratic rainfall have left farmers struggling to recover from repeated losses. These shocks not only impact agricultural productivity but also lead to financial instability, debt accumulation, and mental health challenges, further exacerbating rural distress. Governments, agricultural scientists, and local communities must collaborate to develop sustainable farming systems, financial support mechanisms, and climate-smart policies to safeguard rural livelihoods. Investments in advanced irrigation systems, weather-resistant crop varieties, and early warning systems can significantly reduce the vulnerability of farmers to environmental shocks.

Moreover, providing social safety nets, including crop insurance, financial aid, and mental health support, is essential to mitigate the adverse effects of climate-induced disasters. Strengthening rural infrastructure and promoting sustainable agricultural practices will ensure long-term stability for farming communities. Without urgent action, environmental shocks will continue to undermine food security and global agricultural sustainability. Protecting farmers from these challenges is not just a matter of economic necessity but also a fundamental step toward ensuring a stable and resilient global food system. Addressing these issues through comprehensive policies and community-driven initiatives will be key to securing the future of agriculture and the well-being of millions dependent on it.

This chapter provided a general introduction, significance of the study, objectives, statement of the problem, limitations and delimitations of the study. In the following pages, the reviews of related studies on the areas of impact of environmental shocks on farmers’ livelihood have been discussed.

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CHAPTER - II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The term 'review' means to organize the knowledge of the specific areas of research to evolve an edifice of knowledge to show that his study would be an addition to this field. The task of review of literature is highly creative and tedious because research has to synthesis the available knowledge of the field in a unique way to provide the rationale for his study. The review of related literature is a significant part of a research study. This helps the researcher to gather up-to-date information about what has been done; in the particular on which he intends to study. Review of related studies further avoids duplication of effort that has already been done and it helps the investigator to go further deep into the problem in hand. It also helps to study the different facets of the problem. It provides the opportunity of giving an insight into the methods, measures and various others, which would lead to the improvement of the research design significantly. It is a valuable guide in defining the problem, recognizing its significance, suggesting the promising data gathering devices, appropriate study design and source of data.

According to **T.C. Aggarwal, (1996)** "the state of related literature implies locating, reading and evaluating reports of research as well as reports of casual observations and opinions that are related to the individual planned research report".

2.2 NEED OF THE RELATED LITERATURE

To put in the words of **John W.Best (1989)**, it is "a summary of the writings of recognized authorities and of research provides evidence that the research is familiar with what is already known and what is still unknown and untested". Since effective research is based upon the past knowledge, this step helps to eliminate duplication and replication of what has been done provides useful hypothesis and helpful suggestions for significant investigations. The researcher is a specialist rather than a generalist" **(Best. J.W., 1986)**.Therefore to be a specialist, a researcher has to go through all the related literature and relevant studies.

2.3. OBJECTIVES OF REVIEW OF LITERATURE

1. To provide theories, ideas, explanations or hypotheses which may prove useful in the formation of a new problem
2. To indicate whether the evidence already available solves the problem adequately without requiring further investigation. It avoids the replication
3. To provide the sources for hypotheses. The researcher can formulate research hypotheses on the basis of available studies.
4. To suggest method, procedure, sources of data and Statistical techniques appropriate to the solution of the problem.
5. To locate comparative data and findings useful in the interpretation and discussion of results. The conclusions drawn in the related studies may be significantly compared and may be used as the subject for the findings of the study.
6. To help in developing expertise and general scholarship of the investigator in the area investigated.
7. To contribute towards the accurate knowledge of the evidence or literature in one's area of activity is a good avenue towards making oneself. Whether one is employed in an institution of higher learning or a research organization this knowledge is an asset.
8. To provide some insight regarding strong points and limitations of the previous studies.

9. To enable the researcher to improve his / her own investigation.

2.4. IMPORTANCE OF THE RELATED LITERATURE

Study of related literature helps in acquiring information about the studies done in the field, protects against unnecessary duplication and guides in carrying out the investigation successfully and makes the investigator familiar with steps. A survey of related literature serves the following purposes.

1. It gains background knowledge of the research topic
2. It provides valuable ideas, theories, explanations or hypotheses in formulating the problem.
3. It identifies the concepts relating to its potential relationships between them and to formulate researchable hypotheses.
4. It defines appropriate methodology, research design and methods of measuring concepts and techniques of analysis.
5. It locates comparative data useful in the interpretation.
6. It identifies data sources used by other researchers and learn how others structured the reports.

2.5. PURPOSE OF THE STUDY

Review of the related literature besides, allowing the researcher acquaints himself with current knowledge in the field or area in which he is going to conduct his research serves the following.

1. The review of related literature enables the researcher to define the limits of his field. It helps the researcher to delimit and define his problems. The knowledge of related literature, brings the researcher up-to-date on the work which others have done and thus to state the objectives clearly and concisely.
2. By reviewing the related literature, the researcher can avoid unfruitful and useless problems areas. He can select those

areas in which positive findings are very likely to result and his endeavours would be likely to add to the knowledge in a meaningful way.

3. Through the review of related literature, the researcher can avoid unintentional duplication of well-established findings. It is no use to replicate a study when the stability and validity of its results have been clearly established.
4. The review of related literature gives the researcher an understanding of the research methodology which refers to the way the study is to be conducted. It helps the researcher to know about the tools and instruments which proved to be useful and promising in the previous studies. The advantage of the related literature is also to provide insight into the Statistical methods through which validity of results is to be established.
5. The final and important specific reason for reviewing the related literature is to know about the recommendations of previous researchers listed in their studies for further research.

2.6 CLASSIFICATION OF THE RELATED LITERATURE

The investigator has classified the studies into two major sections namely.

A. Indian Studies.

B. Foreign studies.

2.7 INDIAN STUDIES

Bipin Das et al (2024) in their study, “Socio-Ecological Shocks, Weak Community Support Systems and Tragic Responses of Farmers – A Modelling Study on India”. The agricultural economy of India is undergoing significant distress – low growth and farmers’ indebtedness - leading to 0.35 million farmers’ suicides during the period 1996–2021. India has a varied agro-ecosystem. The distress is acute in some regions, like Maharashtra (Marathwada, Vidarbha regions), Punjab, and Karnataka. This study explores the intricate relationship between contextual (social-economic and environmental) conditions of entrepreneurial uncertainty and agricultural disruptions, malfunctioning institutions for regional socio-ecological systems, and subsequent tragic re-actions (including suicidal behaviour) by farmers. The research focuses on the socio-spatial fabric of poor agricultural entrepreneurs in India. The case study of Osmanabad district of Deccan region of India reveals that the consequences of poor institutional response mechanisms to perturbations of agriculture are far-reaching, leading to physical and emotional tolls on farmers and their families, food scarcity, economic instability, and a deep sense of insecurity. The study brings out agricultural vulnerabilities and tragic responses by farmers, shedding light on the underlying causes and dynamics of this complex phenomenon (including low community support systems). A tipping point analysis on farmers' indebtedness is presented, which can help policy makers to prevent farmer communities from reaching the extreme stage of economic and mental distress leading to suicidal behaviour, and to ensure the well-being and stability of the community. The paper argues that understanding and addressing these challenges require collaborative action and partnerships among different stakeholders, especially among communities, states, and universities.

Jatav (2024) conducted study on, "Farmers' Perception of Climate Change and Livelihood Vulnerability: A Comparative Study of Bundelkhand and Central regions of Uttar Pradesh, India". The present study aims to assess livelihood vulnerability of farmers in two regions of the most populous State of Uttar Pradesh namely Bundelkhand and Central region. By using multistage random sampling technique, a total of 480 samples from 16 villages, 8 development blocks, 4 districts, and 2 regions were selected to elicit grass-root information on farmers' perception of climate change, their sensitivity and adaptive capacity to changing climate, and determinants of livelihood vulnerability. Further, this study has adopted methodology mentioned in the Intergovernmental Panel on Climate Change's fourth Assessment Report for the development of climate vulnerability index. The results show that farmers in Jhansi district were highly vulnerable to changing climate, while farmers in Barabanki district were relatively less vulnerable. The elevated degree of vulnerability to livelihood in Jhansi district attributed to its comparatively higher exposure and sensitivity to climatic change. The Binary Logistic Regression results show that illiterate farmers are relatively more vulnerable than literate farmers. On the contrary, higher income, assured irrigation, the use of certified seeds, and crop insurance are negatively associated with the LVI. In other words, farmers who have income from non-farm sources, use certified and recommended seed varieties, and avail themselves of crop insurance are relatively less vulnerable to climate change than those who do not have the aforesaid facilities. Hence, the present study suggests that farmers, must adapt to climate change to reduce its negative impact and reap the benefits of adaptation which can be achieved through capacity building, skill development (i.e., use of ultra-modern techniques), and capacity to strengthen the farmers' ability to adapt. Further, there is also a need to sensitize government officials on the dangers of climate change and to provide appropriate technical support to farmers for their adaptation.

Arabinda Roy et al (2024) in their research paper titled, "Exploring Climate Change Impacts on Rural Livelihoods and Adaptation Strategies: Reflections from Marginalized Communities in India". The research is primarily based on primary data which have been collected at household level using multistage purposive sampling methods and total sample size is 154. Descriptive and inferential statistical methods were employed for data analysis. The results were discussed in the context of the sustainable livelihoods approach and findings depicts that there is a decreasing trend in the availability of water for domestic purposes, crop failure and low agricultural production, reduction in human health, poor livestock health and a range of other problems due to climate change which subsequently impacted on their livelihood. Indigenous and local knowledge were widely used in dealing with the effects of climate change, while modern technologies were underutilized among marginalized communities. Farmers and fisherman's used multiple adaptation strategies to combat climate change effects such as modifications in farm management, migration, selling labour to neighbourhoods, measures related to financial resources and risk reduction, borrowing funds from local money lender as well as family and neighbours, credit programmes and assistance from NGOs and reducing household food consumption. Large-scale education, training programmes, development interventions and policies targeted at enhancing resource endowment are needed. The findings from this study can help policymakers and other stack holders about ongoing adaptation measures as well as the needs of households, bring out the gap between farm households and policymakers and also to develop suitable policies and effective adaptation strategies to enhance the livelihoods within this context of local marginalized communities context.

Venkatram et al (2024) in their research paper titled “Farming Is Charming: Informal Learning of Farmers in Coimbatore, Tamil Nadu, India”. The agricultural sector in India has come to prominence as a source of employment and livelihood. It is one of the most significant informal sectors in the country, and one in which informal learning plays a major role. This article analyses the informal learning of farmers in Coimbatore, Tamil Nadu, India. In the course of this research, qualitative interviews with 34 farmers in Coimbatore were conducted and analysed with regard to informal learning. The findings show that informal learning is lifelong and chiefly takes place at home in a family and peer group context. Informal learning is facilitated by training courses specifically adapted to farmers' needs, which can help them improve their situation on their respective farms. However, not every farmer attends these courses, indicating a need to strengthen the programmes, conduct information campaigns to raise awareness, and improve accessibility, especially for farmers and agricultural labourers.

Sahoo and Moharaj (2024) in their study examined, “Assessing Agricultural Vulnerability to Climate Change through Dynamic Indexing Approach”. The present study aims to assess agricultural vulnerability in the context of climate change, focusing on the diverse districts of Odisha. Acknowledging that vulnerability is influenced by exposure, sensitivity, and adaptive capacity, our research incorporates the growth rate and instability of vital performance indicators to evaluate the relative vulnerability of each district. A key strength of this approach is the use of normalized indicators, weighted in accordance with the proportional average of major crops in each district relative to the state, culminating in a comprehensive vulnerability index through the aggregation of these weighted components. The findings revealed significant variability in the vulnerability profiles across districts, thereby necessitating state-level intervention through tailored “Location Performance Vulnerability” based adaptation strategies. These strategies, including early weather warning systems, development of new and early maturing crop varieties, and adjustment of crop planting dates, are crucial for mitigating the adverse effects of climate change on agriculture.

Gudepu Renuka (2023) in her research titled, "The Impact of Climate Change on the Agriculture in India Introduction". The objectives of the study are to analyze how climate change has impacted the Indian agriculture, to study the factors that can influence the climate change for creating a situation of food insecurity. This study's overall design was exploratory. The research paper is an endeavor that is founded on secondary data that was obtained from reliable online resources, newspapers, textbooks, journals, and publications. The research design of the study is mostly descriptive in nature. This research is entirely dependent on secondary data that demonstrates the significant impact that climate change has had on Indian agriculture. Climate change is affecting India's agricultural sector, which employs 40% of the nation's labor force, according to a report compiled by Climate Trends, a research-based consulting and capacity-building initiative that aims to bring greater focus on issues of environment, climate change, and sustainable development. A little over 70% of India's rural population is employed in agriculture. A study found that during the previous three decades, 59,000 suicides in India had been connected to warmer growing season temperatures, which caused damage to crops.

Sandrala Gayathri (2023) in her research titled, "Economic Impact of Integrated Farming System on Livelihood Security of Farmers in Telangana". The study carried with following specific objectives, to study the socio-economic features of IFS farmers, to analyze and compare the resource use efficiency among IFS and Non- IFS farmers, to study the livelihood pattern of the IFS farmers with Non- IFS farmers, to study the economic performance of different IFS modules on livelihood security of farmers The study was conducted in Telangana, which constituted three agro-climatic zones and thirty-three districts. The multistage random sampling technique was employed to select sample respondents. Total sample size of 540 farmers constituting 270 IFS adopted farmers and 270 Non- IFS farmers were selected for the study. To fulfill the objectives of the study both primary and secondary data were collected using structured questionnaires during the agriculture year 2021-22. To study the general socio-economic characteristics of the sample farmers tabular analysis with statistical tools like average, ratios and percentage were worked out. To study the resource use efficiency, Linear and Cobb-Douglas production functions were used. To study the performance of different IFS modules, cost and returns for major crops as well as each IFS module practiced in the study area was worked out. Similarly, to know the financial feasibility of IFS modules over the years, discounted measuring viz., returns per rupee of investment, internal rate of return etc., was worked out. Another aspect of perception of farmers towards the impact of IFS on livelihood security was quantified by using three pointer Likert scale. The constraint faced by farmers in adoption of IFS was worked out by using Garett ranking technique.

Chowdhury J.R. and Parida Y (2023) in their paper reported, "Flood Shocks and Post-disaster Recovery of Households: An Empirical Analysis from Rural Odisha, India". This paper uses primary household survey data collected after the severe flooding that occurred in the Bhadrak region of Odisha in 2014. We contribute to the literature by examining the factors that enhance rural households' disaster recovery capacities. The investigators distinguish two main recovery outcomes: an income (economic) recovery and a housing structure (structural) recovery outcome. A Generalized Ordered Logit Model (GOLM) is employed where the recovery is determined by socioeconomic characteristics and coping mechanisms available to the households. The findings revealed that rural agricultural households adopted several measures in response to the flood. Migratory labor-based strategies significantly increased the likelihood of economic recovery one year after the disaster. Selling productive assets reduced the likelihood of recovery. Community-level coping strategies were not effective, as floods caused devastating effects on a large part of the village community. Poorer households were more constrained in their capacities to recover from disaster shock. However, there was evidence of community-level support in terms of labor exchange between households in close neighborhoods. Finally, the study finds that post-disaster public assistance was mainly provided to land-owning farmers rather than poor, landless agricultural households.

Verma and Sudan (2021) in their study examined, "Impact of Climate Change on Marginal and Small Farmers' Livelihood and their Adaptation Strategies-A Review". The objective of this paper has been to review the impact of climate change on the livelihoods of marginal (those cultivating less than one-hectare land) and small farmers (cultivating between 1 and 2 hectares land) and their coping and adaptation strategies enhancing their resilience to climate change. This paper reviewed literature including peer-reviewed papers, reports, and books related to climate change impacts on agriculture and livelihoods of marginal and small farmers in developing countries. The findings reveal that marginal and small farmers are vulnerable to climate change and variability, on account of their marginalized status, direct reliance on agriculture for their livelihoods, and inadequate resources and capacity to deal with adversities. The review found that climate change is negatively impacting livelihoods of marginal and small farmers by reducing crop and animal yields, crop failures, crop and animal diseases outbreak, livestock mortality, shortage of pasture and water for livestock all of which eventuates in reduced farm income, food insecurity and a downward spiral in social and economic indicators like health, education, and wellbeing.

Sahoo and Sridevi (2021) in their research paper titled, "Social vulnerability and adaptation to climate change: Evidence from vulnerable farmers' groups in Odisha, India". Farmers are the worst-affected and differentially vulnerable to climate change. This article has dealt with two research questions: (i) what factors drive the social vulnerability of farmers' groups to climate change?, and (ii) how they adapt to the negative effects of climate change? The study applied an indicator-index approach to measuring the social vulnerability of different categories of farmers. The findings reveal that the small and marginal farmers are more vulnerable to climatic risks than are the medium and large farmers possibly because of their weak economic and social conditions. In this context, adaptation is key to reducing the climatic impacts and building the resilience of the agricultural system.

Tristan Berchoux et al (2019) in their research paper titled, "Agricultural Shocks and Drivers of Livelihood Precariousness across Indian Rural Communities". The paper investigates the drivers of livelihood precariousness using a place-based approach. They identify five community types in rural regions of the Mahanadi Delta, India; exurban, agro-industrial, rainfed agriculture, irrigated agriculture and resource periphery by clustering three types of community capitals (natural, social and physical). Based on this typology, the associations between precarious livelihood activities (unemployment or engagement in agricultural labour) with agricultural shocks and household capitals. Results demonstrate that, the type of community influences the impact of agricultural shocks on livelihoods as four of the five community types had increased likelihoods of precarious livelihoods being pursued when agricultural shocks increased. The research demonstrates that the bundle of locally available community capitals influences households' coping strategies and livelihood opportunities. For example, higher levels of physical capital were associated with a lower likelihood of precarious livelihoods in agro-industrial communities but had no significant impact in the other four. Results also indicate that agricultural shocks drive livelihood precariousness (odds ratios between 1.03 and 1.07) for all but the best-connected communities, while access to household capitals tends to reduce it. Our results suggest that poverty alleviation programmes should include community typologies in their approach to provide place-specific interventions that would strengthen context-specific household capitals, thus reducing livelihood precariousness.

Viswanathan et al (2019) in their research paper titled, “Depression, Suicidal Ideation, and Resilience among Rural Farmers in a Drought Affected Area of Trichy District, Tamil Nadu”. The objective of this study was to find out the prevalence of depression and suicidal ideation, to measure the resilience, and to find out the factors that influence depression and resilience among farmers. A community based cross-sectional analytical study was performed among farmers residing in a drought affected area of Tiruchirappalli district of Tamil Nadu. The sample size was 191 and cluster sampling was used to select the participants. Structured, pretested questionnaires were used to find the prevalence of depression, suicidal ideation, and resilience among farmers. Pearson Correlation, Student’s t-test, analysis of variance, and Pearson Chi-square test were used to identify the factors influencing depression and resilience. A total of 194 farmers participated in the study. The mean age of the farmers was 46.68 ± 12.6 years, majority 64% were males and 89% were literates. Among the participants, 97.4% had some form of depression, and 67% had severe depression. About 60% of the farmers had suicidal ideation. Male farmers, farmers with few years of farming experience, and severe reduction in yield had a higher level of depression. Suicidal ideation was influenced by gender, small-scale farming, fewer years of experience in farming, and the impact of drought on yield. The mean resilience score was 49.4 ± 10. Gender and years of experience in farming had a significant association with resilience.

Chunera and Dash (2019) in their study examined, "Farm level adaptation strategies to climate change in India: An overview". Climate change is the most intricate environmental problem faced by the world today. Agriculture sector is vulnerable to climate change due to its immense dependence on climate. Therefore, implementing adaptation strategies by farmer becomes indispensable in order to minimize the effects of climate change. From this review, it is concluded that farmers have been adapting to the impacts of climate change in their own ways. Different methods are being used by farmers; the major ones include the use of different crop varieties, shifting cropping patterns, delayed sowing etc. It was observed that high cost of adaptation, limited knowledge on adaptation measures and lack of improved technology were found to be the major hindrance towards adapting to climate change. Therefore it is recommended that timely information dispersion should be done about early warnings of climate change and also awareness campaigns and trainings must be organised to enhance the farmers' adaptive capacity.

Meeta .G (2016) in their study examined, **"**Vulnerability of Indian Agriculture to Climate Variability". The vulnerability of Indian agriculture comes from its exposure to climate variability, high livelihood dependence upon the sector and low adaptive capacity in terms of irrigation coverage and extent of other technological inputs. Given the future climate scenarios and their projected impact on Indian agriculture and farm incomes, it is critical to characterize the current vulnerability of agriculture in India to climate variability. The present study attempts to understand the impact of climate variability at macro and micro levels in Indian agriculture. At the macro or the state level, the study focuses on sensitivity of gross domestic products of the states, mediated through agriculture, by looking at the interrelationship between agricultural production, rainfall variability and growth of state domestic products. For the micro analysis, research investigates into the vulnerability of small and marginal farmer households in a field based inquiry. Using a livelihood framework, the study characterizes the vulnerability of small and marginal farmer households and identifies the factors that affect their well-being. The original contribution of the study established that small and marginal farmer households are not inherently vulnerable due to the limitations posed by their small size of land holdings. Further, the vulnerability among small and marginal farmer households is heterogeneous in character. The idiosyncratic characteristics of the farmer households and their access to key resources such as land and ability (or lack of) to diversify income have a significant role to play in determining the vulnerability at the household level. At the macro level, the study identifies distinct differentiation in the sensitivity of state domestic products. It concludes that the indirect contribution of agriculture through the livelihood dependence is a more significant indicator of vulnerability than the sector s direct contribution to the domestic product.

Piyoosh Rautela and Bhavna Karki (2015) in their research paper titled, "Impact of Climate Change on Life and Livelihood of Indigenous People of Higher Himalaya in Uttarakhand, India". Increase in average temperatures and abrupt changes in the precipitation regime are perceived to take place in the region by most people. Duration, amount and form of atmospheric precipitation is reported to have changed significantly. Even during winters the people of the region are increasingly getting overwhelmed with liquid precipitation rather than solid precipitation that were traditionally received in the form of snow. This is perceived to be responsible for reduced duration of snow in the region. This is held responsible for reduced water availability in the region and people have already started to face scarcity of water. Most people of the region at the same time agree that there are changes in the timing of flowering and fruiting of plants. Productivity of the agricultural fields is also reported to have decreased. Increased incidences of pest infestations and animal attacks are also reported from the region. These have forced the inhabitants to introduce many changes in their traditional life support pursuits. Of these some are identified as being part of the coping strategy of the people of the region that is witnessing climate induced changes at an alarming rate. These are required to be studied, documented, researched and improvised with appropriate inputs from formal science and technology so as to make these viable and acceptable to the masses.

2.8 FOREIGN STUDIES

Das (2025) conducted study on, “Weathering Changes: Livelihood Adaptation to Weather Shocks in Rural India by Disadvantaged Social Groups”. In this article, the investigators examined how households from disadvantaged social groups in India adapt through migration to climate-related shocks. The relative importance of factors like social networks and public intervention in enabling adaptation to slow-onset climate change. The use household- and village-level data from two consecutive waves of the Indian Human Development Survey and gridded weather data from CRU at the University of East Anglia for our analysis. The results indicated that, in India, major changes in dryness significantly increased migration, but disadvantaged social groups facing climate change are less likely to migrate. Social networks do not play any significant role in the migration behaviour of disadvantaged groups facing these changes. Efficient implementation of poverty alleviation programmes does improve the probability of migration among these groups.

Yang et al. (2024) conducted study on, "The Impact of Livelihood Resilience and Climate Change Perception on Farmers' Climate Change Adaptation Behavior Decision". This article tries to explore the impact of livelihood resilience and climate change perception on the climate change adaptation behavior of farmers in the Qinling Mountains region of China. In this study, 443 micro-survey data of farmers are obtained through one-on-one interviews with farmers. The Logit model and Poisson regression model are used to empirically examine the impact of farmers' livelihood resilience and climate change perception on their climate change adaptation behaviors. It was found that 86.68% of farmers adopt adaptive behaviors to reduce the risks of facing climate change. Farmers' perception of extreme weather has a significant positive impact on their adaptive behavior under climate change. The resilience of farmers' livelihoods and their perception of rainfall have a significant positive impact on the intensity of their adaptive behavior under climate change. Climate change adaptation behaviors are also different for farmers with different levels of livelihood resilience.

Blocher et al (2024) conducted study on, "The Effects of Environmental and Non-Environmental Shocks on Livelihoods and Migration in Tanzania". Disruptive events and calamities can have major consequences for households in the predominantly agrarian communities of Eastern Africa. Here, they analyzed the impacts of environmental and non-environmental shocks on migration in Tanzania using panel models and longitudinal data from the Tanzania National Panel Survey between 2008 and 2013. Shocks are defined as events that lead to losses in income, assets, or both. They found shocks resulting from changes in environmental conditions to be positively related to migration over time with more recent shocks exerting the strongest impact. According to their estimates, the probability of having a household member absent increases by 0.81% with each additional environmental shock encountered in the past 12 months. Different types of shocks have differential effects on migration with the strongest effects being observed for shocks with an immediate impact on household livelihoods, including through livestock losses and crop damage. Households in the sample are differently affected with rural, agriculturally dependent, and poor households without alternative income sources showing the strongest changes in their migration behavior in response to shocks. The study included important insights into the relationship between disruptive events and migration in Eastern Africa considering a broad time window and the compounding influence of different shock types. The findings had a range of policy implications highlighting the need for a comprehensive perspective on household responses in times of distress that considers the interplay of different shock types as well as the role of context in shaping mobility patterns.

Ngoma et al (2023) in their research paper entitled, "Climate Shocks, Vulnerability, Resilience and Livelihoods in Rural Zambia". Climate and weather shocks pose risks to livelihoods in Southern Africa. The investigator assessed the extent to which smallholders are exposed to climate shocks in Zambia and how behavioural choices influence the negative effects of these shocks on vulnerability and resilience. They used household data from the nationally representative Rural Agricultural Livelihoods Survey and employ an instrumental variable probit regression model to control for the endogeneity of key choice variables. There are four main findings. First, droughts are the most prevalent climate shock faced by rural smallholder farmers in Zambia, but the extent of exposure differs spatially, with the Southern and Western Provinces being the hardest hit. Nationally, 76% of all smallholder farmers are vulnerable and only 24% are resilient, with female households most vulnerable. Second, increased climate shocks correlate with both increased vulnerability and reduced resilience, with short- and long-term deviations in seasonal rainfall worsening vulnerability and resilience. Third, higher asset endowments and education are correlated with reduced vulnerability and increased resilience. And last, climate-smart agricultural practices significantly improved household resilience. These findings implied a need to support scaling of climate-smart agricultural technologies and to invest in risk mitigation strategies such as weather-indexed insurance and targeted social cash transfers.

Duru et al (2022) conducted study on, "The Effects of Climate Change on the Livelihood of Rural Women: A Case Study of Ilorin South, Nigeria". The research was conducted phenomenological using questionnaires, interviews, and focus group discussions to access the assets required for improving the livelihood of rural women affected by climate change. The interpreted results of the data gathered using questionnaires showed that rural women in Ilorin South Local Government Area (LGA) of Kwara State, Nigeria, are impacted by the perils of anthropogenically induced climate change disasters that have impacts on their livelihood. These implications can be seen in the resilience of the methods used by these rural women to combat the continuing impact of climate change on their livelihood. The findings of the research also indicated that there are other factors making them vulnerable to the impacts of climate change such as lack of basic infrastructures, low capital base, and the use of crude farming methods.

Qian et al (2022) in their research paper titled, "The Impact of Farming Households' Livelihood Vulnerability on the Intention of Homestead Agglomeration: The Case of Zhongyi Township, China". This paper constructed a framework for the influence of farmers' livelihood vulnerability on their intention of homestead agglomeration, then assessed the livelihood vulnerability of farmers based on 211 questionnaire data points, and analyzes the influence of farmers' livelihood vulnerability on their intention of homestead agglomeration through binary logistic regression. The results showed that the vulnerability of farmers' livelihoods had a significant negative effect on the intention of homestead agglomeration, and the more vulnerable farmers' livelihoods were, the more significant their tendency to gather residential land. In addition, from the three-dimensional perspective of "exposure-sensitivity-adaptability", exposure and sensitivity have a negative effect on farmers' intention to agglomerate, while adaptability has a significant positive effect. Therefore the result confined that the vulnerability of farmers' livelihoods can be improved by reducing exposure and sensitivity and increasing adaptive capacity to enhance farmers' willingness to cluster their homesteads, thus providing some theoretical support for the preliminary work of homestead layout optimization in rural spatial governance.

Mohammed et al (2022) in their research paper, "Analysis of Climate Change Vulnerability and Adaptation to Increase Resilience among Farmers in Borno State, Nigeria". This study analyzed climate change vulnerability and adaptation among smallholder farmers in Borno State, Nigeria. The study was conducted in Sudan and Guinea savannah Agro-Ecological Zones (AEZ) of the state. Survey research design was employed for the study. Multi-stage sampling procedure was used in selecting 360 farmers for the study. Descriptive statistics such as percentages, frequencies, means and livelihood vulnerability index (LVI) were used in analyzing the data. Overall, based on IPCC-LVI explanations of climate change vulnerability, Sudan savannah was found to be the most vulnerable. AEZ with vulnerability index of -0.0104 against Guinea savannah with LVI of -0.0416. A few factors can explain this low adaptive capacity: In both AEZs, farmers do adapt to climate change through various farm level practices. These adaptation strategies, however, do vary slightly among the two AEZs. The adaptation strategies practiced by respondents in Sudan AEZ were multiple cropping (98.9%), early planting (63.9%), mulching/use of cover crops (36.1%) and increased fertilizer application (25.00%). In Guinea AEZ, the most widely used adaptation strategies include multiple cropping (93.30%), use of new crop varieties tolerant to the new climate regime (72.20%), increased application of fertilizer (47.20%) and application of chemicals (25.00%). The study concluded that Sudan savannah AEZ is the most vulnerable AEZ among the AEZs considered in this study. Major adaptation strategies practiced were technologically based. The study, therefore, recommended that farmers' adaptive capacity should be enhanced particularly in Sudan savannah zone.

Zeleke et al (2021) in their research paper, "Vulnerability of Smallholder Farmers to Climate Change-Induced Shocks in East Hararghe Zone, Ethiopia". Vulnerability assessment varies widely across households, countries, and regions. Though many previous studies assessed vulnerability to climate change, their unit of analysis was aggregate. Therefore, the objective of this study was to measure the vulnerability of smallholder farmers to climate change at the household level and identify its determinant factors in east Hararghe zone. A multi-stage sampling procedure was used to select districts, kebeles, and sample respondents. Vulnerability as expected poverty approach was used to measure household-level vulnerability. Logit model was also used to assess factors contributing to households' vulnerability. The study revealed that 73% of households were vulnerable to climate-induced shocks. Households with better farm experience, land size, livestock ownership, access to credit, access to extension service, social capital, access to climate information, non-farm income, and headed by a male were not vulnerable to climate change; whereas households who were living in low and midland agro-ecologies, far from the market, and participating in productive safety-net programs were vulnerable to climate change. The study indicated that the vulnerability of smallholder farmers was sensitive to the minimum income required to maintain daily life. Income-generating activities that supplement farm income should be well designed in policy to reduce the vulnerability of smallholder farmers.

Wang et al (2021) in their research paper, "Impact of Environmental and Health Risks on Rural Households' Sustainable Livelihoods: Evidence from China". China has entered a "post-poverty alleviation" era, where the achievement of sustainable livelihoods by farmers has become a focus. This study used the China Family Panel Studies (CFPS) database, which was constructed based on an analysis of the DFID sustainable livelihood framework, and built a sustainable livelihood index system for farmers using the entropy weight method to measure the weights of sustainable livelihood indexes and calculate a sustainable livelihood index. This study used the Tobit model to discuss the impacts of different types of risk on the achievement of a sustainable livelihood by farmers. The results showed that environmental risk, chronic disease risk, and major disease risk all had significant negative impacts on the ability of farmers to achieve a sustainable livelihood. The impacts of major disease and chronic disease risks on the achievement of a sustainable livelihood by farmers living in plain areas were stronger than those associated with environmental risk. In China, the environmental risks were complex and diverse and were the most important factors that affect the achievement of a sustainable livelihood by rural households in mountainous areas. Chronic disease risk was also an important adverse factor that affected the achievement of a sustainable livelihood by rural households in mountainous areas.

Lokonon Boris Odilon Kounagbè (2017) in their study, "Farmers' Vulnerability to Climate Shocks: Insights from the Niger Basin of Benina". This paper investigated the vulnerability of farm-based livelihood systems to climate shocks in the Niger basin of Benin using a household survey dataset relative to the

2012-2013 agricultural years. The integrated approach is used to assess the vulnerability to climate shocks as function of exposure, sensitivity and adaptive capacity, and the indices are used as dependent variable in an Ordinary Least Squares regression. The findings revealed that 57.43% of the farm households are vulnerable to climate shocks, and highlight that the lowest adaptive capacity does not necessarily coincide with highest exposure and sensitivity to result in the highest vulnerability. The econometric estimations showed that vulnerability levels increase differently with respect to the type of climate shock. Floods appeared to be beneficial to the farm households as they negatively influenced vulnerability to climate shocks. The simulations suggested that vulnerability to climate shocks will increase, in the absence of adaptation.

Matenga et al (2017) conducted a research on, "Impacts of Land and Agricultural Commercialization on Local Livelihoods in Zambia: Evidence from Three Models". By examining three different models of commercial agriculture – a plantation, a commercial farming area, and an out-grower scheme and observed heterogeneous impacts on different segments of rural communities. Each produces gender and generational differentials in employment and other income-earning opportunities. The study supported the hypothesis that the plantation model typifies the 'enclave' economy that is poorly integrated into the surrounding communities and the local economy. While out-grower schemes have often been favourably compared to plantations, our evidence on the Magobbo sugarcane out-grower scheme points to the contrary: its block farming model consolidates smallholdings and creates a peasant-shareholder class. Shareholder 'out-growers' receive dividends from what is essentially an extension of the plantation. This accumulation for a few also produces land scarcity and fragile semi-proletarianised livelihoods for others. By contrast the result was confined that the commercial farming model, while

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based on an elite form of large-scale commercial farming, does provide benefits to surrounding areas, through employment and local economic linkages.

2.9 CRITICAL REVIEW

The research work surveyed and presented above indicates the increasing rate of farmers' livelihood and the major sensitive issues. For analysis of data the above studies used the t-test, correlation, multiple correlation and percentage analysis. The investigator has reviewed a total number of 26 studies both Indian and Foreign studies. There are 11 foreign studies and 15 Indian studies. The present study looks at the impact of environmental shocks on farmers' livelihood. The present study differs from the rest of studies in several ways. Farmers directly face various risk shocks in their livelihood activities, and vulnerable farmers may experience an unexpected income reduction or welfare loss due to environmental shocks. "Agriculture and farmers are two sides of the same coin" is true because they are deeply interconnected and mutually dependent. Agriculture cannot exist without farmers, and farmers rely on agriculture for their livelihood. Farmers' livelihood refers to the means and resources that enable farmers to sustain their daily lives, meet their economic needs, and secure their well-being. Therefore it is important to pay attention to this social issue. In this respect also this study is something different in the educational research field. So the present study is unique and different from the rest of the studies in terms of the variables, population sample and area. Therefore the investigators have conducted a study on the impact of environmental shocks on farmers' livelihood.

CHAPTER - III

METHODOLOGY

3.1 INTRODUCTION

Research is a systematic process of collection and analyzing information for some purpose. Researchers use different methods in their research activities. The selection of method depends on the nature, objective and population of the study. Educational researchers generally use survey, experimental, historical, comparative research and case study. Research is an intellectual activity in which systematic analysis is done. It is a systematized effort to gain new knowledge. Research is the human endeavor to know, to understand, to use and to change the external phenomena. We gain more knowledge and apply the knowledge in different ways to invent new things to make our life more comfortable and final effective solutions to the problems that we confront in life. We become more and more powerful to have control over the physical world.

Research is an academic activity and as such the term should be used in a technical sense. According to Clifford Woody research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis. D. Steiner and M. Stephenson in the Encyclopedia of Social Sciences define research as “the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.”

Webster has defined methodology as “the science of method or arrangement” which is not a particularly useful definition. Method is defined as “orderliness and regularly or habitual practice of them in action”. By placing stress on ‘arrangement’, orderliness, regularity and habitual practice, the methodologies derive their substance essentiality from the classically ideal controlled experiment which permeates rightly or otherwise, in the literature of educational research the methodology means with reference to research that it is a type of inquiry. (Sharma, R.A., 2008).

3.2 METHODS OF EDUCATIONAL RESEARCH

All research involves the elements of observation, description and analysis of what happens under certain circumstances. Researchers use different methods in their research activities for the solution of such population of the study, a simple three-point analysis may be used to classify research. George J. Mouly has classified research method into three basic types.

i) Historical Method
ii) Survey or Descriptive Method
iii) Experimental Method

i) Historical Method

It is concerned with the past and which attempts to trace the past as a means for seeing the present prospective. It is descriptive in nature. Mainly this type of research focuses on understanding the past as well as the present to a limited extent. It is also useful in understanding the future.

ii) Survey Method

Survey is the ‘fact finding’ study. It is a method of research involving collection of data directly from a population or a sample there of at particular time. It must not be confused with the mere clerical routine of gathering and tabulating figures. It requires expert and imaginative planning, careful analysis and rational interpretation of the finding. Data may be collected by observation or interviewing or mailing questionnaires.

iii) Experimental Method

Experimental research is designed to assess the effects of particular variables on a phenomenon by keeping the other variables constant or controlled. It aims at determining whether and in what manner variables are related to each other. The factors, which are influenced, by other factors, which influence it, are known as independent variables. The nature of relationship between independent variables and dependent variables is perceived and stated in the form of casual hypothesis.

3.3 METHOD ADOPTED IN THE PRESENT STUDY

The researcher has chosen survey method to study the problem of farmers livelihood. John W. Best (2006) “The survey method gathers data from a relatively large number cases at particular time survey method involves interpretation, comparison, measurement, classification, evaluation, and generalization. All directed towards a proper understanding solution of significant educational problems”.

3.3.1 Nature of the Survey Method

The nature of the survey method is as follows:

1. It deals with the present.
2. It is oriented towards the determination of the status of given phenomena rather than isolating accounting for its existence factors.
3. It is generally based on cross-sectional samples.
4. It has a fact-finding approach.
5. It studies significant relationship among phenomena.

3.3.2 Characteristics of Survey Method

The following are the characteristics of survey method:

a) The survey method gathers data from a relatively large number of cases at a particular time.
b) It is essentially cross-sectional approach.
c) It involves clearly defined problems and definite objectives.
d) It is concerned with generalized statistics of the whole population or of the sample.
e) It requires careful analysis and interpretation of data gathered.
f) It requires logical and skillful reporting of the findings.

3.3.3 Importance of Survey Method

Survey method is important to other research methods for the following reasons:

i) Factual information regarding existing status enables members of the profession to make efficient plans about future courses of action.
ii) It provides comprehension of underlying issues in the area of the study.
iii) It focuses attention upon the needs that otherwise could remain unnoticed.
iv) It provides extensive information about the nature of educational phenomena.
v) It gathers data from relatively large number of cases at a particular time.

3.4 STEPS IN SURVEY METHOD

According to William Wireman (1985) the detailed steps in a survey method are as follows;

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1. Planning
2. Development and application of sampling plan
3. Construction of questionnaire
4. Data collection
5. Translation of data
6. Data analysis
7. Data Collection Procedure
8. Conclusion and Reporting

3.4.1. Planning

The plan of action has to be drawn up to ensure scientific and objective merits of the study. Definition of the problem, operational definitions of variables, review and development of the survey design should be clearly drawn out.

3.4.2 Development and application of sampling plan

The geographical area to be covered, the sample to be selected and detailed sampling procedure, should be defined and formulated.

3.4.3. Construction of questionnaire

The tools of investigation generally used are interview schedule or questionnaire and the like. A specified investigation should require specified tools of inquiry. If no readymade tool is available, a suitable one will be prepared in a systematic manner. The tools should be tested in a pilot sample before it is administered to the vast sample.

3.4.4 Data Collection

The data will be collected from the proposed group of persons or sources with the help of the tool to be employed in the study. The participation of primary, middle and high school students are imperative to ensure comprehensiveness and authenticity of the data.

3.4.5 Translation of Data

Depending upon the extensiveness of the survey data and upon the nature of the material collected the handling of data usually takes initial tabulation and construction of category systems as necessary and technical preparation for analysis.

3.4.6. Data Analysis

Analysis of data comprises, various approaches designed to restrict the phenomena in their constitutional parts with a view to obtain greater insight into specified aspects. The Statistical analysis of data is principally based on counts of numbers of units that fall into different classes and subclasses, where quantitative responses have been obtained total for the classes are secured. From these numbers and totals, the arithmetic means can be computed for the different classes. Basic summary table can then be compiled more critical analysis can be applied to the data.

3.4.7 Data Collection Procedure

The collection of data is an extremely important of all research endeavours, for the conclusion of a study are based on what data reveal. As the result, the kind of data to be collected, the method of collection to be used, and the scoring of the data need to be considered with care. The term data is referred by Fraenkel &Walen (1993,) as the kinds of information researchers obtain on the subjects of their research. An important decision for every researcher to make during the planning phase of an investigation, therefore, is what kinds of data he or she intends to collect. The device the researcher used to collect data is called an instrument. After deciding on the sample for present study, the selected the villages for data collection.

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3.4.8. Conclusion and Reporting

After collecting and analyzing the data, the researches have to accomplish the tasks of drawing inferences following by reporting. It is only through interpretation that the research can expose relations and processes that come under his findings. Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented. As the problem selected for the present study is concerned with one of the current problems, the investigators decided to employ the survey method for the collection of data.

3.5 POPULATION AND SAMPLE

Population:

The population for this study consists of farmers in Tirunelveli District. This includes farmers engaged in various types of farming activities such as crop cultivation, horticulture, mixed farming, and allied agricultural practices. The target population specifically includes farmers who have experienced environmental shocks affecting their livelihood.

Sample:

The investigator has used stratified random sampling technique for selecting the sample from the population. The sample is a small part of a population selected for observation and analysis. John E. Conklin defines, “A sample is a representative group of people chosen from a large population”. The investigator has used stratified random sampling technique for selecting the sample from the population. The sample consists of 350 farmers.

Tools are data gathering devices. There are number of tools employed in research. Each tool has its own characteristics and each should be considered for its appropriateness for collecting certain kind of data in the selected research problem. A good research tool must satisfy reliability, validity, objectivity and predictability.

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The distributions of the samples under different categories are given below.

Table 3.1 Villages wise distribution

S.No	Name of the villages	No. of. Sample
1	Marukalkurichi, Nanguneri	65
2	Chettimedu	48
3	Oochikulam	42
4	Kalakad	49
5	Rengasamuthiram	38
6	Veeravanallur	37
7	Puthukudi	29
8	Manur	42
Total		**350**

Figure 3.1 Villages wise distribution

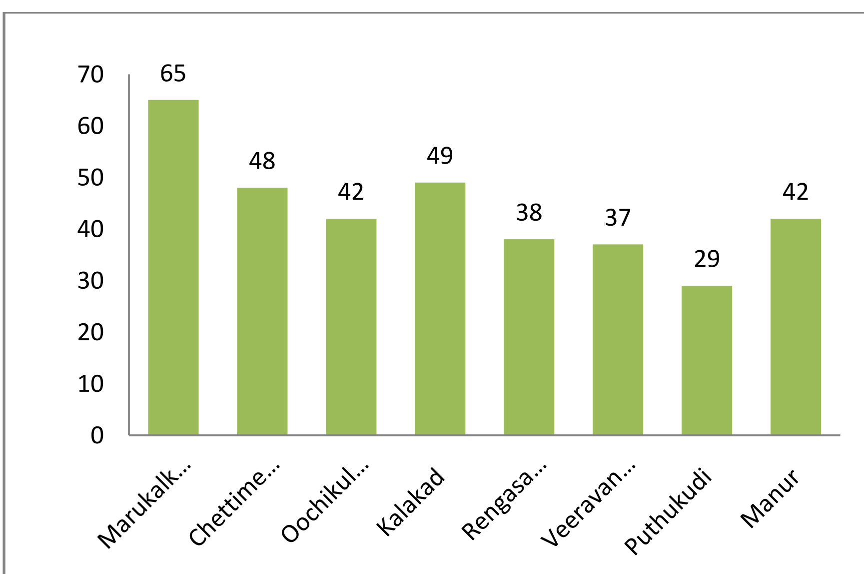

TABLE 3.2 DISTRIBUTION OF THE SAMPLE

Variables	Category	Sample	Percentage
Gender	Male	214	61.00
	Female	136	39.00
Type of Family	Joint	228	65.00
	Nuclear	122	35.00
Membership in farmers' organization	Member	67	81.00
	Non-Member	283	19.00
Type of farming	Organic	112	32.00
	Commercial	88	25.00
	Mixed	150	43.00
Type of land	Irrigated	138	39.00
	Rain fed	119	34.00
	Mixed	93	27.00
Land ownership status	Owned	85	24.00
	Leased	132	38.00
	Landless labour	133	38.00
Farm mechanization	Use of Traditional tool	52	15.00
	Use of Modern Machinery	195	56.00
	Use of both tools	103	29.00
Recovery time after shock	Below 6 months	88	25.00
	6-12 months	94	27.00
	Above 12 months	168	48.00
Educational Status	Uneducated	144	41.00
	School	134	38.00
	others	72	21.00

Age	Below 35 years	39	11.00
	36-50 years	137	39.00
	Above 50 years	174	50.00
Annual Income	Below 50000	88	25.00
	50000-100000	168	48.00
	Above 100000	94	27.00
Experience in farming,	Below 4 years	33	10.00
	4-7 years	78	22.00
	7-10 years	136	29.00
	Above 10 years	103	39.00
Access to weather information	Newspaper	97	28.00
	Radio	43	12.00
	Television	168	48.00
	Mobile Apps	42	12.00
Water sources for farming	Irrigation canals	66	19.00
	Wells	79	23.00
	ponds	103	29.00
	rain fed	87	25.00
	others	15	4.00
Type of Crisis experienced	Floods	72	19.00
	Droughts	92	23.00
	Pests	66	29.00
	Heavy Rainfall	92	25.00
	others	28	4.00

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TABLE 3.3

DISTRIBUTION OF THE SAMPLE IN TERMS OF GENDER

Gender	Number of Farmers	Percentage
Male	214	61.00
Female	136	39.00
Total	**350**	**100**

The above table shows that 61.00 % of the farmers are male and 39.00 % are female.

Figure 3.2 Distribution of the sample in terms of gender

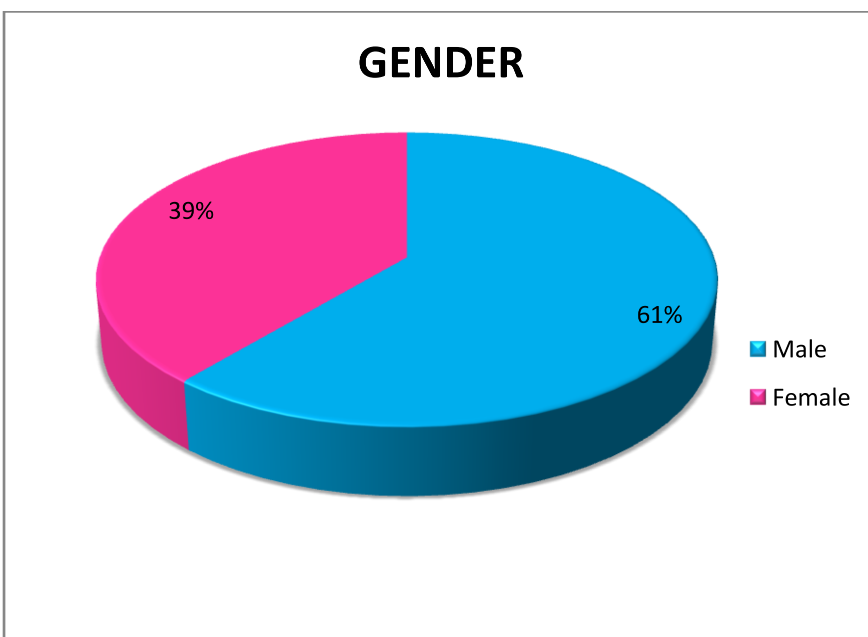

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TABLE 3.4

DISTRIBUTION OF THE SAMPLE IN TERMS OF TYPE OF FAMILY

Type of Family	Number of Farmers	Percentage
Joint	228	65.00
Nuclear	122	35.00
Total	**350**	**100**

The above table shows that 65.00% of the farmers are from nuclear family and 35.00% of the farmers are from joint family.

Figure 3.3 Distribution of the sample in terms of Type of Family

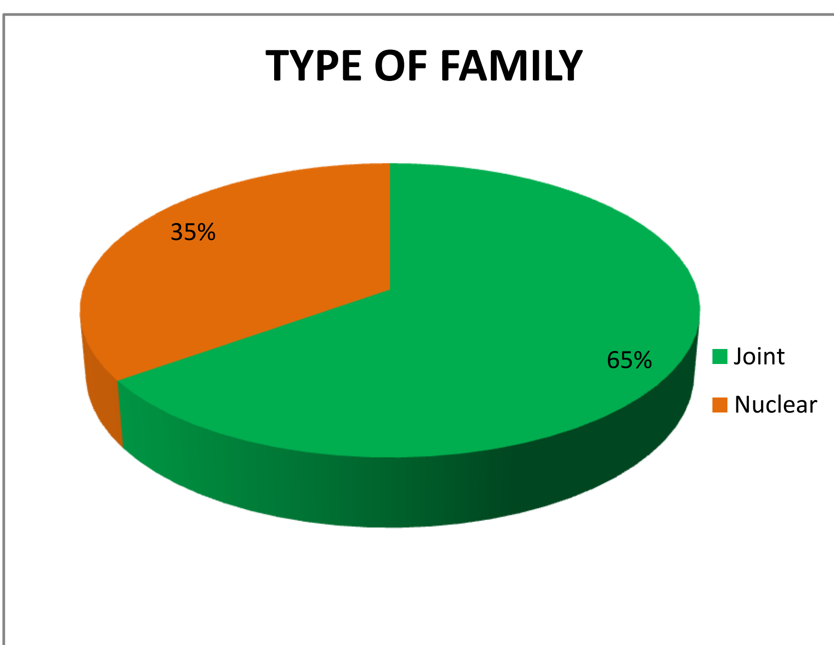

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TABLE 3.5

DISTRIBUTION OF THE SAMPLE IN TERMS OF MEMBERSHIP IN FARMERS ORGANIZATION

Membership in farmers Organization	Number of Farmers	Percentage
Member	67	81.00
Non-member	283	19.00
Total	**350**	**100**

The above table shows that 81.00% of the farmers have membership in farmers organization and 19.00% of the farmers are non-member.

Figure 3.4 Distribution of the sample in terms of Membership in farmers organization

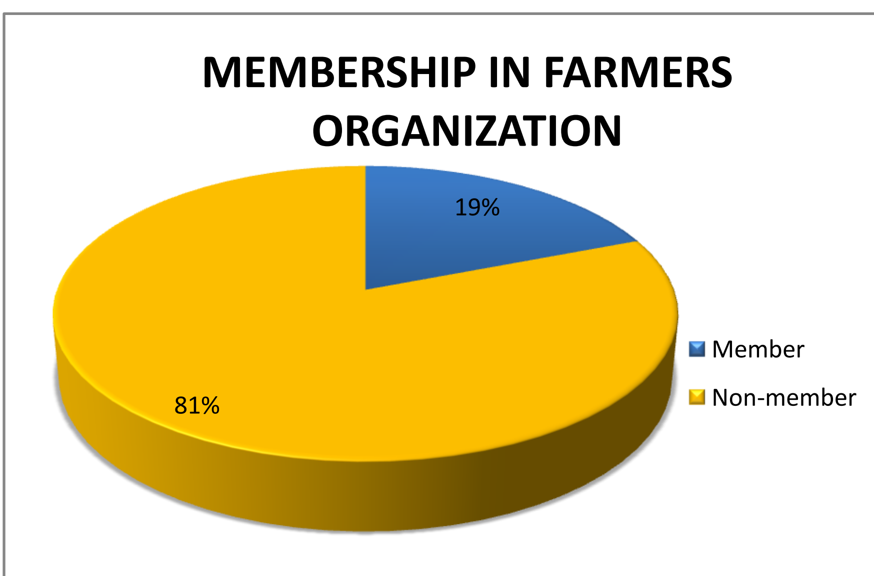
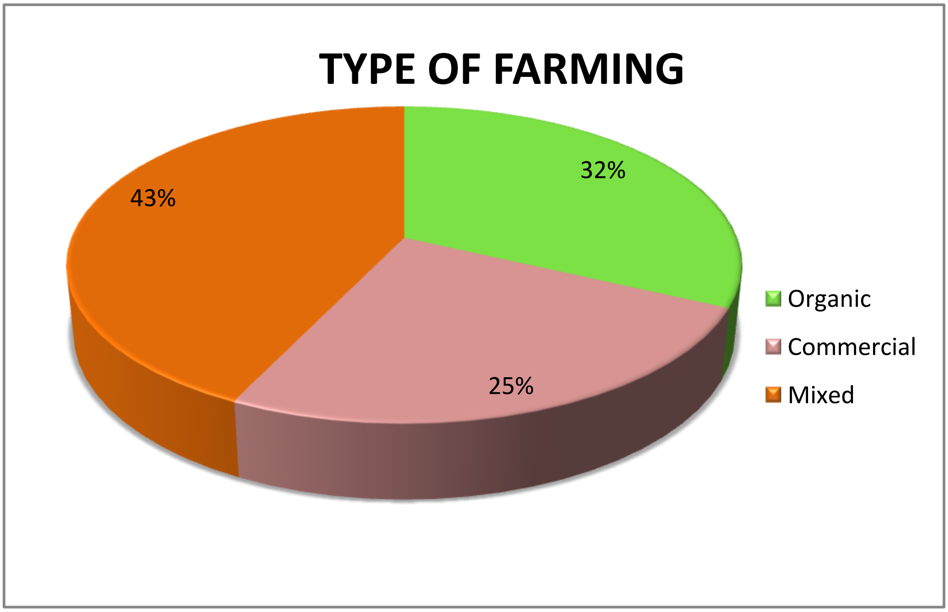


TABLE 3.6
DISTRIBUTION OF THE SAMPLE IN TERMS OF TYPE OF FARMING

Type of Farming	Number of Farmers	Percentage
Organic	112	32.00
Commercial	88	25.00
Mixed	150	43.00
Total	**350**	**100**

The above table shows that 32.00% of farmers engage in organic farming, 25.00% of farmers practice commercial farming, and 43.00% of farmers follow mixed farming.

Figure 3.5 Distribution of the sample in terms of Type of Farming



ISBN: 978-93-6135-982-8

TABLE 3.7
DISTRIBUTION OF THE SAMPLE IN TERMS OF TYPE OF LAND

Type of Land	Number of Farmers	Percentage
Irrigated	138	39.00
Rain fed	119	34.00
Mixed	93	27.00
Total	**350**	**100**

The above table shows that 39.00% of farmers cultivate irrigated land, 34.00% of farmers rely on rain-fed land, and 27.00% of farmers practice farming on mixed land.

Figure 3.6 Distribution of the sample in terms of Type of Land

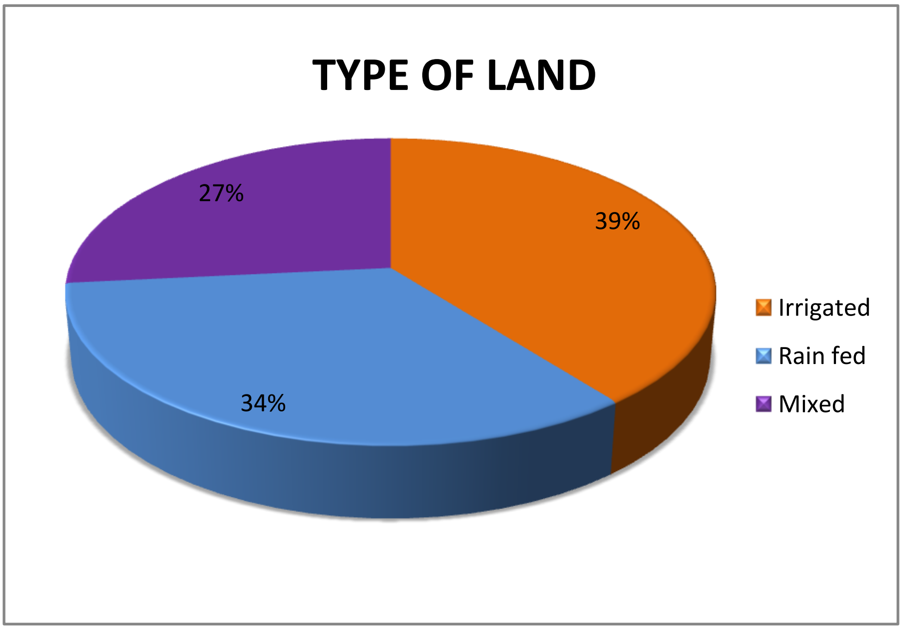


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TABLE 3.8

DISTRIBUTION OF THE SAMPLE IN TERMS OF ACCESS TO WEATHER INFORMATION

Access to weather Information	Number of Farmers	Percentage
Newspaper	97	28.00
Radio	43	12.00
Television	168	48.00
Mobile Apps	42	12.00
Total	**350**	**100**

The above table shows that 28.00% of farmers obtain weather updates from newspapers, 12.00% rely on the radio, 48.00% receive information through television, and 12.00% use mobile apps to receive weather information.

Figure 3.7 Distribution of the sample in terms of Access to weather information

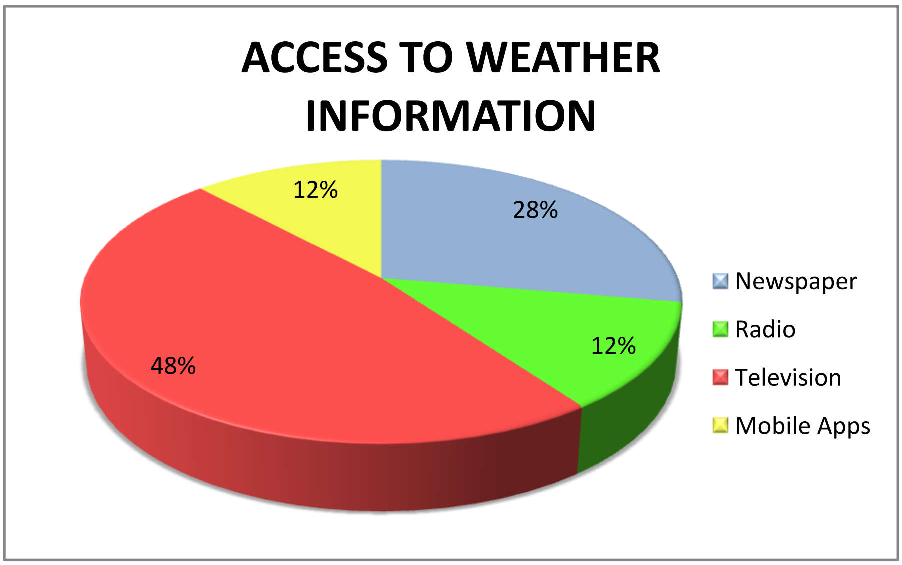


TABLE 3.9
DISTRIBUTION OF THE SAMPLE IN TERMS OF WATER SOURCES FOR FARMING

Water sources for farming	Number of Farmers	Percentage
Irrigation canals	66	19.00
Wells	79	23.00
ponds	103	29.00
rain fed	87	25.00
others	15	4.00
Total	**350**	**100**

The above table shows that 19.00% of farmers rely on irrigation canals, 23.00% use wells, 29.00% depend on ponds, 25.00% practice rain-fed farming, and 4.00% use other water sources for farming.

Figure 3.8 Distribution of the sample in terms of Water Sources for Farming

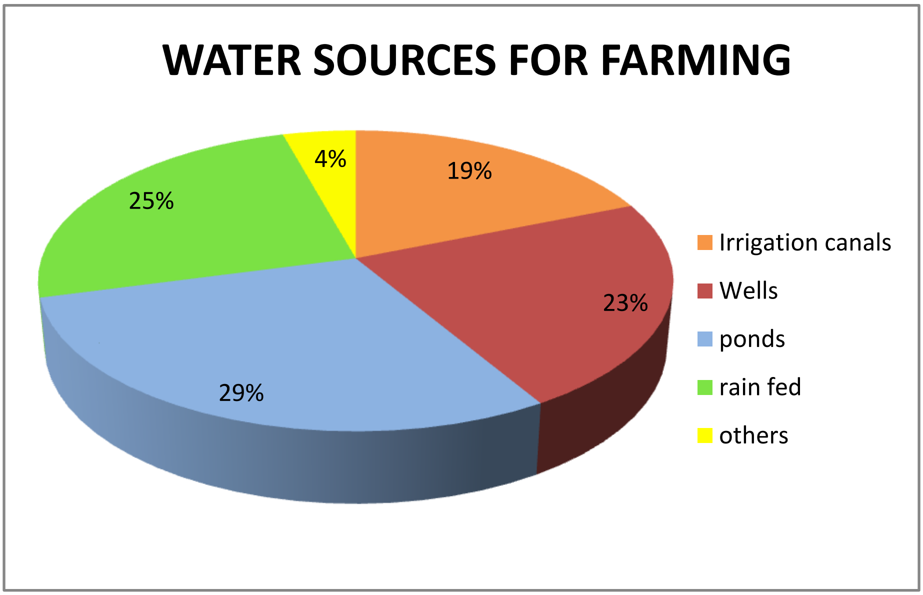
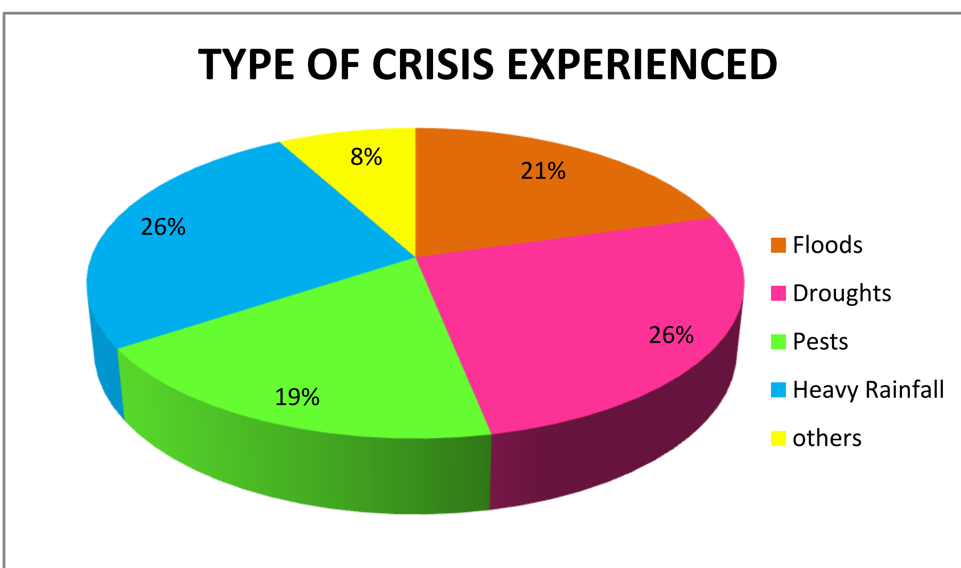


TABLE 3.10
DISTRIBUTION OF THE SAMPLE IN TERMS OF TYPE OF CRISIS EXPERIENCED

Type of Crisis experienced	Number of Farmers	Percentage
Floods	72	21.00
Droughts	92	26.00
Pests	66	19.00
Heavy Rainfall	92	26.00
others	28	8.00
Total	**350**	**100**

The above table shows that 21.00% of farmers have been affected by floods, 26.00% have faced droughts, 19.00% have been impacted by pests, 26.00% have experienced heavy rainfall, and 8.00% have encountered other types of crises.

Figure 3.9 Distribution of the sample in terms of Type of Crisis experienced



3.6. TOOL USED FOR THE PRESENT STUDY

By keeping various objectives and purposes of the study in mind, the investigators prepared the following tools.

1. Personal data sheet prepared by the investigators.
2. Environmental Shocks tool prepared by the investigators.

3.7. DESCRIPTION OF THE TOOL

Personal Data form

The personal data form is used to collect general information of the farmers in Tirunelveli District. It includes some personal information about the respondents such as Gender, Type of family, Membership in farmers' organization, Type of farming, Type of land, Land ownership status, Farm mechanization, Recovery time after shock, Educational status, Age, Experience in farming, Water sources for farming, Access to weather information, Annual Income, and Type of crisis experienced.

Environmental Shocks Questionnaire

The Environmental Shocks Questionnaire consists of 39 statements designed to assess individuals' perceptions, preparedness, and adaptive capacity in response to environmental shocks. Each statement is accompanied by three response options **(**Agree **/** Undecided / Disagree), representing the different ways in which respondents may perceive or experience these shocks. The 39 items are categorized under five dimensions, each representing a specific type of environmental shocks:

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DESCRIPTION OF ENVIRONMENTAL SHOCKS SCALE

Environmental Shocks (Dimensions)	Number of items
Climatic Shocks	1,2,3,4,5,6,7,8,9
Pollutional Shocks	10,11,12,13,14, 15,16,17
Biological Shocks	18,19,20,21, 22,23,24,25
Hydrological Shocks	26,27,28, 29,30,31,32
Chemical Shocks	33,34,35,36,37,38

3.8 PILOT STUDY

Pilot study is a preliminary study conducted on a limited scale before original studies are carried out in order to gain some primary information on the basis of which the main project would be planned and formulated. A pilot study was conducted to the farmers in Tirunelveli District. The questionnaires were distributed to twenty-five farmers to find out the validity of the items concluded in the questionnaire. The same questionnaire was distributed to the same set of farmers after two weeks interval.

3.9 VALIDITY FOR THE STUDY

Content Validity

To establish content validity, the tool was given to the experts to get their valuable comments. They suggested certain modifications. According to their suggestions certain items were deleted and some were modified. Thus the content validity was established.

Item validity

Carl Pearson product moment correlation co-efficient between the item score and the total score was calculated. Thus items having low validity were deleted and the revised tool was compiled.

Table 3.11 Environmental Shocks Scale

Item No.	γ value	Item No.	γ value	Item No.	γ value
1.	0.324	16	0.267	31	0.225
2.	0.298	17	0.275	32	0.253
3.	0.316	18.	0.248	33	0.261
4.	0.431	19.*	0.012	34	0.214
5.	0.386	20.	0.272	35	0.229
6.	0.342	21.*	0.002	36	0.234
7.	0.331	22.	0.304	37*	0.065
8.	0.301	23	0.291	38	0.224
9.*	0.099	24.*	0.028	39	0.271
10.	0.286	25.	0.218	40	0.262
11.	0.413	26.	0.224	41*	0.049
12.	0.276	27.	0.241	42	0.224
13.	0.249	28	0.234	43*	0.076
14.	0.347	29	0.272	44	0.310
15	0.316	30	0.233	45	0.231

*items were deleted

3.10. RELIABILITY

The reliability of the tool was calculated by Karl Pearson Product Moment Correlation Coefficient between the pretest and posttest scores. It was found to be 0.718

3.11 ADMINISTRATION OF THE TOOL

The investigator approached the farmers permission for the data collection and collected data from farmers using a questionnaire through in-person interactions. Before administering the tool, the investigator clarified the doubts and explained the purpose of the data collection. The respondents were then instructed to place a tick mark in the appropriate column.

3.12 STATISTICAL TECHNIQUES USED

"Statistics is the scientific study of handling quantitative information. It embodies a methodology of collection, classification, description and interpretation of data obtained through the conduct of surveys and experiments". (Aggarwal Y.P, 2000).

The investigator has used the following statistical techniques for analyzing and interpreting the data.

1. Arithmetic mean

The mean is a simple arithmetic average. It is common place knowledge that to take the average of a set of raw score we simply add all the scores up and divide it by the total number of scores". (Aggarwal, Y.P, 2000)

The investigator has used the following formula to find out the arithmetic mean:

$$\overline{X} = \frac{\Sigma x}{N}$$

Where,

$\overline{X}$	=	Arithmetic mean
Σ x	=	Sum of scores
N	=	Total number of scores

2. Standard deviation

"The square root of average of all deviations of scores from the mean of a given series or frequency distribution is known as standard deviation". It is also called as "mean square error". The word standard deviation was coined by Karl Pearson. It is denoted by σ (Sigma) or S.D. Bhandarkar K.M (2007).

The investigator has used the following formula for calculating standard deviation.

$$S.D = \frac{1}{N} \times \sqrt{N\Sigma x^2 - (\Sigma x)^2}$$

Where,

S.D. = Standard Deviation

Σx = Sum of scores

N = Total number of items

3. t-test

Theoretical work on 't' distribution was done by W.S. Gosset in the early 1908. Gosset was employed by the Guiness Brewery in Dulbin, Ireland which did not permit employees to publish research findings under their own names. So Gosset adopted the pen name 'student' and published his findings under this name and there after the 't' distribution is commonly called students 't' distribution.

(Sharma R.A, 2006)

The investigator has used the following formula for calculating't' test.

$$t = \frac{M_1 - M_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

Where,

M_1 = Mean of the I group

M_2 = Mean of the II group

S_1 = Standard deviation for the I group
S_2 = Standard deviation for the II group
N_1 = Size of the I group
N_2 = Size of the II group

4. ANOVA (Analysis of variance)

The technique of analysis of variance was first devised by sir Ronald Fisher, an English statistician who is also considered to be the father of modern statistics as applied to social and behavioural sciences. The analysis of variance, as the name indicates deals with variance rather than with standard deviations and standard errors (Aggarwal Y.P., 2000).
The investigator has used the following formula for calculating ANOVA :

$$F = \frac{Mean\ Square Variance\ between\ the\ groups}{Mean\ Square Variance\ within\ the\ group}$$

5. Chi-square

"If the difference between/among the observed and expected frequencies is squared and the same is divided by the expected frequencies and all the quantities obtained independently are added then the same total obtained is called chi-square (x^2)", (Ramakrishnan, P., 2003).

The investigator has used the following formula for calculating chi-square:

$$\lambda^2 = \frac{\Sigma(O-E)^2}{E}$$

Where,
λ^2 = Chi-square
Σ = Sum of Summation
O = Observed frequency

E = Expected frequency

6. Pearson's product moment correlation

"Correlation refers to relationship between two or more paired variables" (Aggarwal Y.P., 2000).

The investigator has used the following formula for Pearson's Product Moment correlation.

$$\chi = \frac{N(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{N\Sigma x^2 - (\Sigma x)^2}\sqrt{N\Sigma y^2 - (\Sigma y)^2}}$$

Where,

N	=	Number of the scores
Σx	=	Sum of the x scores
Σy	=	Sum of the y scores
Σx^2	=	Sum of the x scores squared
Σy^2	=	Sum of the y scores squared
Σxy	=	Sum of the product of x and y scores

7. Regression

Simple linear regression is a model that assesses the relationship between a dependent variable and an independent variable. The simple linear model is expressed using the following equation:

$Y = a + bX + \epsilon$

Where:

Y – Dependent variable

X – Independent (explanatory) variable

a – Intercept

b – Slope

ϵ – Residual (error)

CHAPTER - IV

ANALYSIS OF DATA

4.1. INTRODUCTION

Analysis of data refers to examining and investigating the organized material through a scientific procedure in order to ascertain some facts. The most significant factor in educational research is analysis of data. Kothari C.R. (1990) in his book "Research Methodology" states, "The process of analysis, relationship or difference supporting or conflicting with original or new hypothesis should be subjected to statistical tests of significance to determine with what validity of the data can be said to indicate any conclusion".

John. W. Best (1995) in his book on Research in Education states, "Statistic is a body of mathematical technique or process for gathering, organizing, analyzing, and interpreting numerical data, because most research capitulate such a huge quantitative data. Statistic is a basic tool of measurement, and evaluation in research. Statistical data describes group behavior or group characteristics abstracted from a number of individual observations that are combined to make generalizations possible" (P.274). William Wiersma (1986) in his book on Research Methods in Education states, "Statistics have multiple meanings in educational research, but probably in its simplest meaning is- bits of information. It also refers to the theory, procedures and methodology by which data are summarized" (P. 323). Thus the statistical analysis is a significant factor in research work.

4.1.1 FUNCTIONS OF ANALYSIS OF DATA

- To obtain the significant results.
- To make the raw data meaningful.
- To evaluate parameters.
- To test the null hypothesis
- To draw some inferences or make generalization**.**

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4.2. OBJECTIVE TESTING

1. Level of impact of Environmental shocks on Farmers livelihood

TABLE 4.1

Level of impact of Environmental shocks on Farmers livelihood

Dimensions of Environmental Shocks	Low		Moderate		High	
	N	%	N	%	N	%
Climatic Shocks	61	17.4	250	71.4	39	11.1
Pollutional Shocks	60	17.1	239	68.3	51	14.6
Biological Shocks	62	17.7	246	70.3	42	12.0
Hydrological Shocks	71	20.3	228	65.1	51	14.6
Chemical Shocks	77	22.0	225	64.3	48	13.7
Environmental Shocks	67	19.1	239	68.3	44	12.6

It is inferred from the above table that 17.4% of farmers experience a low impact, 71.4% experience a moderate impact, and 11.1% experience a high impact in the dimension of climatic shocks on their livelihood.

It is inferred from the above table that 17.1% of farmers experience a low impact, 68.3% experience a moderate impact and 14.6% experience a high impact in the dimension of Pollutional shocks on their livelihood.

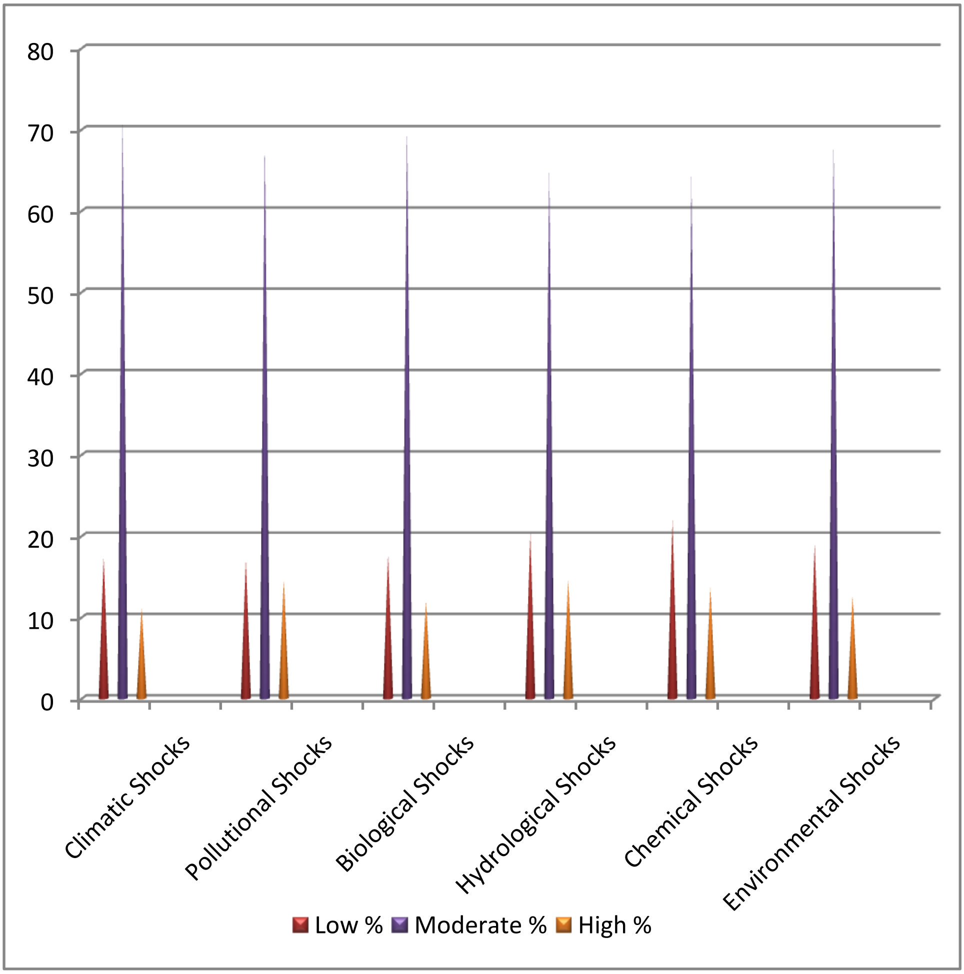
It is inferred from the above table that 17.7%of farmers experience a low impact, 70.3% experience a moderate impact and 12.0% experience a high impact in the dimension of Biological shocks on their livelihood.

It is inferred from the above table that 20.3%of farmers experience a low impact, 65.1% experience a moderate impact and 14.6% experience a high impact in the dimension of Hydrological shocks on their livelihood.

It is inferred from the above table that 22.0% of farmers experience a low impact, 64.3% experience a moderate impact and 13.7% experience a high impact in the dimension of Chemical shocks on their livelihood.

.It is inferred from the above table that 19.1% of farmers experience a low impact, 68.3% experience a moderate impact and 12.6% experience a high impact in the overall dimension of Environmental shocks on their livelihood.

Figure 4.1 Level of impact of Environmental shocks on Farmers livelihood



2. Level of impact of Environmental shocks and its dimensions on Farmers livelihood with regard to Gender

TABLE 4.2

Level of impact of Environmental shocks and its dimensions on Farmers livelihood with regard to Gender

Dimensions of Environmental Shocks	Gender	Low		Moderate		High	
		N	%	N	%	N	%
Climatic Shocks	Male	36	16.3	134	75.3	24	8.4
	Female	24	18.5	97	67.9	15	13.6
Pollutional Shocks	Male	38	17.9	149	70.1	27	12.0
	Female	22	16.3	89	65.7	25	18.1
Biological Shocks	Male	37	17.9	141	66.8	28	15.2
	Female	23	13.9	94	74.7	19	11.4
Hydrological Shocks	Male	35	16.3	145	67.9	34	15.8
	Female	26	15.7	88	71.1	22	13.3
Chemical Shocks	Male	39	19.0	147	70.1	28	10.9
	Female	30	18.1	84	68.7	22	13.3
Environmental Shocks	Male	34	18.5	156	68.5	24	13.0
	Female	30	18.1	84	68.7	22	13.3

It is inferred from the above table that 16.3% of male farmers experience a low impact, 75.3% experience a moderate impact, and 8.4% experience a high impact in the dimension of climatic shocks on their livelihood. Regarding female farmers, 18.5% experience a low impact, 67.9% experience a moderate impact, and 13.6% experience a high impact in the dimension of climatic shocks on their livelihood.

It is inferred from the above table that 17.9% of male farmers experience a low impact, 70.1% experience a moderate impact, and 12.0% experience a high impact in the dimension of pollutional shocks on their livelihood. Regarding female farmers, 16.3% experience a low impact, 65.7% experience a moderate impact, and 18.1% experience a high impact in the dimension of pollutional shocks on their livelihood.

It is inferred from the above table that 17.9% of male farmers experience a low impact, 66.8% experience a moderate impact, and 15.2% experience a high impact in the dimension of biological shocks on their livelihood. Regarding female farmers, 13.9% experience a low impact, 74.7% experience a moderate impact, and 11.4% experience a high impact in the dimension of biological shocks on their livelihood.

It is inferred from the above table that 16.3% of male farmers experience a low impact, 67.9% experience a moderate impact, and 15.8% experience a high impact in the dimension of hydrological shocks on their livelihood. Regarding female farmers, 15.7% experience a low impact, 71.1% experience a moderate impact, and 13.3% experience a high impact in the dimension of hydrological shocks on their livelihood.

It is inferred from the above table that 19.0% of male farmers experience a low impact, 70.1% experience a moderate impact, and 10.9% experience a high impact in the dimension of chemical shocks on their livelihood. Regarding female farmers, 18.1% experience a low impact, 68.7% experience a moderate impact, and 13.3% experience a high impact in the dimension of chemical shocks on their livelihood.

It is inferred from the above table that 18.5% of male farmers experience a low impact, 68.5% experience a moderate impact, and 13.0% experience a high impact in the dimension of overall environmental shocks on their livelihood. Regarding female farmers, 18.1% experience a low impact, 68.7% experience a moderate impact, and 13.3% experience a high impact in the dimension of overall environmental shocks on their livelihood.

3. Level of impact of Environmental shocks and its dimensions on Farmers livelihood with regard to type of family

TABLE 4.3

Level of impact of Environmental shocks and its dimensions on Farmers livelihood with regard to Type of Family

Dimensions of Environmental Shocks	Type of Family	Low		Moderate		High	
		N	%	N	%	N	%
Climatic Shocks	Joint	35	18.5	166	69.0	27	12.5
	Nuclear	29	17.0	69	73.6	24	9.4
Pollutional Shocks	Joint	32	18.5	172	68.4	24	13.1
	Nuclear	25	15.1	74	71.7	21	13.2
Biological Shocks	Joint	38	15.8	162	71.7	28	12.5
	Nuclear	39	17.0	66	69.8	27	13.2

Hydrological Shocks	Joint	41	15.2	150	69.0	37	15.8
	Nuclear	37	15.1	51	77.4	34	7.5
Chemical shocks	Joint	38	22.9	162	64.3	28	12.8
	Nuclear	36	17.0	59	69.8	33	13.2
Environmental Shocks	Joint	41	18.5	151	69.4	36	12.1
	Nuclear	27	13.2	72	79.2	23	7.5

It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 69.0% experience a moderate impact, and 12.5% experience a high impact in the dimension of climatic shocks on their livelihood on their livelihood. Regarding farmers from nuclear families, 17.0% experience a low impact, 73.6% experience a moderate impact, and 9.4% experience a high impact in the dimension of climatic shocks on their livelihood on their livelihood.

It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 68.4% experience a moderate impact, and 13.1% experience a high impact in the dimension of pollutional shocks on their livelihood. Regarding farmers from nuclear families, 15.1% experience a low impact, 71.7% experience a moderate impact, and 13.2% experience a high impact in the dimension of pollutional shocks on their livelihood.

It is inferred from the above table that 15.8% of farmers from joint families experience a low impact, 71.7% experience a moderate impact, and 12.5% experience a high impact in the dimension of biological shocks on their livelihood. Regarding farmers from nuclear families, 17.0% experience a low impact, 69.8% experience a moderate impact, and 13.2% experience a high impact in the dimension of biological shocks on their livelihood.

It is inferred from the above table that 15.2% of farmers from joint families experience a low impact, 69.0% experience a moderate impact, and 15.8% experience a high impact in the dimension of hydrological shocks on their livelihood. Regarding farmers from nuclear families, 15.1% experience a low impact, 77.4% experience a moderate impact, and 7.5% experience a high impact in the dimension of hydrological shocks on their livelihood.

It is inferred from the above table that 22.9% of farmers from joint families experience a low impact, 64.3% experience a moderate impact, and 12.8% experience a high impact in the dimension of chemical shocks on their livelihood. Regarding farmers from nuclear families, 17.0% experience a low impact, 69.8% experience a moderate impact, and 13.2% experience a high impact in the dimension of chemical shocks on their livelihood.

It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 69.4% experience a moderate impact, and 12.1% experience a high impact in the dimension of overall environmental shocks on their livelihood. Regarding farmers from nuclear families, 13.2% experience a low impact, 79.2% experience a moderate impact, and 7.5% experience a high impact in the dimension of overall environmental shocks on their livelihood.

4.3 HYPOTHESES TESTING

Null Hypothesis - 1

There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Gender.

TABLE 4.4
Difference between the impact of environmental shocks and its dimensions on farmers livelihood with respect to gender

Dimensions of Environmental Shocks	Gender	N	Mean	SD	Calculated 't' value	Remarks
Climatic Shocks	Male	214	24.73	5.54	2.83	S
	Female	136	27.09	6.98		
Pollutional Shocks	Male	214	21.36	4.65	2.32	S
	Female	136	24.47	5.88		
Biological Shocks	Male	214	24.98	4.82	2.63	S
	Female	136	22.14	6.18		
Hydrological Shocks	Male	214	23.79	5.89	1.75	NS
	Female	136	23.54	6.39		
Chemical shocks	Male	214	16.89	4.90	3.27	S
	Female	136	18.02	5.60		
Environmental Shocks	Male	214	115.75	26.62	2.084	S
	Female	136	129.27	23.46		

(At 5 % level of significance, the table value of't' is 1.96)

It is inferred from the above table that there is no significant difference between the impact of Environmental shocks on male and female farmers in the dimension of hydrological shocks on Farmers livelihood, as the calculated t value (1.75) is less than the table value (1.96) at the 5% level of significance. However, there is a significant difference between the impact of

Environmental shocks on male and female farmers in the dimensions such as climatic shocks, pollutional shocks, biological shocks, chemical shocks and the overall impact of environmental shocks on Farmers livelihood. The calculated t values (2.83, 2.32, 2.63, 3.27, and 2.084, respectively) are greater than the table value of 1.96 at the 5% level of significance Hence the null hypothesis is rejected.

Null Hypothesis - 2

There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to type of family.

TABLE 4.5

Difference between the impact of environmental shocks and its dimensions on farmers livelihood with respect to type of family

Dimensions of Environmental Shocks	**Type of family**	**N**	**Mean**	**SD**	**Calculated 't' value**	**Remarks**
Climatic Shocks	Nuclear	122	26.44	6.78	2.74	S
	Joint	228	28.58	7.65		
Pollutional Shocks	Nuclear	122	24.29	5.79	1.99	S
	Joint	228	25.65	6.75		
Biological Shocks	Nuclear	122	26.36	6.75	1.09	NS
	Joint	228	26.83	6.72		
Hydrological Shocks	Nuclear	122	23.65	6.13	1.48	NS
	Joint	228	23.73	7.23		
Chemical shocks	Nuclear	122	18.37	4.84	2.06	S
	Joint	228	19.57	5.83		
Environmental Shocks	Nuclear	122	119.11	23.46	2.66	S
	Joint	228	126.36	26.70		

(At 5 % level of significance, the table value of 't' is 1.96)

It is inferred from the above table that there is no significant difference between the impact of Environmental shocks on nuclear and joint family farmers and its dimensions such as biological shocks and hydrological shocks on Farmers livelihood, as the calculated t values (1.09 and 1.48, respectively) are less than the table value (1.96) at the 5% level of significance. However, there is significant difference between the impact of Environmental shocks on nuclear and joint family farmers and its dimensions such as climatic shocks, pollutional shocks, chemical shocks and the overall environmental shocks on Farmers livelihood, as the calculated t values (2.74, 1.99, 2.06, and 2.66, respectively) are greater than the table value of 1.96 at the 5% level of significance. Hence, the null hypothesis is rejected.

Null Hypothesis - 3

There is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to membership in farmers organization.

TABLE 4.6

Difference between the impact of environmental shocks and its dimensions on farmers livelihood with respect to membership in farmers organization

Dimensions of Environmental Shocks	Membership in farmers organization	N	Mean	SD	Calculated 't' value	Remarks
Climatic Shocks	Member	67	26.46	6.81	1.74	NS
	Non-Member	283	26.41	7.59		
Pollutional Shocks	Member	67	24.34	5.93	1.99	NS
	Non-Member	283	24.54	6.53		
Biological Shocks	Member	67	26.15	6.44	1.09	NS
	Non-Member	283	26.96	6.55		
Hydrological Shocks	Member	67	23.72	6.33	1.48	NS
	Non-Member	283	24.60	6.98		

Chemical shocks	Member	67	18.28	4.90	1.06	NS
	Non-Member	283	19.58	5.70		
Environmental Shocks	Member	67	118.94	24.08	1.66	NS
	Non-Member	283	117.08	25.84		

(At 5 % level of significance, the table value of 't' is 1.96)

It is inferred from the above table that there is no significant difference between the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, chemical shocks on Farmers livelihood with respect to membership in farmers organization. The calculated t values (1.74, 1.99, 1.09, 1.48, 1.06, and 1.66, respectively) are less than the table value (1.96) at the 5% level of significance. Hence, the null hypothesis is accepted. Thus there is no significant difference between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to membership in farmers organization.

Null Hypothesis - 4

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Type of farming.

TABLE 4.7

DIFFERENCE AMONG THE IMPACT OF ENVIRONMENTAL SHOCKS AND ITS DIMENSIONS ON FARMERS LIVELIHOOD WITH RESPECT TO TYPE OF FARMING

Dimensions of Environmental Shocks	**Source of variation**	**df (2, 347)**		**Calculated 'F' value**	**Remarks**
		Sum of squares	**Variance Estimate**		
Climatic Shocks	between	136.66	68.33	1.29	NS
	within	18314.94	52.78		
Pollutional Shocks	between	311.31	155.66	2.02	NS
	within	13449.78	38.76		
Biological Shocks	between	275.59	137.80	2.24	NS
	within	14768.38	42.56		
Hydrological Shocks	between	408.91	204.45	1.69	NS
	within	15127.78	43.60		
Chemcal shocks	between	148.97	74.48	1.63	NS
	within	9814.92	28.29		
Environmental Shocks	between	5524.00	2762.00	1.42	NS
	within	217004.50	625.37		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, chemical shocks on Farmers livelihood with respect to Type of farming. The calculated *F* values (1.29, 2.02, 2.24, 1.69, 1.63 and 1.42, respectively) are less than the table value of 3.03 at the 5% level of significance. Hence, the null hypothesis is accepted.

Null Hypothesis - 5

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Type of Land.

TABLE 4.8

Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to type of land

Dimensions of Environmental Shocks	**Source of variation**	**df (2, 347)**		**Calculated 'F' value**	**Remarks**
		Sum of squares	**Variance Estimate**		
Climatic Shocks	between	514.03	257.02	4.97	S
	within	17937.56	51.69		
Pollutional Shocks	between	300.78	150.39	3.88	S
	within	13460.31	38.79		
Biological Shocks	between	404.56	202.28	4.79	S
	within	14639.41	42.19		
Hydrological Shocks	between	195.20	97.60	3.21	S
	within	15341.49	44.21		
Chemical shocks	between	175.47	87.73	3.11	S
	within	9788.42	28.21		
Environmental Shocks	between	6522.00	3261.00	5.24	S
	within	216006.5	622.50		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is significant difference among the impact of environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, chemical shocks on farmers livelihood with respect to type of land. This is evident as the calculated F values (4.97, 3.88, 4.79, 3.21, 3.11, and 5.24, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence, the null hypothesis is rejected. Thus there is significant difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to type of land.

Null Hypothesis - 6

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to land ownership status.

TABLE 4.9
Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to land ownership status

Dimensions of Environmental Shocks	**Source of variation**	**df (2, 347)**		**Calculated 'F' value**	**Remarks**
		Sum of squares	**Variance Estimate**		
Climatic Shocks	between	203.53	101.77	3.94	S
	within	18248.06	52.59		
Pollutional Shocks	between	259.59	129.80	3.34	S
	within	13501.50	38.91		
Biological Shocks	between	129.61	64.80	2.51	NS
	within	14914.36	42.98		
Hydrological Shocks	between	254.98	127.49	3.89	S
	within	15281.70	44.04		
Chemical shocks	between	22.49	11.25	1.39	NS
	within	9941.40	28.65		
Environmental Shocks	between	3556.00	1778.00	3.82	S
	within	218972.5	631.04		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of Environmental shocks and its dimensions such as Biological Shocks and Chemical Shocks on Farmers livelihood with respect to land ownership, as the calculated F values (2.51 and 1.39, respectively) are less than the table value of 3.03 at the 5% level of significance. However, there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks on Farmers livelihood with respect to land ownership, as their calculated F values (3.94, 3.34, 3.89, and 3.82, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected.

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Null Hypothesis - 7

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to farm mechanization.

TABLE 4.10
Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to farm mechanization

Dimensions of Environmental Shocks	**Source of variation**	**df (2, 347)**		**Calculated 'F' value**	**Remarks**
		Sum of squares	**Variance Estimate**		
Climatic Shocks	between	221.24	101.77	1.94	NS
	within	16548.06	52.59		
Pollutional Shocks	between	248.29	129.80	1.34	NS
	within	14201.34	38.91		
Biological Shocks	between	134.56	64.80	1.51	NS
	within	15114.28	42.98		
Hydrological Shocks	between	222.49	127.49	2.89	NS
	within	14981.70	44.04		
Chemical Shocks	between	46.49	11.25	0.39	NS
	within	9941.40	28.65		
Environmental Shocks	between	2935.00	1778.00	2.82	NS
	within	219722.50	631.04		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks, Chemical Shocks, and overall environmental shocks on Farmers livelihood with respect to farm mechanization. The calculated F values (1.94, 1.34, 1.51, 2.89, 0.39, and 2.82, respectively) are less than the table value 3.03 at the 5% level of significance. Hence the null hypothesis is accepted. Thus there is no significant difference among the impact of environmental shocks and its dimensions on Farmers livelihood with respect to farm mechanization.

Null Hypothesis - 8

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to recovery time after shock.

TABLE 4.11

Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to recovery time after shock

Dimensions of Environmental Shocks	Source of variation	df (2, 347)		Calculated 'F' value	Remarks
		Sum of squares	Variance Estimate		
Climatic Shocks	between	153.47	76.73	3.16	S
	within	4009.61	20.32		
Pollutional Shocks	between	138.81	69.41	4.01	S
	within	4521.95	22.92		
Biological Shocks	between	128.15	64.07	3.27	S
	within	3934.74	19.94		
Hydrological Shocks	between	153.47	76.73	3.19	S
	within	4009.61	20.32		
Chemical Shocks	between	165.38	82.69	3.55	S
	within	3801.75	19.30		
Environmental Shocks	between	4518.00	2356.00	4.82	S
	within	216994.50	725.37		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is significant difference in the no significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks, Chemical Shocks and overall environmental shocks on Farmers livelihood with respect to recovery time after shock. This is evident as the calculated F values (3.16, 4.01, 3.27, 3.19, 3.55, and 4.82 respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected. Thus there is significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to recovery time after shock.

Null Hypothesis - 9

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to educational status.

TABLE 4.12

Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to educational status

Dimensions of Environmental Shocks	Source of variation	df (2, 347)		Calculated 'F' value	Remarks
		Sum of squares	Variance Estimate		
Climatic Shocks	between	93.66	46.83	3.56	S
	within	4033.42	20.45		
Pollutional Shocks	between	232.01	116.0	1.49	NS
	within	4394.88	22.29		
Biological Shocks	between	132.38	66.19	1.33	NS
	within	3898.62	19.77		
Hydrological Shocks	between	134.25	46.83	3.27	S
	within	3405.25	20.45		
Chemical Shocks	between	137.63	40.34	3.05	S
	within	3989.46	23.05		
Environmental Shocks	between	1035.38	72.12	3.52	S
	within	42176.62	22.77		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of environmental shocks and its dimensions such as Pollutional Shocks and Biological Shocks on farmers livelihood with respect to educational status. This is evident as the calculated F values (1.49 and 1.33, respectively) are less than the table value of 3.03 at the 5% level of significance. However, there is significant difference in the impact of environmental shocks and its dimensions such as Climatic Shocks, Hydrological Shocks, Chemical Shocks, and overall Environmental Shocks on farmers livelihood with respect to educational status. The calculated F values (3.56, 3.27, 3.05, and 3.52, respectively) are greater than the table value of 3.03, confirming a significant variation. Hence the null hypothesis is rejected.

Null Hypothesis - 10

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to age.

TABLE 4.13

Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to age

Dimensions of Environmental Shocks	**Source of variation**	**df (2, 347)**		**Calculated 'F' value**	**Remarks**
		Sum of squares	**Variance Estimate**		
Climatic Shocks	between	148.72	74.48	3.14	S
	within	3998.59	22.39		
Pollutional Shocks	between	141.21	71.10	2.22	NS
	within	4128.59	24.39		
Biological Shocks	between	131.26	63.98	2.98	NS
	within	3879.04	20.01		
Hydrological Shocks	between	151.99	75.89	3.46	S
	within	3895.98	23.08		
Chemical Shocks	between	158.98	83.17	2.09	NS
	within	4011.07	20.01		
Environmental Shocks	between	3918.98	2286.77	2.67	NS
	within	213779.7	734.19		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of Environmental shocks and its dimensions such as Pollutional Shocks, Biological Shocks, Chemical Shocks, and overall Environmental Shocks on Farmers livelihood with respect to age. This is indicated by the calculated F values (2.22, 2.98, and 2.67, respectively), which are lower than the table value of 3.03 at the 5% level of significance. However, there is significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks and Hydrological Shocks on farmers livelihood with respect to age. The calculated F values (3.14 and 3.46, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected.

Null Hypothesis - 11

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to annual income.

TABLE 4.14

Difference among the impact of environmental shocks and its dimensions on farmers livelihood with respect to Annual Income

Dimensions of Environmental Shocks	Source of variation	df (2, 347)		Calculated 'F' value	Remarks
		Sum of squares	Variance Estimate		
Climatic Shocks	between	121.44	46.83	4.21	S
	within	3988.98	20.45		
Pollutional Shocks	between	198.78	116.0	4.63	S
	within	4210.66	22.29		
Biological Shocks	between	164.53	66.19	5.01	S
	within	4011.42	19.77		
Hydrological Shocks	between	175.77	46.83	2.75	NS
	within	3764.81	20.45		
Chemical Shocks	between	152.63	40.34	4.32	S
	within	3568.88	23.05		
Environmental Shocks	between	987.52	72.12	4.78	S
	within	4476.77	22.77		

(At 5 % level of significance, the table value of 'F' is 3.03)

It is inferred from the above table that there is no significant difference among the impact of Environmental shocks and its dimensions such as hydrological shocks on Farmers livelihood with respect to annual income, as the calculated F value 2.75 is less than the table value of 3.03 at the 5% level of significance. However, there is a significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks, pollutional shocks, Biological shocks, Chemical shocks and overall environmental shocks on farmers livelihood with respect to annual income. The calculated F values (4.21, 4.63, 5.01, 4.32, and 4.78, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected.

Null Hypothesis - 12

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and experience in farming.

TABLE 4.15

Association between the impact of environmental shocks and its dimensions on farmers livelihood and experience in farming

Dimensions of Environmental Shocks	df	Calculated 'χ^2' value	Remarks
Climatic Shocks	4	16.00	S
Pollutional Shocks		15.56	S
Biological Shocks		5.79	NS
Hydrological Shocks		8.44	NS
Chemical Shocks		14.93	S
Environmental Shocks		13.33	S

(At 5 % level of significance, the table value of 'χ^2' is 9.488)

It is inferred from the above table that there is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks and Hydrological Shock on Farmers livelihood and experience in farming, as the calculated 'χ^2' values (5.79 and 8.44, respectively) are less than the table value 9.488 at the 5% level of significance. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Chemical shocks and overall environmental shocks on Farmers livelihood and experience in farming, as the calculated 'χ^2' values (16.00, 15.56, 14.93 and 13.33, respectively) are greater than the table value 9.488 at the 5% level of significance. Hence the null hypothesis is rejected.

Null Hypothesis - 13

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and access to weather information.

TABLE 4.16

Association between the impact of environmental shocks and its dimensions on farmers livelihood and access to weather information

Dimensions of Environmental Shocks	df	Calculated 'χ^2' value	Remarks
Climatic Shocks	4	6.49	NS
Pollutional Shocks		7.56	NS
Biological Shocks		8.24	NS
Hydrological Shocks		6.16	NS
Chemical Shocks		7.28	NS
Environmental Shocks		5.34	NS

(At 5 % level of significance, the table value of 'χ^2' is 9.488)

It is inferred from the above table that there is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and access to weather information. This is evident as the calculated 'χ^2' values for all dimensions Climatic Shocks (6.49), Pollutional Shocks (7.56), Biological Shocks (8.24), Hydrological Shocks (6.16), Chemical Shocks (7.28), and overall Environmental Shocks (5.34) are less than the table value of 9.488 at the 5% level of significance. Hence, the null hypothesis is accepted. Thus there is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and access to weather information.

Null Hypothesis - 14

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and water sources for farming.

TABLE 4.17

Association between the impact of environmental shocks and its dimensions on farmers livelihood and water sources for farming

Dimensions of Environmental Shocks	**df**	**Calculated 'χ^2' value**	**Remarks**
Climatic Shocks	6	4.22	NS
Pollutional Shocks		5.34	NS
Biological Shocks		6.32	NS
Hydrological Shocks		5.39	NS
Chemical Shocks		6.29	NS
Environmental Shocks		5.45	NS

(At 5 % level of significance, the table value of 'χ^2' is 12.592)

It is inferred from the above table that there is no association between the impact of Environmental shocks and its dimensions on Farmers livelihood and water sources for farming. This is evident as the calculated 'χ^2' values for all dimensions such as Climatic Shocks (4.22), Pollutional Shocks (5.34), Biological Shocks (6.32), Hydrological Shocks (5.39), Chemical Shocks (6.29), and overall Environmental Shocks (5.45) are less than the table value of 12.592 at the 5% level of significance. Hence, the null hypothesis is accepted. Thus there is no association between the impact of Environmental shocks and its dimensions on Farmers livelihood and water sources for farming.

Null Hypothesis - 15

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood and type of crisis experienced.

TABLE 4.18

Association between the impact of environmental shocks and its dimensions on farmers livelihood and type of crisis experienced

Dimensions of Environmental Shocks	df	Calculated 'χ^2' value	Remarks
Climatic Shocks	6	19.39	S
Pollutional Shocks		16.92	S
Biological Shocks		8.14	NS
Hydrological Shocks		13.69	S
Chemical Shocks		8.08	NS
Environmental Shocks		18.66	S

(At 5 % level of significance, the table value of 'χ^2' is 12.592)

It is inferred from the above table that there is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks, Chemical Shocks on Farmers livelihood and type of crisis experienced, as the calculated 'χ^2' values (8.14, 8.08, respectively) less than table value of 12.592 at the 5% level of significance. However, there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks (19.39), Pollutional Shocks (16.92), Hydrological Shocks (13.69), and overall Environmental Shocks (18.66), on Farmers livelihood and type of crisis experienced, as their calculated values are greater than the table value of 12.592 at the 5% level of significance. Hence the null hypothesis is rejected.

Null Hypothesis - 16

There is no significant influence of Environmental shocks on Farmers livelihood.

TABLE 4.18

INFLUENCE OF ENVIRONMENTAL SHOCKS ON FARMERS LIVELIHOOD

Environmental shocks on Farmers livelihood	Model Summary			ANOVA			Coefficient		
	R	R^2	Adj-R^2	F	df	p-value	β	t	p-value
	0.784	0.681	0.580	675.32	1	0.000	0.486	17.102	0.000
Predictors: (Constant), Environmental shocks Dependent Variable: Livelihood									

Influence of predictors on dependent variable

It is inferred from the above table 4.18, there is significant influence of Environmental shocks on Farmers livelihood. The model summary shows an R value of 0.784, suggesting a strong positive correlation between environmental shocks and farmers livelihood. The R^2 value 68.1 % indicates the variance in farmers livelihood can be explained by environmental shocks. The table indicates that the regression model is highly significant ($p <.000$), as evidenced by the F-statistic of 675.32, with one degree of freedom for the predictor variable "Environmental Shocks." This suggests that the variability in the dependent variable, livelihood is largely explained by the predictor variable, supporting the notion that Environmental shocks significantly influences livelihood outcomes. Hence the null hypothesis is rejected. Overall, these findings indicate that environmental shocks play a crucial role in shaping farmers' livelihood, significantly affecting their well-being and economic stability.

CHAPTER – V

FINDINGS, INTERPRETATIONS, RECOMMENDATIONS AND SUGGESTIONS

5.1 INTRODUCTION

This chapter serves as the culmination of the research, bringing together the key findings derived from data analysis, their interpretations, and the implications they hold in the broader context of the study. The research aimed to examine the impact of environmental shocks on farmers' livelihood, exploring the various socio-economic and environmental challenges they face, along with their coping mechanisms and adaptive strategies. The findings of this study provide a comprehensive understanding of how environmental shocks such as climate change, extreme weather events, soil degradation, and water scarcity have altered agricultural productivity, income stability, and overall well-being of farming communities. Through a systematic interpretation of these findings, this chapter seeks to bridge the gap between theoretical insights and practical realities, offering a nuanced perspective on the severity and extent of these challenges. Interpretations involve analyzing and explaining the significance of the findings, often in relation to existing theories, literature, or real-world implications. This process helps to understand the meaning behind the data and its broader impact.

Furthermore, based on the insights gained, this chapter puts forth a set of well-grounded recommendations aimed at mitigating the adverse effects of environmental shocks on agriculture. These recommendations focus on improving government policies, strengthening institutional support, promoting sustainable agricultural practices, and enhancing farmers' resilience through education, financial assistance, and technology adoption. In addition to recommendations, the chapter concludes with suggestions for future research, emphasizing areas that require further exploration to develop more effective strategies for safeguarding farmers' livelihood in the face of environmental uncertainties. By synthesizing key findings, offering meaningful interpretations, and proposing actionable recommendations, this chapter aims to contribute to the ongoing discourse on sustainable agriculture and rural development. The recommendations and suggestions provided in the study and analyses of the problem, the investigators have obtained these findings and on the basis of these findings they have submitted the recommendations and suggestions. Suggestions refer to additional insights or directions for future research, improvements in methodologies, or further exploration of related topics to enhance understanding.

According to Lokesh Koul (1997) "Interpretation calls for a careful, logical and critical examination of the sample chosen the tools selected and used in the study".

5.2 FINDINGS BASED ON OBJECTIVES

1. It is inferred from the above table that 17.4% of farmers experience a low impact, 71.4% experience a moderate impact, and 11.1% experience a high impact in the dimension of climatic shocks on their livelihood.

   It is inferred from the above table that 17.1% of farmers experience a low impact, 68.3% experience a moderate impact and 14.6% experience a high impact in the dimension of Pollutional shocks on their livelihood.

   It is inferred from the above table that 17.7%of farmers experience a low impact, 70.3% experience a moderate impact and 12.0% experience a high impact in the dimension of Biological shocks on their livelihood.

   It is inferred from the above table that 20.3%of farmers experience a low impact, 65.1% experience a moderate impact and 14.6% experience a high impact in the dimension of Hydrological shocks on their livelihood.

   It is inferred from the above table that 22.0% of farmers experience a low impact, 64.3% experience a moderate impact and 13.7% experience a high impact in the dimension of Chemical shocks on their livelihood.

It is inferred from the above table that 19.1% of farmers experience a low impact, 68.3% experience a moderate impact and 12.6% experience a high impact in the dimension of Environmental shocks on their livelihood

2. It is inferred from the above table that 16.3% of male farmers experience a low impact, 75.3% experience a moderate impact, and 8.4% experience a high impact in the dimension of climatic shocks on their livelihood. Regarding female farmers, 18.5% experience a low impact, 67.9% experience a moderate impact, and 13.6% experience a high impact in the dimension of climatic shocks on their livelihood.

   It is inferred from the above table that 17.9% of male farmers experience a low impact, 70.1% experience a moderate impact, and 12.0% experience a high impact in the dimension of pollutional shocks. Regarding female farmers, 16.3% experience a low impact, 65.7% experience a moderate impact, and 18.1% experience a high impact in the dimension of pollutional shocks.

   It is inferred from the above table that 17.9% of male farmers experience a low impact, 66.8% experience a moderate impact, and 15.2% experience a high impact in the dimension of biological shocks. Regarding female farmers, 13.9% experience a low impact, 74.7% experience a moderate impact, and 11.4% experience a high impact in the dimension of biological shocks.

   It is inferred from the above table that 16.3% of male farmers experience a low impact, 67.9% experience a moderate impact, and 15.8% experience a high impact in the dimension of hydrological shocks. Regarding female farmers, 15.7% experience a low impact, 71.1% experience a moderate impact, and 13.3% experience a high impact in the dimension of hydrological shocks.

It is inferred from the above table that 19.0% of male farmers experience a low impact, 70.1% experience a moderate impact, and 10.9% experience a high impact in the dimension of Chemical shocks. Regarding female farmers, 18.1% experience a low impact, 68.7% experience a moderate impact, and 13.3% experience a high impact in the dimension of Chemical shocks.

It is inferred from the above table that 18.5% of male farmers experience a low impact, 68.5% experience a moderate impact, and 13.0% experience a high impact in the dimension of overall environmental shocks. Regarding female farmers, 18.1% experience a low impact, 68.7% experience a moderate impact, and 13.3% experience a high impact in the dimension of overall environmental shocks.

3. It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 69.0% experience a moderate impact, and 12.5% experience a high impact in the dimension of climatic shocks on their livelihood. Regarding farmers from nuclear families, 17.0% experience a low impact, 73.6% experience a moderate impact, and 9.4% experience a high impact in the dimension of climatic shocks on their livelihood.

   It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 68.4% experience a moderate impact, and 13.1% experience a high impact in the dimension of pollutional shocks. Regarding farmers from nuclear families, 15.1% experience a low impact, 71.7% experience a moderate impact, and 13.2% experience a high impact in the dimension of pollutional shocks.

   It is inferred from the above table that 15.8% of farmers from joint families experience a low impact, 71.7% experience a moderate impact, and 12.5% experience a high impact in the dimension of biological shocks. Regarding farmers from nuclear families, 17.0% experience a low impact, 69.8% experience a moderate impact, and 13.2% experience a high impact in the dimension of biological shocks.

It is inferred from the above table that 15.2% of farmers from joint families experience a low impact, 69.0% experience a moderate impact, and 15.8% experience a high impact in the dimension of hydrological shocks. Regarding farmers from nuclear families, 15.1% experience a low impact, 77.4% experience a moderate impact, and 7.5% experience a high impact in the dimension of hydrological shocks.

It is inferred from the above table that 22.9% of farmers from joint families experience a low impact, 64.3% experience a moderate impact, and 12.8% experience a high impact in the dimension of Chemical shocks. Regarding farmers from nuclear families, 17.0% experience a low impact, 69.8% experience a moderate impact, and 13.2% experience a high impact in the dimension of Chemical shocks.

It is inferred from the above table that 18.5% of farmers from joint families experience a low impact, 69.4% experience a moderate impact, and 12.1% experience a high impact in the dimension of overall environmental shocks. Regarding farmers from nuclear families, 13.2% experience a low impact, 79.2% experience a moderate impact, and 7.5% experience a high impact in the dimension of overall environmental shocks.

5.3 FINDINGS BASED ON HYPOTHESIS

1. There is no significant difference between the impact of Environmental shocks and its dimension such as hydrological shock on Farmers livelihood with respect to Gender. But there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, and Chemical Shocks on Farmers livelihood with respect to Gender.

2. There is no significant difference between the impact of Environmental shocks and its dimensions such as Biological Shocks, Hydrological Shocks on Farmers

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livelihood with respect to type of family. But there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, and Chemical Shocks on Farmers livelihood with respect to type of family.

3. There is no significant difference between the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, and chemical shocks on Farmers livelihood with respect to membership in farmers organization.

4. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to type of farming.

5. There is significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Type of land.

6. There is no significant difference among the impact of Environmental shocks and its dimensions such as Biological Shocks and Chemical Shocks on Farmers livelihood with respect to land ownership status. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks on Farmers livelihood with respect to land ownership status.

7. There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to farm mechanization.

8. There is significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to recovery time after shock.

9. There is no significant difference among the impact of environmental shocks and its dimensions such as Pollutional Shocks and Biological Shocks on farmers livelihood with respect to educational status. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Hydrological Shocks, Chemical Shocks, and overall Environmental Shocks on farmers livelihood with respect to educational status.

10. There is no significant difference among the impact of Environmental shocks and its dimensions such as Pollutional Shocks, Biological Shocks, Chemical Shocks, and overall Environmental Shocks on Farmers livelihood with respect to the age. But there is significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks and Hydrological Shocks on farmers livelihood with respect to the age.

11. There is no significant difference among the impact of Environmental shocks and its dimensions such as hydrological shocks on Farmers livelihood with respect to annual income. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, pollutional shocks, Biological shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to annual income.

12. There is no significant association between the impact of Environmental shocks and its dimensions such as

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Biological Shocks and Hydrological Shock on Farmers livelihood with respect to experience in farming. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to experience in farming.

13. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to access to weather information.

14. There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to water sources for farming.

15. There is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks, Chemical Shocks on Farmers livelihood with respect to type of crisis experienced. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks, and overall Environmental Shocks, on Farmers livelihood with respect to type of crisis experienced.

16. There is significant influence of Environmental shocks on Farmers livelihood.

5.4 INTERPRETATIONS

Interpretation related to finding no-1

There is no significant difference between the impact of Environmental shocks and its dimension such as hydrological

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shock on Farmers livelihood with respect to Gender. But there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, and Chemical Shocks on Farmers livelihood with respect to Gender.

From Table 4.4, it is evident that there is no significant difference between male and female farmers in the impact of Environmental shocks and its dimension of hydrological shocks, as the calculated t-value (1.75) is less than the table value (1.96) at the 5% significance level. The mean values indicate that both male (M = 23.79) and female (M = 23.54) farmers experience a similar level of impact from hydrological shocks, such as water shortages. However, there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, and Chemical Shocks on Farmers livelihood with respect to Gender. Female farmers experience a greater impact from climatic shocks (M = 27.09) compared to male farmers (M = 24.73). This suggests that extreme weather events like droughts, floods, and unseasonal rains disrupt crop production and daily activities more for women, possibly due to their reliance on small-scale farming. Similarly, pollutional shocks, including air, water, and soil contamination, have a greater impact on female farmers (M = 24.47) than on male farmers (M = 21.36), indicating that women, who are more involved in domestic water collection and household agriculture, bear the brunt of environmental pollution. In the case of biological shocks, such as crop diseases and pest infestations, male farmers (M = 24.98) experience a higher impact than female farmers (M = 22.14). This could be attributed to the fact that men are more engaged in large-scale crop production and commercial agriculture, where crop losses have significant financial consequences. On the other hand, chemical shocks, which include pipeline leakages and improper disposal of chemicals, affect female farmers (M = 18.02) more

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than male farmers (M = 16.89). This highlights that women are more vulnerable to the harmful effects of chemical exposure, possibly due to direct contact with contaminated soil and water while working in the fields. Improper disposal of agricultural chemicals can have long-term effects on both crop productivity and human health.

Moreover, the overall impact of environmental shocks on farmers livelihood also shows a significant difference, with female farmers (Mean = 129.27) experiencing a greater impact than male farmers (Mean = 115.75). This suggests that environmental shocks affect farmers differently based on gender, with women being more vulnerable to these challenges. Thus the null hypothesis is rejected. This may be due to the fact that female farmers often face greater challenges than men due to limited access to land, financial resources, technology, and decision-making power, making them more vulnerable to environmental risks. In contrast, men may have greater mobility and alternative livelihood opportunities, which can reduce their direct exposure to such shocks Consequently, farmers' livelihood are more affected, particularly for women, as they bear a disproportionate burden of environmental stressors.. According to the WHO, women are more severely impacted by environmental shocks such as droughts, floods, heavy rains, heat waves, and water scarcity all increasingly attributed to climate change, and suffers higher risk than men in health and life expectancy. The dimensions of livelihood impact could include income loss, agricultural productivity, food security, migration, coping strategies, and social resilience. For instance, environmental shocks may force men to migrate for work, while women take on additional farming and household responsibilities without adequate support, intensifying their economic and social vulnerabilities. These gender disparities highlight the need for gender-responsive policies to mitigate the impact of environmental shocks on farmers. Agricultural extension services, credit schemes, and climate adaptation programs should consider gender-specific needs to ensure equitable resilience strategies. Several studies support this interpretation, including Nelson and Stathers (2009), who found that women farmers in Africa are disproportionately affected by climate change due to unequal access to adaptation resources. Agarwal (2010) also discussed the gendered division of labor in agriculture and how environmental risks exacerbate inequalities. Reports from the Food and Agriculture Organization (FAO, 2020) and the Intergovernmental Panel on Climate Change (IPCC) emphasize that gender disparities in resource access and decision-making power intensify the vulnerability of women to environmental shocks. Additionally, men and women adopt different coping strategies, for example, men are more likely to migrate in response to agricultural distress, whereas women rely on informal labor or community support networks (FAO, 2021). Furthermore, the dual burden of household and farm responsibilities makes women more susceptible to livelihood disruptions caused by environmental shocks (Doss et al., 2018). Research also indicates that climate change disproportionately affects women farmers due to socio-economic constraints, further exacerbating gender disparities in agricultural resilience (Jerneck, 2018). These findings emphasize the need for gender-sensitive policies that enhance women's access to financial aid, training, and climate adaptation strategies to mitigate the adverse effects of environmental shocks on their livelihoods. Since farmers' livelihood are significantly affected by gender disparities, addressing these issues through targeted policies and interventions can help bridge the gender gap and create a more resilient agricultural sector.

Interpretation related to finding no-2

There is no significant difference between the impact of Environmental shocks and its dimensions such as Biological Shocks, Hydrological Shocks on Farmers livelihood with respect to type of family. But there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, and Chemical Shocks on Farmers livelihood with respect to type of family.

From Table 4.5, it is evident that there is no significant difference between nuclear and joint family farmers in the impact of Environmental shocks and its dimensions such as Biological Shocks, Hydrological Shocks, as the calculated t-values (1.09 and 1.48, respectively) are less than the critical value of 1.96 at the 5% significance level. However, there is significant difference between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, and Chemical Shocks on Farmers livelihood with respect to type of family. Farmers from joint families experience a greater impact from climatic shocks (M = 28.58) compared to nuclear family farmers (M = 26.44). This suggests that extreme weather events may affect joint families more due to their larger agricultural operations and greater exposure to land-based livelihoods. Similarly, pollutional shocks have a higher impact on joint family farmers (M = 25.65) than on nuclear family farmers (M = 24.29). This could be due to joint families managing larger landholdings, making them more susceptible to soil degradation and pollution-related losses. In the case of chemical shocks the joint family farmers (M = 19.57) are more affected than nuclear family farmers (M = 18.37). This suggests that joint family farms, which are often larger and more diversified, may have higher exposure to chemical-related risks due to increased use of fertilizers and pesticides. Moreover, the overall impact of environmental shocks on farmers livelihood also shows a significant difference, with joint families (Mean = 126.36) experiencing a greater impact than nuclear families (Mean = 119.11), as supported by a t-value of 2.66 at the 5% significance level. Thus the null hypothesis is rejected. This may be due to the fact that farmers from joint families tend to have better financial security as multiple earning members can contribute to agricultural investments and recovery after shocks. Shared resources, such as land and labor, can help sustain productivity than nuclear family farmers while nuclear families may struggle financially due to fewer income sources, making them more vulnerable to economic losses. Additionally, joint families benefit from greater labor availability, ensuring efficient workforce distribution and quicker recovery from disasters, whereas nuclear families often face labor shortages, especially if one member migrates for work, leaving the farm operations under strain. Social support and psychological well-being also differ, with joint families providing a strong emotional and decision-making support system, reducing stress and enabling better adaptation strategies, while nuclear families may experience higher psychological distress due to limited support. In terms of coping strategies, joint families can pool financial resources, diversify income sources, and engage in cooperative farming, whereas nuclear families have fewer adaptation options and often rely on external aid or migration as their primary response, making them more susceptible to livelihood disruptions Migration trends further highlight this disparity, as joint families are less likely to rely on migration due to shared responsibilities, whereas nuclear families face a higher probability of migration, leading to disruptions in agricultural activities and long-term livelihood instability. These findings highlight that family structure plays a crucial role in determining the extent of environmental shock impacts. Joint families, despite facing higher exposure to climatic, pollutional, and chemical shocks, may have better coping mechanisms through labor-sharing, financial pooling, and collective decision-making. On the other hand, nuclear families, though less affected overall, may have fewer resources to recover from environmental stressors, making them more vulnerable in the long term. This underscores the need for family-based resilience strategies, such as cooperative farming initiatives, financial support mechanisms, and targeted extension services to help both nuclear and joint family farmers mitigate the adverse effects of environmental shocks on their livelihood. The result was supported by the study conducted by Sharma, V., Singh, R., & Mehta, P. (2021). In this study they revealed that there is significant difference in their family type. They concluded that joint families recover faster from climate shocks due to labor-sharing and risk mitigation.

Interpretation related to finding no-3

There is no significant difference between the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, and chemical shocks on Farmers livelihood with respect to membership in farmers organization.

From table 4.6, it is evident that there is no significant difference between the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, and chemical shocks, on Farmers livelihood with respect to membership in farmers organization. The calculated t values (1.74, 1.99, 1.09, 1.48, 1.06, and 1.66, respectively) are less than the table value (1.96) at the 5% level of significance. Thus the null hypothesis is accepted. This may be due to the fact that whether a farmer belongs to a member or a non-member in farmer’s organization does not play a significant role in determining how environmental shocks affect their livelihood. Environmental shocks affect everyone, regardless of whether they are members or non-members of farmers’ organizations. Both members and non-members experience similar risks from climatic and hydrological shocks, as well as losses from pest infestations and wildlife threats. Additionally, internal conflicts, mismanagement, and corruption in some farmers’ organizations can reduce their effectiveness in addressing pollutional and biological shocks. Both members and non-members suffer similar losses from climatic shocks, pest infestations, wildlife threats and chemical shocks. World Bank (2015) reported that non-members often develop their own adaptation strategies, such as crop diversification and migration, making them equally vulnerable or resilient as members. Also noted that poorly governed organizations fail to provide adequate support, leaving members just as exposed to shocks as non-members. Environmental shocks impact all farmers equally when farmer organizations lack strong governance, financial capacity, or technical support mechanisms. Membership alone does not necessarily guarantee protection from climatic, hydrological, chemical, pollutional, or biological shocks if the organization is not effective. The result was supported by the study conducted by Poulton, Kydd & Dorward (2006). In their study they revealed that both members and non-members face similar risks from environmental shocks because many farmers' organizations lack the financial and technical capacity to provide meaningful resilience strategies.

Interpretation related to finding no-4

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to type of farming.

From table 4.7, it is evident that there is no significant difference among the impact of Environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, chemical shocks on Farmers livelihood with respect to Type of farming. The calculated *F* values (1.29, 2.02, 2.24, 1.69, 1.63 and 1.42, respectively) are less than the table value of 3.03 at the 5% level of significance. Hence, the null hypothesis is accepted. This may be due to the reason that the lack of significant differences in the impact of environmental shocks across Organic, Commercial, and Mixed farming can be attributed to several factors. Environmental shocks such as climate change, pollution, and pest outbreaks affect all farming systems universally. Since they depend on natural resources like soil, water, and climate conditions, any disruptions caused by environmental shocks result in comparable struggles, such as crop failure, soil degradation, or pest infestations. Consequently, challenges like crop failure and soil degradation impact all farmers similarly. Additionally, the overlap in farming practices blurs distinctions between these categories, while government support, insurance, and technological advancements provide uniform resilience. FAO (2019) states that farmers, irrespective of their farming type, face similar challenges in resource availability, soil erosion, and pest management, particularly in regions with high environmental stress. The result was supported by the study conducted by Morton (2007). In his study he revealed that extreme climate events such as droughts, floods, and unpredictable rainfall patterns affect all agricultural systems equally, as they all rely on natural resources like water and soil quality.

Interpretation related to finding no-5

There is significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to Type of land.

From table 4.8, it is evident that there is significant difference among the impact of environmental shocks and its dimensions such as climatic shocks, pollutional shocks, biological shocks, hydrological shocks, chemical shocks on farmers livelihood with respect to the type of land. This is evident as the calculated F values (4.97, 3.88, 4.79, 3.21, 3.11, and 5.24, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence, the null hypothesis is rejected. This may be due to the reason that dependence on rainfall, and resilience to external shocks, which directly influence agricultural productivity, income stability, and overall livelihood security Irrigated lands have a steady water supply, making them less vulnerable to droughts. However, they are still susceptible to other environmental shocks such as pollution from agrochemicals, changes in water quality, and salinity buildup. Rainfed lands, on the other hand, are highly dependent on seasonal rainfall, making them more vulnerable to climatic shocks such as droughts and erratic rainfall patterns. These lands may also suffer more from soil degradation and reduced crop yields due to inconsistent water supply. Mixed farming lands, which incorporate both irrigated and rainfed practices, may experience intermediate levels of impact, depending on the balance between the two systems. Additionally, hydrological shocks like floods affect different land types in varying ways. While irrigated lands may have better drainage infrastructure, rainfed lands often suffer from waterlogging or erosion, further threatening soil fertility and productivity. Biological shocks, such as pest infestations, may also vary in severity. Intensive farming in irrigated lands may attract different pests due to monoculture practices, while rainfed areas may experience lower pest outbreaks but struggle with disease-resistant strains due to lack of intervention measures. The availability of coping mechanisms such as irrigation infrastructure, crop insurance, and drought-resistant crop varieties further differentiates the impact among these land types. Farmers relying on rainfed systems often have fewer adaptation options, making their livelihoods more affected compared to those with access to irrigation. Economic vulnerability is also heightened in rainfed systems, as farmers face higher risks of crop failure and food insecurity, often leading to migration or reliance on external aid.

The Intergovernmental Panel on Climate Change (IPCC, 2021) reports that hydrological shocks, including floods and water shortages, impact different land types in distinct ways. Rainfed systems experience greater water stress, while irrigated lands, though less affected by drought, face issues such as salinity buildup and water pollution. This finding is further supported by Rockström et al. (2010), who highlighted that rainfed farming systems are significantly more vulnerable to droughts and erratic rainfall patterns, leading to lower crop yields, higher soil degradation, and economic instability. Overall, these findings emphasize that farmers' livelihood are more affected by environmental shocks depending on the type of land they cultivate. Rainfed farmers are at the highest risk due to their dependence on natural rainfall, while those with irrigated and mixed systems have relatively better resilience.

Interpretation related to finding no-6

There is no significant difference among the impact of Environmental shocks and its dimensions such as Biological Shocks and Chemical Shocks on Farmers livelihood with respect to land ownership status. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks on Farmers livelihood with respect to land ownership status.

From table 4.9, it is evident that there is no significant difference among the impact of Environmental shocks and its dimensions such as Biological Shocks and Chemical Shocks on Farmers livelihood with respect to land ownership, as the calculated F values (2.51 and 1.39, respectively) are less than the table value of 3.03 at the 5% level of significance. However, there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks on Farmers livelihood with respect to land ownership, as their calculated F values (3.94, 3.34, 3.89, and 3.82, respectively) are greater than the table value of 3.03 at the 5% level of significance. Thus the null hypothesis is rejected. This may be due to the reason that farmers who own land generally have greater security, access to credit, and long-term investment opportunities in agricultural infrastructure, which can help them, withstand environmental shocks more effectively. In contrast, leased land farmers and landless laborers face higher vulnerability due to limited control over land resources and fewer financial safeguards. As a result, farmers livelihood are very much affected, especially for those without land ownership.

Owned land farmers have a long-term stake in their agricultural land, allowing them to invest in irrigation systems, soil conservation techniques, and climate-resilient crops. They also have better access to government support, subsidies, and agricultural loans, which can help them recover from climatic shocks such as droughts, floods, or pest infestations. These factors contribute to better resilience and lower overall livelihood disruption. Leased land farmers, on the other hand, face higher uncertainty and economic insecurity since they do not have permanent rights over the land. Their ability to invest in long-term improvements, such as soil fertility management and irrigation infrastructure, is often restricted by short-term lease agreements. This makes them more vulnerable to climatic shocks, pollution, and hydrological disturbances, as they lack incentives and financial support to implement adaptation strategies. Additionally, in the event of crop failure, they may struggle to repay loans or afford another lease, leading to greater economic hardship. Thus, their livelihoods are very much affected due to unstable access to land and resources. Landless laborers are the most vulnerable group, as they rely solely on daily wages from agricultural work and have no direct control over land management decisions. Environmental shocks such as floods, droughts, or pest outbreaks can lead to reduced agricultural productivity, resulting in job loss and severe income insecurity. Since they do not own land, they lack access to institutional support like farm subsidies, credit facilities, or government relief programs, making their livelihoods highly unstable. Many landless laborers are forced to migrate in search of alternative work, leading to social displacement and economic distress. As a result, their livelihoods are very much affected due to their complete dependence on external factors for survival. The significant difference in livelihood impacts across these land ownership categories underscores the role of land tenure security in determining farmers' resilience. Studies, including FAO (2020) and IPCC (2021), emphasize that land ownership provides farmers with greater financial stability, access to adaptation resources, and decision-making power, which reduces their vulnerability to environmental shocks. In contrast, leased land farmers and landless laborers remain at a greater disadvantage due to their dependence on external factors for survival. Overall, farmers' livelihood are very much affected by environmental shocks, particularly for those who do not own land. Strengthening land tenure policies, ensuring fair lease agreements, and providing targeted assistance to tenant farmers and landless laborers can help reduce disparities and enhance the resilience of vulnerable farming communities.

Interpretation related to finding no-7

There is no significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to farm mechanization.

From table 4.10, it is evident that that there is no significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks, Chemical Shocks, and overall environmental shocks on Farmers livelihood with respect to farm mechanization. The calculated F values (1.94, 1.34, 1.51, 2.89, 0.39, and 2.82, respectively) are less than the table value 3.03 at the 5% level of significance. Thus the null hypothesis is accepted. This may be due to the reason that while mechanization influences productivity, it does not necessarily shield farmers from the adverse effects of environmental shocks. Regardless of the type of tools used, farmers remain highly vulnerable to climate change, pollution, pests, chemical, and hydrological disturbances, which affect crop yields, soil fertility, and overall agricultural sustainability. As a result, farmers livelihood are still significantly affected despite different levels of mechanization. Climatic shocks such as droughts, floods, and erratic weather patterns can devastate crops and disrupt farming activities, regardless of whether farmers rely on traditional tools or modern machinery. For instance, while modern machinery may increase efficiency, it does not prevent soil degradation, water scarcity, or extreme temperature impacts. Similarly, traditional tools may provide a low-cost alternative, but they do not offer any significant advantage in mitigating environmental risks.

Pollutional and biological shocks, including soil contamination, pesticide resistance, and crop diseases, impact all types of farms uniformly. While modern machinery can improve soil preparation and irrigation efficiency, it does not prevent chemical pollution or pest outbreaks, which can lead to reduced yields and financial losses. Similarly, farms using traditional tools also suffer from crop failure and soil exhaustion, making it difficult for farmers to recover. Hydrological shocks such as floods and droughts do not discriminate between farms using traditional tools or modern machinery. Even though mechanization can assist in water management through irrigation systems, excessive rainfall or prolonged drought can still destroy crops and reduce productivity. Farmers relying on rain-fed agriculture face even greater risks, and mechanization alone cannot compensate for the loss of natural water sources. Additionally, chemical shocks can affect all farms, irrespective of mechanization. While modern machinery may aid in better pest control techniques, environmental factors such as changing temperatures and habitat destruction still contribute to unpredictable pest infestations. Farmers using traditional tools may have natural pest control methods, but they still experience significant crop damage due to increased

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vulnerability to environmental factors. The fact that there is no significant difference in the impact of environmental shocks based on farm mechanization highlights that the type of tools used is not the primary factor determining resilience. Instead, external factors such as climate adaptability, financial stability, and government support play a more crucial role in protecting farmers livelihood. Farmers, regardless of their mechanization level, struggle with income instability, reduced productivity, and financial stress caused by environmental shocks. This result is supported by the study conducted by Béné et al. (2012). In their study they concluded that farming resilience is shaped more by institutional support and adaptive capacity rather than the level of farm mechanization.

Interpretation related to finding no-8

There is significant difference among the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to recovery time after shock.

From table 4.11, it is evident that there is a significant difference in the no significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Biological Shocks, Hydrological Shocks, and Chemical Shocks on Farmers livelihood with respect to recovery time after shock. This is evident as the calculated F values (3.16, 4.01, 3.27, 3.19, 3.55, and 4.82 respectively) are greater than the table value of 3.03 at the 5% level of significance. Thus, the null hypothesis is rejected. This may be due to the fact that significant difference arises because recovery time plays a crucial role in determining the extent of livelihood disruption among farmers. The longer the recovery period, the more severe the impact on income stability, food security, agricultural productivity, and overall economic well-being. Farmers who recover within 6 months tend to have better financial security, access to adaptive strategies, insurance coverage, and external support, enabling them to resume agricultural activities sooner. However, even during this period, they may experience temporary income losses, reduced savings, and increased stress about future uncertainties. Farmers requiring 6-12 months for recovery face longer disruptions in their agricultural cycles, affecting crop yields, livestock management, and financial planning. During this period, they may struggle with debt, reduced investment in farming, and difficulty meeting household expenses, leading to moderate livelihood distress. Farmers who take more than 12 months to recover experience severe and prolonged livelihood challenges. Extended recovery times often lead to chronic income loss, migration, land abandonment, and long-term economic instability. Farmers in this group may struggle to sustain their agricultural activities, forcing them into alternative low-paying jobs, asset liquidation, or dependence on external aid, further weakening their livelihoods.

During the recovery period, farmers livelihood are deeply affected due to Income loss caused by damaged crops, soil degradation, and lack of resources for reinvestment. Reduced agricultural productivity, delaying future planting cycles and further extending financial stress. Increased debt burden, as farmers often borrow money for survival, pushing them into long-term financial distress. Food insecurity, as reduced production affects both household consumption and market supply. Psychological stress, as uncertainty about future environmental shocks makes long-term planning difficult. This study is supported by Chowdhury and Parida (2023), In their study, they concluded that in rural Odisha, India, examined the aftermath of severe flooding in 2014 and found that recovery capacities among agricultural households varied notably. Households adopting migratory labor-based strategies were more likely to achieve economic recovery within a year.

Interpretation related to finding no-9

There is no significant difference among the impact of environmental shocks and its dimensions such as Pollutional Shocks and Biological Shocks on farmers livelihood with respect to educational status. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, Hydrological Shocks, Chemical Shocks, and overall Environmental Shocks on farmers livelihood with respect to educational status.

From table 4.12, it is evident that there is no significant difference among the impact of environmental shocks and its dimensions such as Pollutional Shocks and Biological Shocks on farmers livelihood with respect to educational status. This is evident as the calculated F values (1.49 and 1.33, respectively) are less than the table value of 3.03 at the 5% level of significance. However, there is significant difference in the impact of environmental shocks and its dimensions such as Climatic Shocks, Hydrological Shocks, Chemical Shocks, and overall Environmental Shocks on farmers livelihood with respect to educational status. The calculated F values (3.56, 3.27, 3.05, and 3.52, respectively) are greater than the table value of 3.03, confirming a significant variation. Thus, the null hypothesis is rejected. This may be due to the fact that uneducated farmers are more vulnerable to climatic, pollutional, biological, hydrological, and chemical shocks due to their reliance on traditional practices and limited access to modern agricultural knowledge. They often struggle with inefficient farming techniques, lack of awareness about government schemes, and minimal access to financial aid, making them more susceptible to crop failure, financial instability, and prolonged recovery periods. Farmers with school education, on the other hand, have basic literacy skills that enable them to access weather forecasts, agricultural advisories, and government support programs. Their ability to implement hybrid farming methods, use improved seeds,

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fertilizers, and irrigation techniques, and analyze risks results in a relatively moderate level of livelihood impact compared to uneducated farmers. Those with higher education are the least affected as they possess greater awareness of climate-smart agriculture, financial risk management, and market trends. They are more likely to invest in advanced farming technologies, insurance schemes, and sustainable practices, ensuring faster recovery and economic stability. Additionally, educated farmers have better access to institutional support, allowing them to diversify their income and reduce dependency on traditional farming alone. The significant difference in livelihood impact emphasizes the need for enhanced education and awareness programs to equip farmers with the necessary knowledge and skills to mitigate environmental shocks, improve adaptive capacity, and ensure long-term sustainability in agriculture.

Interpretation related to finding no-10

There is no significant difference among the impact of Environmental shocks and its dimensions such as Pollutional Shocks, Biological Shocks, Chemical Shocks, and overall Environmental Shocks on Farmers livelihood with respect to the age. But there is significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks and Hydrological Shocks on farmers livelihood with respect to the age.

From table 4.13, it is evident that there is no significant difference among the impact of Environmental shocks and its dimensions such as Pollutional Shocks, Biological Shocks, Chemical Shocks, and overall Environmental Shocks on Farmers livelihood with respect to the age. This is indicated by the calculated F values (2.22, 2.98, and 2.67, respectively), which are less than the table value of 3.03 at the 5% level of significance. However, there is significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks and Hydrological Shocks on Farmers livelihood with respect to the age. The calculated F values (3.14 and 3.46, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected. This suggests that environmental shocks such as climatic, pollutional, biological, hydrological, and chemical shocks affect all farmers similarly, regardless of age. The key determinant of vulnerability is not age itself, but factors such as access to resources, adaptation strategies, and institutional support. This finding, which highlight that pollution and biological threats affect farmers universally, as they rely on the same natural resources such as soil, water, and climate conditions. While younger farmers (below 35 years) may be more receptive to adopting modern technology and climate-smart practices, older farmers (above 50 years) tend to rely more on traditional knowledge and experience. These findings suggest that age may play a role in how farmers perceive and respond to extreme weather conditions and water-related shocks. Middle-aged farmers (36–50 years) may experience greater impact compared to other age groups, as they are often at the peak of their financial and farming responsibilities, with higher investments in agricultural production and greater dependence on farming income. Unlike younger farmers, who may have alternative livelihood options, and older farmers, who may have accumulated savings or diversified income sources, middle-aged farmers face higher financial risk and stress when environmental shocks occur. Furthermore, they often have family responsibilities and loan commitments, making them more vulnerable to economic downturns caused by climate extremes. Additionally, the resilience of farmers is influenced by their ability to adapt to changing environmental conditions. Studies suggest that younger farmers may be more likely to adopt climate-resilient agricultural practices such as drought-resistant crops, water conservation techniques, and precision farming technologies, which could mitigate the impact of environmental shocks.

Conversely, older farmers may be resistant to change, relying on traditional farming techniques that may not be as effective in climate-stressed conditions (Bryan et al., 2009). However, the ability to access resources such as credit, irrigation infrastructure, and technical training plays a more significant role than age itself. Middle-aged farmers (36–50 years) may be more affected due to their financial commitments, family responsibilities, and dependence on farming as a primary livelihood. Policies aimed at enhancing resilience should focus on access to credit, crop insurance, and climate-smart technologies to reduce the risks faced by farmers across all age groups. Additionally, promoting intergenerational knowledge-sharing and skill-building programs can help bridge the gap between traditional wisdom and modern adaptation strategies, ensuring that farmers of all ages are better equipped to withstand environmental shocks.

Interpretation related to finding no-11

There is no significant difference among the impact of Environmental shocks and its dimensions such as hydrological shocks on Farmers livelihood with respect to annual income. But there is significant difference among the impact of Environmental shocks and its dimensions such as Climatic Shocks, pollutional shocks, Biological shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to annual income.

From table 4.14, it is evident that there is no significant difference among the impact of Environmental shocks and its dimensions such as hydrological shocks on Farmers livelihood with respect to annual income, as the calculated F value 2.75 is less than the table value of 3.03 at the 5% level of significance. However, there is a significant difference among the impact of environmental shocks and its dimensions such as Climatic Shocks, pollutional shocks, Biological shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to annual income. The calculated F values (4.21, 4.63, 5.01, 4.32, and 4.78, respectively) are greater than the table value of 3.03 at the 5% level of significance. Hence the null hypothesis is rejected. This may be due to the fact that natural shocks such as climatic changes, pollution, biological threats, hydrological disturbances, and chemical leakages affect agricultural productivity in ways that do not necessarily correlate with income levels. Even high-income farmers with better access to irrigation and advanced farming technologies may still experience severe crop failures, soil degradation, or market disruptions when extreme weather events occur. Conversely, lower-income farmers often employ diversified cropping patterns and traditional resilience mechanisms, which can provide similar levels of protection against shocks.

Furthermore, studies on disaster vulnerability (Kumar et al., 2021; FAO, 2020) indicate that climatic and hydrological shocks, such as droughts and floods, tend to impact entire agricultural regions rather than specific income groups, making income a less significant factor in determining resilience. Similarly, chemical and biological shocks affect crops across all farming scales, and while high-income farmers may invest in pest control, lower-income farmers often rely on natural predators and mixed cropping strategies, leading to comparable overall impacts (Pretty et al., 2018). Moreover, institutional interventions, insurance schemes, and government subsidies play a crucial role in mitigating income disparities in environmental shock impacts. Finally, the lack of significant variation in impact suggests that environmental shocks affect all farmers, regardless of income, and that broader structural factors such as institutional support, regional climatic conditions, and adaptive capacities play a more decisive role in determining resilience. Rather than targeting interventions based solely on income, policymakers should strengthen climate adaptation programs, provide equitable access to risk-mitigation technologies, and enhance farmer education on sustainable resilience strategies. The result was contradicted by the study conducted by Asfaw et al. (2019) and Hertel & Lobell (2014). In their study they revealed that income alone does not significantly alter exposure to climate risks, as all farmers rely on natural resources that are equally susceptible to environmental changes. A study conducted in Bangladesh assessed the impact of climate shocks on agricultural income and food security among farm households. The findings revealed that environmental shocks substantially reduced agricultural income, leading to increased food insecurity.

Interpretation related to finding no-12

There is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks and Hydrological Shock on Farmers livelihood with respect to experience in farming. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to experience in farming.

From table 4.15, it is evident that there is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks and Hydrological Shocks on Farmers livelihood with respect to experience in farming, as the calculated 'χ^2' values (5.79 and 8.44, respectively) are less than the table value 9.488 at the 5% level of significance. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Chemical shocks and overall environmental shocks on Farmers livelihood with respect to experience in farming, as the calculated 'χ^2' values (16.00, 15.56, 14.93 and 13.33, respectively) are greater than the table value 9.488 at the 5% level of significance. Hence the null hypothesis is rejected. This may be due to the fact that farmers with more than 10 years of experience tend to have better traditional knowledge, adaptive skills, and diversified farming strategies, enabling them to withstand environmental disruptions more effectively. In contrast, those with less than four years of experience may lack crisis management strategies, making them more vulnerable to income losses and productivity decline. Less experienced farmers (below 4 years) may lack awareness and preparedness, leading to greater crop failure and income instability when faced with environmental shocks. Experienced farmers are more likely to invest in climate adaptation measures, such as irrigation systems, soil conservation, and drought-resistant crops, whereas newer farmers may struggle due to financial and technical constraints. Additionally, long-standing farmers often have stronger relationships with financial institutions, allowing them to access credit, subsidies, and insurance schemes, which are critical for mitigating the impact of environmental shocks.

Across different dimensions of environmental shocks, experienced farmers demonstrate greater resilience. In the case of climatic shocks, they are more likely to adopt water conservation techniques and crop diversification, whereas new farmers may suffer heavy losses due to a lack of preparedness. Similarly, pollutional shocks affect newer farmers more severely, as they may not have adequate knowledge of soil conservation and water management practices. Biological shocks, such as pest infestations and disease outbreaks, also disproportionately impact inexperienced farmers who lack effective pest control measures. Hydrological shocks, including water scarcity and excessive rainfall, are better managed by experienced farmers who employ efficient irrigation techniques. Likewise, Chemical shocks, such as pipeline leakages and improper waste disposal, require proper regulatory measures and environmental management strategies, which newer farmers may lack the resources or knowledge to implement effectively. These findings emphasize the need for targeted interventions to support less experienced farmers in coping with environmental shocks. Providing training programs on climate adaptation, financial management, and pest control can help them develop resilience. Additionally, improving access to credit, crop insurance, and government subsidies can enhance their ability to recover from environmental shocks. Encouraging participation in farmer cooperatives and knowledge-sharing platforms can further bridge the gap between experienced and new farmers, fostering a more resilient agricultural sector. The significant association between farming experience and the impact of environmental shocks suggests that tailored policies and capacity-building initiatives are essential to ensuring sustainable livelihoods for all farmers, regardless of their level of experience.

Interpretation related to finding no-13

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to access to weather information.

From table 4.16, it is evident that there is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to access to weather information. This is evident as the calculated 'χ^2' values for all dimensions Climatic Shocks (6.49), Pollutional Shocks (7.56), Biological Shocks (8.24), Hydrological Shocks (6.16), Chemical Shocks (7.28), and overall Environmental Shocks (5.34) are less than the table value of 9.488 at the 5% level of significance. Hence, the null hypothesis is accepted. This could be due to several reasons. First, while access to weather information provides forecasts, farmers may not always have the resources or knowledge to effectively act upon it. For example, even if a farmer is aware of an impending drought, they may lack access to drought-resistant seeds, irrigation facilities, or financial support to

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implement adaptive measures. Second, the effectiveness of weather information depends on its accuracy, timeliness, and farmers' ability to interpret and apply it to their agricultural practices. Many farmers, particularly small-scale ones, may struggle with technical terms or lack the training to integrate forecast data into their decision-making. Moreover, structural challenges such as poor infrastructure, limited financial access, and a lack of institutional support could prevent farmers from taking full advantage of weather updates. Studies have shown that while access to climate information can be beneficial, its impact is significantly enhanced when combined with advisory services, training, and financial support. For instance, a study by Tall et al. (2014) found that farmers who received tailored agro-advisory services alongside weather forecasts were more likely to implement adaptation strategies compared to those who only received general weather information. Similarly, a study by Hansen et al. (2011) indicated that farmers often need additional support, such as decision-making tools and community-based training, to fully benefit from climate information. Additionally, social and behavioral factors may influence how farmers perceive and respond to weather forecasts. Some may rely more on traditional knowledge or community experience rather than modern forecasting tools. Others may not trust the reliability of forecasts due to past inaccuracies. Therefore, while access to weather information is important, it is not sufficient on its own to significantly mitigate the impact of environmental shocks on farmers' livelihoods. To enhance its effectiveness, policymakers and agricultural extension services should focus on integrating weather information with capacity-building programs, financial support mechanisms, and localized advisory services.

Interpretation related to finding no-14

There is no significant association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to water sources for farming.

From table 4.17, it is evident that there is no association between the impact of Environmental shocks and its dimensions on Farmers livelihood with respect to water sources for farming. This is evident as the calculated 'χ^2' values for all dimensions such as Climatic Shocks (4.22), Pollutional Shocks (5.34), Biological Shocks (6.32), Hydrological Shocks (5.39), Pest & Wildlife Shocks (6.29), and overall Environmental Shocks (5.45) are less than the table value of 12.592 at the 5% level of significance. Hence, the null hypothesis is accepted. This may be due to the fact that environmental shocks, such as droughts, floods, and extreme weather events, affect all water sources similarly, leading to widespread disruptions in agricultural productivity. Regardless of whether farmers rely on irrigation canals, wells, ponds, or rain-fed sources, the unpredictability and severity of environmental shocks can reduce water availability, hinder crop growth, and ultimately lower yields and income. Without a stable and adequate water supply, farmers struggle with decreased productivity, leading to economic distress and food insecurity. Reduced crop yields result in financial losses, forcing many farmers to take loans, sell assets, or seek alternative livelihoods to cope with the crisis. Additionally, irregular or inadequate water availability exacerbates soil degradation, increases pest infestations, and disrupts planting cycles, further threatening farmers' long-term sustainability.

Farmers dependent on irrigation canals may face issues such as water shortages due to upstream diversions or infrastructure damage caused by floods. Similarly, well-dependent farmers may suffer from declining groundwater levels during prolonged droughts, while those relying on ponds or rain-fed sources are particularly vulnerable to erratic rainfall patterns. In all cases, the inability to secure a consistent water supply leads to reduced agricultural output, economic instability, and greater livelihood risks. Moreover, while access to multiple water sources may provide some level of flexibility, it does not necessarily shield farmers from the adverse effects of environmental shocks. Even with irrigation systems, excessive heat or pollution can diminish water quality, impacting crop health and productivity. Likewise, reliance on rain-fed agriculture without adequate water conservation techniques makes farmers highly susceptible to climate variability. Thus, the findings indicate that all water sources affect farmers' livelihoods in the face of environmental shocks, primarily through yield reductions and income losses. Without proper yield and financial stability, farmers face numerous challenges, including increased debt burdens, food insecurity, migration pressures, and mental stress. Therefore, resilience strategies such as improved irrigation infrastructure, water conservation practices, climate-resilient farming techniques, and financial support mechanisms are crucial to helping farmers mitigate the adverse effects of environmental shocks and sustain their livelihoods.

Interpretation related to finding no-15

There is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks, Chemical Shocks on Farmers livelihood with respect to type of crisis experienced. But there is significant association between the impact of Environmental shocks and its dimensions such as Climatic Shocks, Pollutional Shocks, Hydrological Shocks, and overall Environmental Shocks, on Farmers livelihood with respect to type of crisis experienced.

From table 4.18 it is evident that there is no significant association between the impact of Environmental shocks and its dimensions such as Biological Shocks, Pest & Wildlife Shocks on Farmers livelihood with respect to type of crisis experienced, as the calculated 'χ^2' values (8.14, 8.08, respectively) less than table value of 12.592 at the 5% level of significance. However, there is a significant association between the impact of Environmental shocks on Farmers livelihood and its dimensions such as Climatic Shocks (19.39), Pollutional Shocks (16.92), Hydrological Shocks (13.69), and overall Environmental Shocks (18.66), with respect to type of crisis experienced, as their calculated values are greater than the table value of 12.592 at the 5% level of significance. Hence the null hypothesis is rejected. This may be due to the fact that different types of environmental shocks directly influence various aspects of farmers' economic stability, agricultural productivity, and overall well-being. One of the primary reasons for this significant association is the diverse and severe nature of environmental shocks, each of which poses unique challenges to farming communities. Floods, for instance, can lead to crop submersion, soil erosion, infrastructure damage, and increased waterborne diseases, all of which negatively affect productivity and income. On the other hand, droughts result in prolonged water scarcity, reduced soil moisture, and stunted crop growth, leading to significant yield losses and financial instability. Pest infestations also play a critical role in this association, as they can destroy crops, reduce harvest quality, and increase farmers' reliance on expensive pesticides, further straining their financial resources. Heavy rainfall, while essential for farming, can sometimes be excessive, leading to water logging, root rot, and soil degradation, which hinder crop development and reduce overall yields. Other environmental shocks, such as unexpected temperature fluctuations, storms, and wildfires, can further disrupt farming activities, impacting both short-term productivity and long-term sustainability.

Due to these shocks, farmer's face multiple livelihood challenges, including income loss, food insecurity, increased debt burdens, and migration pressures. The unpredictability of these events makes planning difficult, forcing farmers to adopt costly coping strategies such as borrowing money, selling assets, or switching to less productive crops. In many cases, repeated exposure to such shocks weakens the resilience of farming households, making it harder for them to recover from successive crises. The significant association also highlights the need for proactive measures to mitigate the effects of environmental shocks. Investments in climate-resilient farming techniques, better water management practices, pest control strategies, and early warning systems can help farmers prepare for and adapt to these challenges. Additionally, financial support, crop insurance schemes, and government policies that enhance disaster preparedness can play a crucial role in protecting farmers livelihood from the adverse effects of environmental shocks.

5.5 RECOMMENDATIONS

Farmers worldwide face significant challenges due to environmental shocks, which include climatic, pollutional, biological, hydrological, and chemical shocks. These factors significantly influence farmers income, productivity, and overall well-being. The findings of this study indicate that various socio-economic and environmental factors contribute to the resilience or vulnerability of farmers. Therefore, based on the study's empirical results, the following recommendations are proposed to enhance the impact of environmental shocks:

- Promote climate-resilient crop varieties that can withstand extreme weather conditions.
- Encourage drought-resistant irrigation techniques such as drip irrigation and rainwater harvesting.

- Provide early warning systems and weather forecasts to help farmers prepare for extreme conditions.
- Implement agroforestry and soil conservation techniques to reduce climate-induced soil degradation.
- Develop crop insurance schemes to financially support farmers during climate disasters.
- Reduce dependence on chemical fertilizers and pesticides by promoting organic farming and bio-fertilizers.
- Implement waste management policies to prevent industrial and agrochemical pollution in farming areas.
- Encourage buffer zones with vegetation around farmlands to reduce the impact of air pollution.
- Promote sustainable water management to prevent contamination from industrial and domestic waste.
- Strengthen environmental regulations to control hazardous emissions affecting agricultural lands.
- Develop integrated pest management (IPM) strategies using biological pest control methods.
- Encourage vaccination and disease monitoring programs for livestock.
- Provide wildlife management training and promote community-based solutions to prevent crop damage by animals.
- Strengthen agricultural extension services to help farmers detect and manage plant and livestock diseases.
- Support diversified farming to reduce dependency on a single crop, lowering risks from pests and diseases.
- Improve flood management infrastructure, such as drainage systems and embankments.
- Promote rainwater harvesting and groundwater recharge techniques to manage water scarcity.
- Introduce efficient irrigation methods like drip and sprinkler systems to optimize water use.

- Support crop diversification to include flood-tolerant and drought-resistant crops.
- Develop early warning and response systems to help farmers mitigate the effects of floods and droughts.
- Enforce strict regulations on the use of hazardous chemicals in agriculture.
- Encourage organic farming and the use of natural pest control methods.
- Promote soil testing programs to help farmers use fertilizers efficiently and prevent overuse.
- Develop waste treatment plants to minimize industrial and agrochemical pollution.
- Raise awareness among farmers about safe chemical handling and disposal methods.
- **Government Relief Packages:** Provide direct financial aid, subsidized inputs (seeds, fertilizers, pesticides, and farm equipment), and emergency food supplies to affected farmers.
- **Crop & Livestock Insurance:** Promote affordable insurance schemes to cover losses from floods, droughts, pests, and diseases. Research on developing eco-friendly pest control mechanisms should be prioritized to reduce the impact of biological shocks
- **Emergency Credit Access:** Offer interest-free or low-interest loans to help farmers rebuild their livelihood. Tie crop insurance policies with loans so farmers are not burdened with debt if their crops fail.
- **Water Conservation Techniques:** Promote drip irrigation, rainwater harvesting, and groundwater recharge projects. Constructing small-scale check dams and water reservoirs to ensure water availability during dry seasons. Provide subsidized drip and sprinkler irrigation for efficient water use.

- **Early Warning Systems:** Provide real-time weather updates via mobile apps and radio alerts. Create climate risk maps for each region to help farmers make informed decisions.
- **Smart Farming Technologies:** Promote precision agriculture, mobile-based advisory services, and AI-driven pest detection. Deploy machine-learning models to detect crop diseases and suggest treatments. Use sensor-based irrigation systems to conserve water.
- **Training & Awareness:** Conduct workshops on climate adaptation strategies and sustainable agriculture. Farmers should be trained on modern irrigation techniques, organic farming, and integrated pest management strategies. Integrate climate adaptation modules into school and college curricula.
- **Land & Water Rights Protection:** Secure land tenure policies to support investment in sustainable farming. Implementing land reform policies to support small and marginal farmers who are vulnerable due to lack of ownership security.
- **Diversified Income Sources:** Encourage beekeeping, dairy farming, and agribusinesses to reduce dependence on crop farming. Train farmers in solar farming and biogas production to reduce energy costs. Support farm stays, organic food experiences, and rural handicraft industries.
- **Youth & Women Empowerment:** Promote school and college initiatives to engage youth in sustainable farming solutions. Provide special training & financial incentives to female and young farmers. Provide special grants, microcredit, and training for female farmers.

These recommendations offer practical, research-based solutions to mitigate the impact of environmental shocks on farmers. The findings of this study highlight that environmental shocks have a profound impact on farmers’ livelihood, affecting income stability, crop yield, and food security. It is crucial to implement policies that enhance farmers' resilience, promote sustainable farming techniques, and provide access to financial and technological support. By investing in climate-smart agriculture, improving weather forecasting, strengthening financial security, and encouraging diversification, farmers can better withstand and recover from environmental shocks.

By adopting these recommendations, government agencies, policymakers, agricultural researchers, and farmers themselves can collectively build a more resilient agricultural sector that is equipped to handle the challenges of environmental change.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

On the basis of the findings, the investigators have given the following topics for further research.

- There is a need to investigate depression, suicidal ideation, and resilience among rural farmers in drought-affected areas.
- Analyze the effectiveness of government relief programs and policies in reducing farmer distress.
- There is a need to conduct comparative studies on how small-scale and large-scale farmers cope with environmental shocks.
- Research is needed to study how mobile-based advisory services influence farmers decision-making in climate adaptation
- Exploring the Role of Traditional and Modern Irrigation Methods in Addressing Climate Change Challenges
- Hydrological Shocks and Water Scarcity: How Farmers Adapt to Changing Water Resources

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5.6 CONCLUSION

Farmers face severe challenges due to environmental shocks such as heavy rainfall, droughts, floods, and other climatic extremes. These unpredictable weather conditions significantly impact agricultural productivity, income stability, and overall livelihood. To address these challenges, farmers must be equipped with climate awareness, modern agricultural techniques, and innovative water management strategies to enhance their resilience. Sustainable farming practices, crop diversification, and the adoption of climate-smart technologies can help mitigate the adverse effects of extreme weather events. Additionally, government intervention is crucial in providing financial aid, technological support, and policy measures to help farmers recover from these shocks. Overall, environmental shocks pose a significant threat to farmers well-being and economic stability. A collaborative effort between the government, agricultural institutions, researchers, and farmers is necessary to develop sustainable solutions. By fostering resilience and ensuring adequate support systems, we can safeguard the livelihoods of farmers and promote long-term agricultural sustainability.

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PHOTO GALLERY

Supporting Evidence from Media Sources

To strengthen the context and relevance of the present study, several paper clippings from reputable websites have been included. These clippings provide contemporary insights, real-world examples, and factual support related to the issues discussed in Chapter 1. The media reports highlight significant developments, stakeholder opinions, and data that align with the focus of the study.

2/16/25, 1:03 PM Tirunelveli district records 413% surplus rainfall; suffers crop damage on 7,975 hectares - The Hindu

Tirunelveli district records 413% surplus rainfall; suffers crop damage on 7,975 hectares

Published - January 19, 2024 06:36 pm IST - TIRUNELVELI

THE HINDU BUREAU

District Collector K. P.Karthikeyan hands over a cheque to a shelf help group at the farmers' grievances redress meeting held in Tirunelveli Collectorate on Friday. | Photo Credit: SPECIAL ARRANGEMENT

The district that experienced 413% surplus rainfall during the last northeast monsoon has also consequently suffered 7,975 hectares crop damage, District Collector K. P. Karthikeyan informed here on Friday.

https://www.thehindu.com/news/cities/Madurai/tirunelveli-district-records-413-surplus-rainfall-suffers-crop-damage-on-7975-hectares/article67755939.... 1/2

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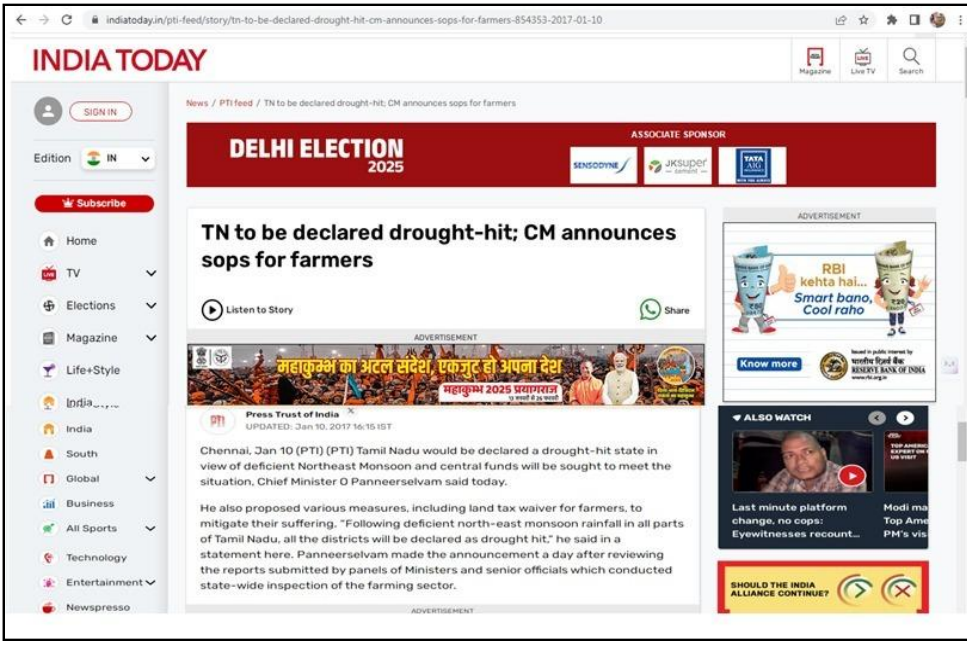
Comprehensive report on drought-like situation in Tirunelveli submitted to government: Collector

Published - October 20, 2023 07:18 pm IST - TIRUNELVELI

THE HINDU BUREAU

Collector K. P. Karthikeyan (second from right) at the farmers' grievances redressal meeting held on Friday. | Photo Credit: SHAIKMOHIDEEN A

District Collector K. P. Karthikeyan has submitted a comprehensive report to the Tamil Nadu Government about the ground reality of the farmers of the district following successive monsoon failures since January 2022.



indiatoday.in/pti-feed/story/tn-to-be-declared-drought-hit-cm-announces-sops-for-farmers-854353-2017-01-10

INDIA TODAY

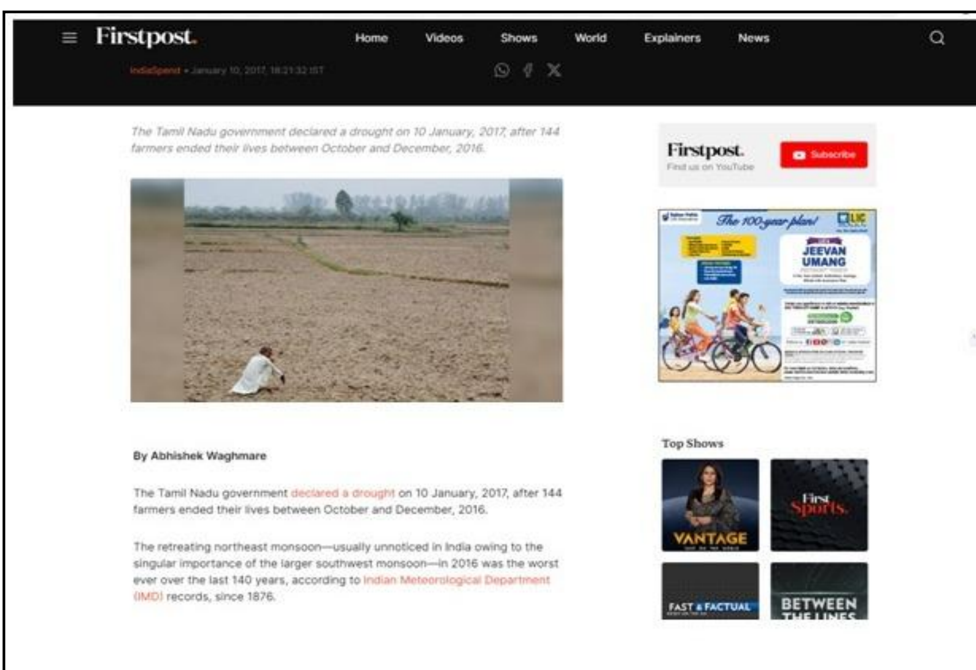
News / PTI feed / TN to be declared drought-hit; CM announces sops for farmers

TN to be declared drought-hit; CM announces sops for farmers

Press Trust of India
UPDATED: Jan 10, 2017 16:15 IST

Chennai, Jan 10 (PTI) (PTI) Tamil Nadu would be declared a drought-hit state in view of deficient Northeast Monsoon and central funds will be sought to meet the situation, Chief Minister O Panneerselvam said today.

He also proposed various measures, including land tax waiver for farmers, to mitigate their suffering. "Following deficient north-east monsoon rainfall in all parts of Tamil Nadu, all the districts will be declared as drought hit," he said in a statement here. Panneerselvam made the announcement a day after reviewing the reports submitted by panels of Ministers and senior officials which conducted state-wide inspection of the farming sector.



Firstpost.

IndiaSpend • January 10, 2017, 18:21:32 IST

The Tamil Nadu government declared a drought on 10 January, 2017, after 144 farmers ended their lives between October and December, 2016.

By Abhishek Waghmare

The Tamil Nadu government declared a drought on 10 January, 2017, after 144 farmers ended their lives between October and December, 2016.

The retreating northeast monsoon—usually unnoticed in India owing to the singular importance of the larger southwest monsoon—in 2016 was the worst ever over the last 140 years, according to Indian Meteorological Department (IMD) records, since 1876.

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THIS STORY IS FROM SEPTEMBER 3, 2020

427 farmers in Tamil Nadu committed suicide in 2019, increase of 6%

Julie Mariappan / TNN / Updated: Sep 3, 2020, 08:58 IST

The farm sector crisis, triggered by the vagaries of nature, continues to take the lives of landed farmers and farm workers in Tamil Nadu.

Representative image

CHENNAI: The farm sector crisis, triggered by the vagaries of nature, continues to take the lives of landed farmers and farm workers in Tamil Nadu. The National Crime Records Bureau report for 2019 says 427 people engaged in agriculture in Tamil Nadu committed suicide , an increase of 6% over the previous year figure. They include six landed farmers and 421 agricultural labourers.

427 farmers in Tamil Nadu committed suicide in 2019, increase of 6%

Among them, 294 were men and 133 women.

While the home ministry report does not specify reasons for suicides of farmers and farm labourers, its last detailed report on farmers' suicides released in 2015 pointed to bankruptcy, farm crisis, family issues, illness and drug abuse among reasons for the suicides among farmers. "The suicides among the community is certainly a cause of concern. Many take their lives due to harassment of bankers for default of loan repayment and lack of minimum support price for many crops," Tamil Nadu Farmers' Association general secretary P Shanmugam said.

KILLING FIELDS

No. of farmers and agricultural labourers who ended their lives in the country in 2019

STATES	Farmers/ cultivators	Agricultural labourers
Maharashtra	2,680	1,247
Karnataka	1,331	661
Andhra Pradesh	628	401
Chattisgarh	458	266
Madhya Pradesh	142	399
Telangana	491	8
Tamil Nadu	6	421

Source: Accidental Deaths and Suicides of India, 2019, National Crime Records Bureau

The state had seen a declining trend of suicides among the farming community from 895 in 2014 to 401 in 2018. It now stands seventh in the country. Certain states and Union territories like West Bengal, Bihar, Odisha, Uttarakhand, Manipur, Chandigarh, Puducherry and Delhi had reported nil suicides of farmers and agricultural labourers last year.

newindianexpress.com/states/tamil-nadu/2023/Mar/22/schemes-integrated-to-uplift-lives-of-tribal-farmers-2558365.html

Mar 18, 2025 2:24 PM | E-PAPER

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Tamil Nadu

Schemes integrated to uplift lives of tribal farmers

To ensure a better livelihood for tribal communities, the government will provide 20% for their nutritional security, as well as seedlings and seeds to create home gardens.

A harvester machine reaping paddy crops in a field near Nagapattinam. (Photo | M K Ashok Kumar, EPS)

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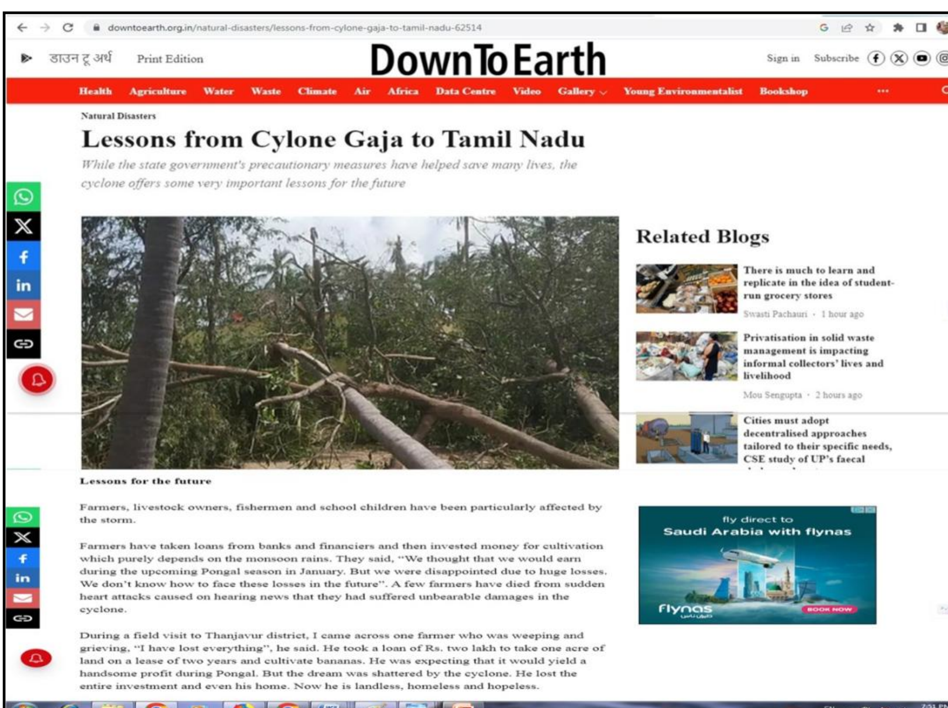

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Natural Disasters

Lessons from Cylone Gaja to Tamil Nadu

While the state government's precautionary measures have helped save many lives, the cyclone offers some very important lessons for the future

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Lessons for the future

Farmers, livestock owners, fishermen and school children have been particularly affected by the storm.

Farmers have taken loans from banks and financiers and then invested money for cultivation which purely depends on the monsoon rains. They said, "We thought that we would earn during the upcoming Pongal season in January. But we were disappointed due to huge losses. We don't know how to face these losses in the future". A few farmers have died from sudden heart attacks caused on hearing news that they had suffered unbearable damages in the cyclone.

During a field visit to Thanjavur district, I came across one farmer who was weeping and grieving, "I have lost everything", he said. He took a loan of Rs. two lakh to take one acre of land on a lease of two years and cultivate bananas. He was expecting that it would yield a handsome profit during Pongal. But the dream was shattered by the cyclone. He lost the entire investment and even his home. Now he is landless, homeless and hopeless.

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Field Visit and Data Collection


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22/02/2025 01:49 PM GMT +05:30


GPS Map Camera
Google
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GPS Map Camera
Google
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GPS Map Camera
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GPS Map Camera
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26/02/2025 03:20 PM GMT +05:30

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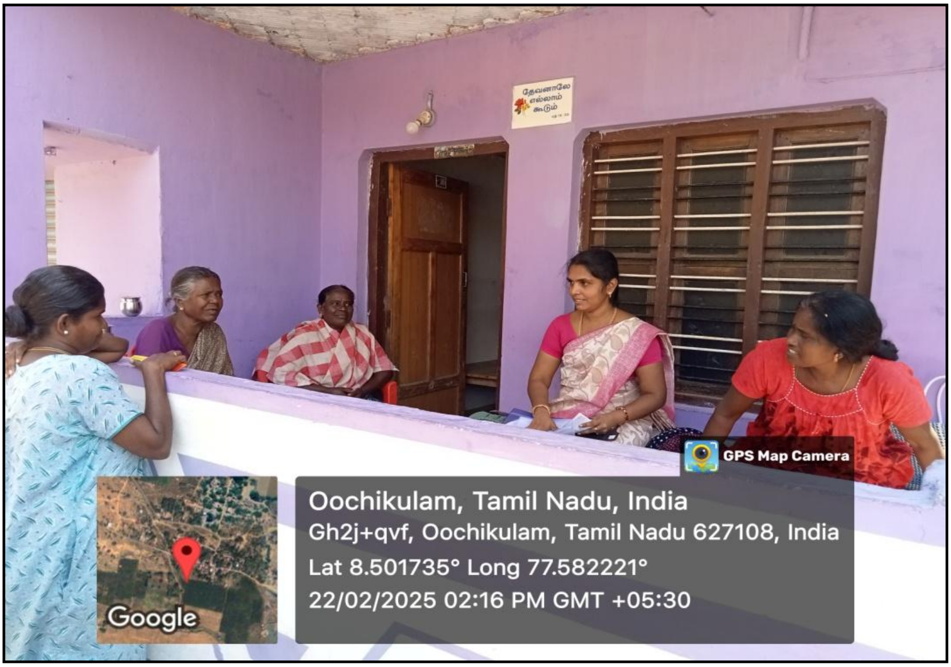
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2025/02/26 15:10


Reuters/Rupak De Chowdhuri


GPS Map Camera
Tirunelveli, Tamil Nadu, India
Fhvm+7v7, Tamil Nadu 627108, India, Tirunelveli,
Tamil Nadu 627108, India
Lat 8.495168° Long 77.586283°
22/02/2025 02:24 PM GMT +05:30
Google


2025/02/26 15:10

ISBN: 978-93-6135-982-8

Awareness Programme through Tableau: Unique Initiative

St. Ignatius College of Education (Autonomous), Palayamkottai showcased the significance of farmers through a creatively designed tableau, emphasizing their crucial role in society. This impactful presentation resonated deeply with the public, drawing widespread attention and appreciation. The tableau's powerful message not only engaged the audience but also received extensive media coverage, featuring prominently in various newspapers.

Here are some photos and newspaper clippings capturing this remarkable event.

விவசாயிகளின் இன்னல்கள், நீர் மாசுபடுதல் உள்ளிட்ட

சமூக அவலங்களை நிலைக்காட்சி மூலம் வெளிப்படுத்திய கல்லூரி மாணவிகள்

பாளை இக்னேஷியஸ் கல்வியியல் கல்லூரி மாணவிகள் தற்போதைய சமூக அவலங்களை நிலைகாட்சியாக வெளிப்படுத்தினர். விவசாயிகளின் இன்னல்கள், நீர் மாசுபடுதல் குறித்து வெளிப்படுத்திய மாணவிகள்.

பார்வையாளர்கள் கண்டு வியப்பு

மறந்து போன கிராமத்து சூழலை எடுத்துரைத்த மாணவிகள்.

சமூக அக்கறையை ஏற்படுத்திய மாணவிகளின் நிலைக்காட்சி

தத்ரூபமாக அமைக்கப்பட்ட நிலைக்காட்சி.

நெல்லை மாவட்டம் பாளையங்கோட்டையில் பரபரப்பான காலை நேரத்தில் சமூக அவலங்களை மக்களுக்கு எடுத்துரைத்து விழிப்புணர்வு ஏற்படுத்தும் வகையில் மாணவிகள் நிகழ்த்திய நிலைக்காட்சி அனைவரின் மனதிலும் நீங்காத இடத்தை பிடித்தது. ஒவ்வொரு நிலைக்காட்சியிலும் பங்கேற்ற மாணவிகள் கண் இமைகளைக் கூட மூடாமல் ஒரே முக பாவனையுடன் நீண்ட நேரம் நின்று விழிப்புணர்வு ஏற்படுத்தினர்.

இக்னேஷியஸ் கல்வியியல் கல்லூரி வளாகத்தில் மாணவிகளால் நிகழ்த்தப்பட்ட ஒவ்வொரு நிலைக்காட்சியும் எண்ணற்ற எண்ணங்களை பார்வையாளர்களுக்கு கடத்துவதாக அமைந்தது. இதில், சாலையோரம் வைக்கப்பட்ட டிஜிட்டல் பேனர் விழுந்ததில் ஸ்கூட்டரில் சென்ற பெண்கள் விபத்துக்குள்ளாகி இறந்து கிடந்த காட்சி அனைவரையும் ஒரு கணம் உலுக்கியது. வறட்சியால் விவசாயம் பொய்த்து போனதால் விவசாயிகள் விஷம் குடித்து விளைநிலத்தில் மடிந்த காட்சியும், தூக்குப் போட்டு உயிரை மாய்த்த காட்சியும் மனதை ரணமாக்கியது.

மேலும் நீர்நிலைகளை பாதுகாக்க வேண்டும் போன்ற கருத்துகளை வலியுறுத்தியும் நடந்த மாணவிகளின் நிலைக்காட்சிகள் கவனம் ஈர்த்தன. பாரம்பரிய விவசாயத்தை கண்முன்னே காட்டும் வகையில், கிராமத்தில் ஆடு, மாடுகளை வளர்ப்பது போன்றும், விளை நிலத்தில் தொட்டில் கட்டி குழந்தையை தூங்க வைத்து விட்டு, பெண்கள் வேளாண் பணிகளில் ஈடுபடுவது போன்றும் சித்தரிக்கப்பட்ட நிலைக்காட்சி தத்ரூபமாக அமைந்தது.

சுற்றுச்சூழலை பாதுகாப்பது குறித்து மாணவிகள் குறிஞ்சி, முல்லை, மருதம், நெய்தல், பாலை என 5 குழுக்களாக நிலைக்காட்சிகளை அமைத்து இருந்தனர். பிளாஸ்டிக் பொருட்களை பயன்படுத்துவதால் ஏற்படும் தீமைகள் குறித்து குறிஞ்சி அணியினரும், புவி வெப்பமயமாதல், நிலச்சரிவு, வறட்சி போன்றவற்றால் ஏற்படும் பாதிப்புகள் குறித்து முல்லை அணியினரும், நீர்வளத்தை பாதுகாப்பது குறித்து மருதம் அணியினரும் நிலைக்காட்சிகள் அமைத்து விழிப்புணர்வு ஏற்படுத்தினர்.

விவசாயத்தை அழிக்கும், விவசாயிகளை பாதுகாக்கும் வகையில் நெய்தல் அணியினரும், நீர், காற்று, ஒலி மாசுபாடுகளை தடுக்க வலியுறுத்தி பாலை அணியினரும் நிலைக்காட்சிகள் அமைத்து பார்வையாளர்களுக்கு விழிப்புணர்வு ஊட்டினர். இதனை சுற்று வட்டார பகுதி மக்கள், மாணவ–மாணவிகள் ஆர்வமுடன் பார்வையிட்டனர்.

ஜெனிஷா பென்

திவ்யா

இதுகுறித்து நிலைக்காட்சியில் பங்கேற்ற மாணவி ஜெனிஷா பென் கூறுகையில், "இயற்கையோடு இணைந்து வாழ வேண்டும். அவ்வாறு வாழ்ந்தால் மனிதன் ஆரோக்கியமாகவும், நீண்ட நாட்களும் வாழ முடியும். வருங்கால சந்ததியினருக்கு நல்ல சுற்றுச்சூழலை வழங்க முடியும் என்பதை உணர்த்தும் வகையில் நிலைக்காட்சியில் பங்கேற்று விழிப்புணர்வு ஏற்படுத்தினோம்" என்றார்.

மாணவி திவ்யா கூறுகையில், "நம் முன்னோர் ஆரோக்கியமான வாழ்க்கைக்கு சொல்லிவிட்டு சென்ற பழங்கால பொருட்களைக் கொண்டு நிலைக்காட்சியை உருவாக்கினோம். இயற்கையோடு நாம் ஒன்றிணைந்து வாழ வேண்டும்" என்றார்.

பேராசிரியர்கள் கூறுகையில், "சமூக முன்னேற்றத்துக்காக முயற்சி செய்வதும், பிரச்சினைகளை இனம் கண்டு அவற்றை தீர்த்து வைக்கும் ஆற்றலையும், திறமையையும் வளர்ப்பதுதான் உண்மையான பெண் கல்வி ஆகும். வருங்கால ஆசிரியைகளாக வர இருக்கும் மாணவிகள் இந்த நிலைக்காட்சியை மிக தத்ரூபமாக நிகழ்த்தி உள்ளனர்" என்றனர்.

8 | T

தினமலர்
திருநெல்வேலி | சனி 25.1.2025

பாளை இக்னேஷியஸ் கல்வியியல் கல்லூரி மாணவிகள் நிலைக்காட்சி மூலம் சமூக அவலங்களை தத்ரூபமாக வெளிப்படுத்தினர்.

சமூக அவலங்கள் காட்சி மாணவிகள் தத்ரூபம்

திருநெல்வேலி, ஜன. 25– பாளை இக்னேஷியஸ் கல்வியியல் கல்லூரி மாணவிகள் நிலைக்காட்சி மூலம் சமூக அவலங்களை தத்ரூபமாக வெளிப்படுத்தினர்.

கல்லூரி செயலாளர் மேரி செலஸ்டினா வழிகாட்டுதலில் நடந்த நிகழ்ச்சிக்கு கல்லூரி முதல்வர் வசந்தி மடோனா தலைமை வகித்தார். சேவியர் கல்வியியல் கல்லூரி முதல்வர் காட்வின் ரூபஸ் முன்னிலை வகித்தார். மாநகர போலீஸ் துணை கமிஷனர் கீதா துவக்கி வைத்தார்.

புறநகர் ரோட்டரி சங்க தலைவர் கிளாடிஸ் ஸ்டெல்லாபாய், ரோட்டரி பட்டய தலைவர் மேகலிங்கம் உட்பட பலர் பேசினர். மாணவிகள் 5 குழுக்களாக பிரிந்து நிலைக்காட்சி மூலம் தத்ரூபமாக சமூக அவலங்களை வெளிப்படுத்தினர். இதில் மாணவ, மாணவிகள் ஆர்வத்துடன் பார்வையிட்டனர்.

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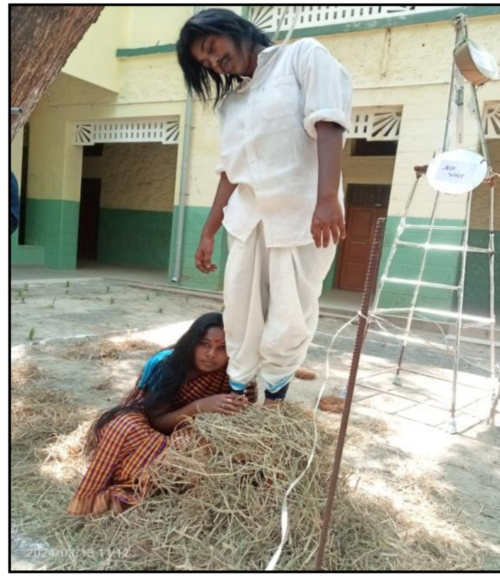

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APPENDIX
ROUGH TOOL

TITLE: THE IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS LIVELIHOOD

Name of the Institution: St.Ignatius College of Education (Autonoumou) Palayamkottai

அன்பார்ந்த மாணவ மாணவியரே

எங்களது ஆராய்ச்சி தொடர்பாக உங்களிடமிருந்து சில விவரங்கள் தேவைப்படுகின்றன. அவற்றை உரிய வகையில் அளித்து உதவும்படி கேட்டுக் கொள்கிறோம். இவை இரகசியமாக பாதுகாக்கப்பட்டு எங்கள் ஆராய்ச்சிக்கு மட்டும் பயன்படுத்தப்படும் என உறுதி அளிக்கிறோம்.

தங்கள் நன்றியுள்ள,
ஆராய்ச்சியாளர்கள்

Personal Information

Gender பாலினம்	:	Male ஆண்	Female பெண்	
Type of Family குடும்ப வகை	:	Nuclear தனிக்குடும்பம்	Joint கூட்டுக்குடும்ப ம்	
Membership in farmers' organization விவசாயிகள் அமைப்பில் உறுப்பினர்	:	Member உறுப்பினர்	Non-member உறுப்பினர் அல்லாதவர்	
Type of farming விவசாயத்தின் வகை	:	Organic இயற்கை விவசாயம்	Commercial வணிக விவசாயம்	Mixed கலப்பு விவசாயம்
Type of land நிலத்தின் வகை		Irrigated பாசன நிலம்	Rainfed மானாவாரி நிலம்	Mixed கலப்பு நிலம்
Land ownership status நில உரிமை நிலை	:	Owned சொந்தமான நிலம்	Leased குத்தகை நிலம்	Landless Labour நிலமற்ற உழைப்பு
Farm mechanization விவசாய இயந்திரங்கள்		Use of Traditional tools பாரம்பரிய	Use of Modern Machinery நவீன	Use of both tools இரண்டு கருவிகளின் பயன்பாடு

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Recovery time after shock அதிர்ச்சிக்குப் பின் மீட்பு காலம்	:	Below 6 months 6 மாதங்களுக்கு கீழ்	6-12 months 12-6மாதங்கள்	Above 12 months 12 மாதங்களுக்கு மேல்	
Educational Status கல்வி நிலை	:	Uneducated படிக்காதவர்	School பள்ளி	Others மற்றவை	
Age வயது		Below 35 years 35 வயதுக்கு கீழ்	41-50 years 4-150 வயது	Above 50 years 50 வயதுக்கு மேல்	
Annual Income ஆண்டு வருமானம்		Below 50000 50000 க்கு கீழ்	50000-100000 50000-100000	Above 100000 100000 க்கு மேல்	
Experience in farming, விவசாய அனுபவம்	:	Below 4 years 4 ஆண்டுகளுக்கு கீழ்	4-7 years 7-4 ஆண்டுகள்	7-10 years 7-10 ஆண்டுகள்	Above 10 years 10 ஆண்டுகளுக்கு கீழ்
Access to weather information வானிலை தகவல்களுக்கான அணுகல்	:	Newspaper செய்தித்தாள்	Radio வானொலி	Television தொலைக்காட்சி	Mobile Apps கைப்பேசி பயன்பாடு
Water sources for farming விவசாயத் திற்கான நீர் ஆதாரங்கள்	:	Irrigation canals பாசன கால்வாய்கள்	Wells கிணறுக ள்	Ponds குளங்கள்	rain fed மானாவா ரி	Others மற்றவை
Type of Crisis experienced அனுபவித்த நெருக்கடியி ன் வகை	:	Floods வெள்ளம்	Droughts வறட்சி	Pests பூச்சிகள்	Heavy rainfall பலத்த மழை	others மற்றவை

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Debt amount	:	Yes	No
கடன் தொகை		ஆம்	இல்லை
Did you experience crop failure due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகளால் பயிர் இழப்பை நீங்கள் சந்தித்தீர்களா?		ஆம்	இல்லை
Have you lost livestock due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகளால் கால்நடைகளை இழந்திருக்கிறீர்களா?		ஆம்	இல்லை
Did you change farming methods due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகள் காரணமாக விவசாய முறைகளை மாற்றினீர்களா?		ஆம்	இல்லை
Did you receive any government support for recovery?	:	Yes	No
மீட்புக்காக உங்களுக்கு ஏதேனும் அரசு ஆதரவு கிடைத்ததா?		ஆம்	இல்லை
Have you taken loans or credit due to shocks?	:	Yes	No
அதிர்ச்சிகள் காரணமாக நீங்கள் கடன்கள் அல்லது கடன் வாங்கியிருக்கிறீர்களா?		ஆம்	இல்லை

S.No	Statements	Agree	Undecided	Disagree
1	Frequent droughts have significantly reduced my agricultural productivity. தொடர்ந்து ஏற்படும் வறட்சி நிலை என் விவசாய உற்பத்தியை குறிப்பிடத்தக்க அளவில் குறைத்துள்ளது.			
2.	Unexpected heavy rainfall has caused severe damage to my crops. எதிர்பாராத கனமழை என் பயிர்களுக்கு கடுமையான சேதத்தை ஏற்படுத்தியுள்ளது.			
3.	Temperature fluctuations have negatively affected my crop yield. வெப்பநிலை மாற்றங்கள் என் பயிர் உற்பத்தியை எதிர்மறையாக பாதித்துள்ளன.			
4.	Prolonged dry spells have made irrigation more challenging நீடித்த வறண்ட காலநிலை நீர்ப்பாசனத்தை மிகவும் சவாலாக ஆக்கியுள்ளது			
5.	Unseasonal weather patterns have disrupted my farming schedule. பருவமில்லாத வானிலை என் விவசாய அட்டவணையை சீர்குலைத்துவிட்டது.			
6.	Sudden hailstorms have caused damage to my standing crops. திடீரென ஆலங்கட்டி மழை பெய்ததால், பயிர்கள் சேதமடைந்துள்ளன.			
7.	Strong winds have uprooted my crops and damaged farm infrastructure. பலத்த காற்று என் பயிர்களை வேரோடு பிடுங்கியது மற்றும் பண்ணை உள்கட்டமைப்பை சேதப்படுத்தியது.			
8.	Variability in climate has affected the germination and growth of crops. பருவநிலை மாறுபாடு பயிர்களின் முளைப்பு மற்றும் வளர்ச்சியை பாதித்துள்ளது.			
9.*	Climate change has forced me to change my cropping pattern. பருவநிலை மாற்றம் என் பயிர் முறையை மாற்ற வேண்டிய கட்டாயத்தில் உள்ளது.			
10.	Climate shocks have increased my dependency on government relief schemes. காலநிலை அதிர்ச்சிகள் அரசின் நிவாரணத் திட்டங்களில் நான் சார்ந்திருப்பதை அதிகரித்துள்ளன.			
11.	Air pollution has affected the health of my crops and livestock. காற்று மாசுபாடு எனது பயிர்கள் மற்றும் கால்நடைகளின் ஆரோக்கியத்தை பாதித்துள்ளது.			
12.	Air pollution from nearby factories has affected the growth of my crops. அருகிலுள்ள தொழிற்சாலைகளின் காற்றுமாசு என் பயிர்களின் வளர்ச்சியை பாதித்துள்ளது.			
13.	Soil pollution has reduced the fertility of my land. மண் மாசுபாடு என் நிலத்தின் வளத்தை குறைத்துள்ளது.			
14.	Vehicular emissions have negatively impacted plants in my field. வாகனங்களில் இருந்து வரும் புகை என் பண்ணையின் செடிகளை மோசமாக பாதிக்கின்றன.			
15.	Dust and smog in the air affect the photosynthesis process in crops. தூசி மற்றும் புகைமூட்டம் காரணமாக, பயிர்களில் ஒளிச்சேர்க்கை செயல்முறை பாதிக்கப்படுகிறது.			

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16.	Water pollution from agricultural chemicals has affected my irrigation sources. விவசாய இரசாயனங்களின் நீர் மாசுபாடு எனது நீர்ப்பாசன ஆதாரங்களை பாதித்துள்ளது.			
17.	Plastic waste accumulation on farmland has degraded soil quality. விவசாய நிலங்களில் பிளாஸ்டிக் கழிவுகள் குவிந்து மண்ணின் தரத்தை சீர்குலைத்துள்ளது.			
18.	Polluted water sources have increased livestock mortality. மாசுபட்ட நீர் ஆதாரங்களால் கால்நடைகளின் இறப்பு அதிகரித்துள்ளது.			
19.*	I believe environmental pollution is a major reason for declining farm productivity. சுற்றுச்சூழல் மாசுபாடு, விவசாய உற்பத்தி குறைவதற்கான முக்கியக் காரணமாக இருக்கிறது என நம்புகிறேன்.			
20.	Outbreaks of plant diseases have led to major crop losses. தாவர நோய்களின் வெடிப்பு பெரும் பயிர் இழப்புக்கு வழிவகுத்தது.			
21.*	Animal diseases have reduced the productivity of my livestock. விலங்கு நோய்கள் எனது கால்நடைகளின் உற்பத்தித்திறனைக் குறைத்துள்ளன.			
22.	Virus outbreaks in crops have severely affected my income. பயிர்களில் வைரஸ் தாக்குதலால் எனது வருமானம் கடுமையாக பாதிக்கப்பட்டுள்ளது.			
23.	Soil-borne pathogens have made farming more difficult. மண்ணில் பரவும் நோய்க்கிருமிகள் விவசாயத்தை கடினமாக்கியுள்ளன.			
24.*	Livestock epidemics have forced me to cull animals and suffer losses. கால்நடைகளின் தொற்றுநோய்கள் விலங்குகளை கொல்லவும் இழப்புகளை சந்திக்கவும் என்னை கட்டாயப்படுத்தியுள்ளன.			
25.	Insect-borne diseases have spread rapidly due to changing weather patterns. மாறிவரும் பருவநிலை மாற்றத்தால் பூச்சிகளால் பரவும் நோய்கள் வேகமாகப் பரவுகின்றன.			
26.	Frequent pest infestations have led to heavy crop losses. அடிக்கடி பூச்சி தாக்குதலால் அதிக பயிர் இழப்பு ஏற்பட்டுள்ளது.			
27.	Crop destruction by wild animals has led to reduced harvests. வனவிலங்குகளால் பயிர்களை அழிப்பதால் அறுவடை குறைந்துள்ளது.			
28.	Rodent attacks have damaged my stored grains. நான் சேமித்து வைத்திருந்த தானியங்களை கொறித்துண்ணிகள் சேதப்படுத்தின.			
29.	Bird attacks on my crops have led to economic losses. எனது பயிர்கள் மீது பறவை தாக்குதல்களால் பொருளாதார இழப்பு ஏற்பட்டுள்ளது.			
30.	Flooding has led to soil erosion and loss of topsoil on my farm. வெள்ளத்தால் எனது பண்ணையில் மண் அரிப்பு மற்றும் மேல் மண் இழப்பு ஏற்பட்டுள்ளது.			
31.	Water logging has reduced the productivity of my crops. தண்ணீர் தேங்குவதால் எனது பயிர்களின் விளைச்சல் குறைந்துள்ளது.			
32.	Groundwater depletion has made it difficult to irrigate my fields. நிலத்தடி நீர் குறைவால் எனது வயல்களுக்கு நீர் பாய்ச்சுவதில் சிரமம் ஏற்பட்டுள்ளது.			
33.	Sudden flash floods have damaged my crops and farm infrastructure. திடீர் வெள்ளம் என் பயிர்கள் மற்றும் பண்ணை உள்கட்டமைப்புகளை சேதப்படுத்தியது.			

34.	Poor drainage systems have worsened the impact of excess rainfall on my farm. மோசமான வடிகால் அமைப்புகள் எனது பண்ணையில் அதிகப்படியான மழையின் தாக்கத்தை மோசமாக்கியுள்ளன.			
35.	Erratic hydrological conditions have increased my dependency on government support. ஒழுங்கற்ற நீர்நிலை நிலைமைகள் அரசாங்க ஆதரவை நான் சார்ந்திருப்பதை அதிகரித்துள்ளன.			
36.	Siltation of water bodies has reduced water availability for agriculture. நீர்நிலைகளில் வண்டல் மண் படிந்ததால் விவசாயத்திற்கு தேவையான நீர் இருப்பு குறைந்துள்ளது.			
37.*	Water scarcity has led to conflicts among farmers in my area. தண்ணீர் பற்றாக்குறையால் எனது பகுதி விவசாயிகளிடையே மோதல் ஏற்பட்டுள்ளது.			
38.	Excessive use of chemical fertilizers has reduced soil fertility on my farm. அதிக இரசாயன உரம் பயன்படுத்துவதால் என் பண்ணையின் மண் விளைச்சல் குறைந்துள்ளது.			
39.	Chemical waste from nearby industries has contaminated my farmland. அருகிலுள்ள தொழிற்சாலைகளில் இருந்து வரும் இரசாயனக் கழிவு என் பண்ணையை மாசுபடுத்தியுள்ளது.			
40.	Pesticide residues on crops have affected my farm's product quality and market value. பயிர்களில் பூச்சிக்கொல்லி எச்சம் இருப்பது, உற்பத்தி தரத்தையும் சந்தை மதிப்பையும் பாதித்துள்ளது.			
41.*	I have noticed a decline in beneficial insects (e.g., bees, butterflies) due to excessive pesticide use. அதிக பூச்சிக்கொல்லி பயன்பாடு காரணமாக பயனுள்ள பூச்சிகளின் தேனீக்கள்),சிட்டுக்குருவிகள்எண்ணிக்கை (.குறைந்துள்ளது			
42.	Exposure to agrochemicals has caused health issues for me or my farm workers. பயிர் இரசாயனங்களுக்கு எதிரான சந்திப்பால் எனக்கு அல்லது என் பண்ணை தொழிலாளர்களுக்கு உடல்நலப் பிரச்சனைகள் ஏற்பட்டுள்ளன.			
43*	The cost of chemical fertilizers and pesticides has significantly increased my farming expenses. இரசாயன உரங்களும் பூச்சிக்கொல்லிகளும் அதிக விலை காரணமாக எனது வேளாண்மை செலவுகளை அதிகரித்துள்ளன.			
44	Continuous use of chemical inputs has reduced earthworm and microbial activity in my soil. தொடர்ச்சியான இரசாயனப் பயன்பாடு என் மண்ணில் உள்ள நிலவெட்டி மற்றும் நுண்ணுயிர்களின் செயல்பாட்டைக் குறைத்துள்ளது.			
45	There is limited access to eco-friendly or organic alternatives in my farming area. என் வேளாண் பகுதியில் சுற்றுச்சூழல் நட்பான அல்லது உயிர் வேளாண் மாற்றுத் தீர்வுகள் கிடைப்பது குறைவாகவே உள்ளது.			

FINAL TOOL

TITLE: THE IMPACT OF ENVIRONMENTAL SHOCKS ON FARMERS LIVELIHOOD

Name of the Institution: St.Ignatius College of Education (Autonoumou) Palayamkottai

அன்பார்ந்த மாணவ மாணவியரே

எங்களது ஆராய்ச்சி தொடர்பாக உங்களிடமிருந்து சில விவரங்கள் தேவைப்படுகின்றன. அவற்றை உரிய வகையில் அளித்து உதவும்படி கேட்டுக் கொள்கிறோம். இவை இரகசியமாக பாதுகாக்கப்பட்டு எங்கள் ஆராய்ச்சிக்கு மட்டும் பயன்படுத்தப்படும் என உறுதி அளிக்கிறோம்.

தங்கள் நன்றியுள்ள,
ஆராய்ச்சியாளர்கள்

Personal Information

Gender பாலினம்	:	Male ஆண்	Female பெண்	
Type of Family குடும்ப வகை	:	Nuclear தனிக்குடும்பம்	Joint கூட்டுக்குடும்ப ம்	
Membership in farmers' organization விவசாயிகள் அமைப்பில் உறுப்பினர்	:	Member உறுப்பினர்	Non-member உறுப்பினர் அல்லாதவர்	
Type of farming விவசாயத்தின் வகை	:	Organic இயற்கை விவசாயம்	Commercial வணிக விவசாயம்	Mixed கலப்பு விவசாயம்
Type of land நிலத்தின் வகை		Irrigated பாசன நிலம்	Rainfed மானாவாரி நிலம்	Mixed கலப்பு நிலம்
Land ownership status நில உரிமை நிலை	:	Owned சொந்தமான நிலம்	Leased குத்தகை நிலம்	Landless Labour நிலமற்ற உழைப்பு
Farm mechanization விவசாய இயந்திரங்கள்		Use of Traditional tools பாரம்பரிய	Use of Modern Machinery நவீன	Use of both tools இரண்டு கருவிகளின் பயன்பாடு

Recovery time after shock அதிர்ச்சிக்குப் பின் மீட்பு காலம் :	Below 6 months 6 மாதங்களுக்கு கீழ்	6-12 months 12-6மாதங்கள்	Above 12 months 12 மாதங்களுக்கு மேல்		
Educational Status : கல்வி நிலை	Uneducated படிக்காதவர்	School பள்ளி	Others மற்றவை		
Age வயது	Below 35 years 35 வயதுக்கு கீழ்	41-50 years 4-150 வயது	Above 50 years 50 வயதுக்கு மேல்		
Annual Income ஆண்டு வருமானம்	Below 50000 50000 க்கு கீழ்	50000-100000 50000-100000	Above 100000 100000 க்கு மேல்		
Experience in farming, விவசாய அனுபவம் :	Below 4 years 4 ஆண்டுகளுக்கு கீழ்	4-7 years 7-4 ஆண்டுகள்	7-10 years 7-10 ஆண்டுகள்	Above 10 years 10 ஆண்டுகளுக்கு கீழ்	
Access to weather information : வானிலை தகவல்களுக்கான அணுகல்	Newspaper செய்தித்தாள்	Radio வானொலி	Television தொலைக்காட்சி	Mobile Apps கைப்பேசி பயன்பாடு	
Water sources for farming : விவசாயத் திற்கான நீர் ஆதாரங்கள்	Irrigation canals பாசன கால்வாய்கள்	Wells கிணறுகள்	Ponds குளங்கள்	rain fed மானாவாரி	Others மற்றவை
Type of Crisis experienced : அனுபவித்த நெருக்கடியின் வகை	Floods வெள்ளம்	Droughts வறட்சி	Pests பூச்சிகள்	Heavy rainfall பலத்த மழை	others மற்றவை

Debt amount	:	Yes	No
கடன் தொகை		ஆம்	இல்லை
Did you experience crop failure due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகளால் பயிர் இழப்பை நீங்கள் சந்தித்தீர்களா?		ஆம்	இல்லை
Have you lost livestock due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகளால் கால்நடைகளை இழந்திருக்கிறீர்களா?		ஆம்	இல்லை
Did you change farming methods due to environmental shocks?	:	Yes	No
சுற்றுச்சூழல் அதிர்ச்சிகள் காரணமாக விவசாய முறைகளை மாற்றினீர்களா?		ஆம்	இல்லை
Did you receive any government support for recovery?	:	Yes	No
மீட்புக்காக உங்களுக்கு ஏதேனும் அரசு ஆதரவு கிடைத்ததா?		ஆம்	இல்லை
Have you taken loans or credit due to shocks?	:	Yes	No
அதிர்ச்சிகள் காரணமாக நீங்கள் கடன்கள் அல்லது கடன் வாங்கியிருக்கிறீர்களா?		ஆம்	இல்லை

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S.No	Statements	Agree	Undecided	Disagree
1	Frequent droughts have significantly reduced my agricultural productivity. தொடர்ந்து ஏற்படும் வறட்சி நிலை என் விவசாய உற்பத்தியை குறிப்பிடத்தக்க அளவில் குறைத்துள்ளது.			
2.	Unexpected heavy rainfall has caused severe damage to my crops. எதிர்பாராத கனமழை என் பயிர்களுக்கு கடுமையான சேதத்தை ஏற்படுத்தியுள்ளது.			
3.	Temperature fluctuations have negatively affected my crop yield. வெப்பநிலை மாற்றங்கள் என் பயிர் உற்பத்தியை எதிர்மறையாக பாதித்துள்ளன.			
4.	Prolonged dry spells have made irrigation more challenging நீடித்த வறண்ட காலநிலை நீர்ப்பாசனத்தை மிகவும் சவாலாக ஆக்கியுள்ளது			
5.	Unseasonal weather patterns have disrupted my farming schedule. பருவமில்லாத வானிலை என் விவசாய அட்டவணையை சீர்குலைத்துவிட்டது.			
6.	Sudden hailstorms have caused damage to my standing crops. திடீரென ஆலங்கட்டி மழை பெய்ததால், பயிர்கள் சேதமடைந்துள்ளன.			
7.	Strong winds have uprooted my crops and damaged farm infrastructure. பலத்த காற்று என் பயிர்களை வேரோடு பிடுங்கியது மற்றும் பண்ணை உள்கட்டமைப்பை சேதப்படுத்தியது.			
8.	Variability in climate has affected the germination and growth of crops. பருவநிலை மாறுபாடு பயிர்களின் முளைப்பு மற்றும் வளர்ச்சியை பாதித்துள்ளது.			
9.	Climate shocks have increased my dependency on government relief schemes. காலநிலை அதிர்ச்சிகள் அரசின் நிவாரணத் திட்டங்களில் நான் சார்ந்திருப்பதை அதிகரித்துள்ளன.			
10.	Air pollution has affected the health of my crops and livestock. காற்று மாசுபாடு எனது பயிர்கள் மற்றும் கால்நடைகளின் ஆரோக்கியத்தை பாதித்துள்ளது.			
11	Air pollution from nearby factories has affected the growth of my crops. அருகிலுள்ள தொழிற்சாலைகளின் காற்றுமாசு என் பயிர்களின் வளர்ச்சியை பாதித்துள்ளது.			
12.	Soil pollution has reduced the fertility of my land. மண் மாசுபாடு என் நிலத்தின் வளத்தை குறைத்துள்ளது.			
13.	Vehicular emissions have negatively impacted plants in my field. வாகனங்களில் இருந்து வரும் புகை என் பண்ணையின் செடிகளை மோசமாக பாதிக்கின்றன.			
14.	Dust and smog in the air affect the photosynthesis process in crops. தூசி மற்றும் புகைமூட்டம் காரணமாக, பயிர்களில் ஒளிச்சேர்க்கை செயல்முறை பாதிக்கப்படுகிறது.			
15.	Water pollution from agricultural chemicals has affected my irrigation sources. விவசாய இரசாயனங்களின் நீர் மாசுபாடு எனது நீர்ப்பாசன ஆதாரங்களை பாதித்துள்ளது.			

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16.	Plastic waste accumulation on farmland has degraded soil quality. விவசாய நிலங்களில் பிளாஸ்டிக் கழிவுகள் குவிந்து மண்ணின் தரத்தை சீர்குலைத்துள்ளது.			
17.	Polluted water sources have increased livestock mortality. மாசுபட்ட நீர் ஆதாரங்களால் கால்நடைகளின் இறப்பு அதிகரித்துள்ளது.			
18.	Outbreaks of plant diseases have led to major crop losses. தாவர நோய்களின் வெடிப்பு பெரும் பயிர் இழப்புக்கு வழிவகுத்தது.			
19.	Virus outbreaks in crops have severely affected my income. பயிர்களில் வைரஸ் தாக்குதலால் எனது வருமானம் கடுமையாக பாதிக்கப்பட்டுள்ளது.			
20.	Soil-borne pathogens have made farming more difficult. மண்ணில் பரவும் நோய்க்கிருமிகள் விவசாயத்தை கடினமாக்கியுள்ளன.			
21.	Insect-borne diseases have spread rapidly due to changing weather patterns. மாறிவரும் பருவநிலை மாற்றத்தால் பூச்சிகளால் பரவும் நோய்கள் வேகமாகப் பரவுகின்றன.			
22.	Frequent pest infestations have led to heavy crop losses. அடிக்கடி பூச்சி தாக்குதலால் அதிக பயிர் இழப்பு ஏற்பட்டுள்ளது.			
23	Crop destruction by wild animals has led to reduced harvests. வனவிலங்குகளால் பயிர்களை அழிப்பதால் அறுவடை குறைந்துள்ளது.			
24	Rodent attacks have damaged my stored grains. நான் சேமித்து வைத்திருந்த தானியங்களை கொறித்துண்ணிகள் சேதப்படுத்தின.			
25	Bird attacks on my crops have led to economic losses. எனது பயிர்கள் மீது பறவை தாக்குதல்களால் பொருளாதார இழப்பு ஏற்பட்டுள்ளது.			
26	Flooding has led to soil erosion and loss of topsoil on my farm. வெள்ளத்தால் எனது பண்ணையில் மண் அரிப்பு மற்றும் மேல் மண் இழப்பு ஏற்பட்டுள்ளது.			
27	Water logging has reduced the productivity of my crops. தண்ணீர் தேங்குவதால் எனது பயிர்களின் விளைச்சல் குறைந்துள்ளது.			
28	Groundwater depletion has made it difficult to irrigate my fields. நிலத்தடி நீர் குறைவால் எனது வயல்களுக்கு நீர் பாய்ச்சுவதில் சிரமம் ஏற்பட்டுள்ளது.			
29	Sudden flash floods have damaged my crops and farm infrastructure. திடீர் வெள்ளம் என் பயிர்கள் மற்றும் பண்ணை உள்கட்டமைப்புகளை சேதப்படுத்தியது.			
30	Poor drainage systems have worsened the impact of excess rainfall on my farm. மோசமான வடிகால் அமைப்புகள் எனது பண்ணையில் அதிகப்படியான மழையின் தாக்கத்தை மோசமாக்கியுள்ளன.			
31	Erratic hydrological conditions have increased my dependency on government support. ஒழுங்கற்ற நீர்நிலை நிலைமைகள் அரசாங்க ஆதரவை நான் சார்ந்திருப்பதை அதிகரித்துள்ளன.			
32	Siltation of water bodies has reduced water availability for agriculture. நீர்நிலைகளில் வண்டல் மண் படிந்ததால் விவசாயத்திற்கு தேவையான நீர் இருப்பு குறைந்துள்ளது.			
33	Excessive use of chemical fertilizers has reduced soil fertility on my farm.			

	அதிக இரசாயன உரம் பயன்படுத்துவதால் என் பண்ணையின் மண் விளைச்சல் குறைந்துள்ளது.			
34	Chemical waste from nearby industries has contaminated my farmland. அருகிலுள்ள தொழிற்சாலைகளில் இருந்து வரும் இரசாயனக் கழிவு என் பண்ணையை மாசுபடுத்தியுள்ளது.			
35	Pesticide residues on crops have affected my farm's product quality and market value. பயிர்களில் பூச்சிக்கொல்லி எச்சம் இருப்பது, உற்பத்தி தரத்தையும் சந்தை மதிப்பையும் பாதித்துள்ளது.			
36	Exposure to agrochemicals has caused health issues for me or my farm workers. பயிர் இரசாயனங்களுக்கு எதிரான சந்திப்பால் எனக்கு அல்லது என் பண்ணை தொழிலாளர்களுக்கு உடல்நலப் பிரச்சனைகள் ஏற்பட்டுள்ளன.			
37	Continuous use of chemical inputs has reduced earthworm and microbial activity in my soil. தொடர்ச்சியான இரசாயனப் பயன்பாடு என் மண்ணில் உள்ள நிலவெட்டி மற்றும் நுண்ணுயிர்களின் செயல்பாட்டைக் குறைத்துள்ளது.			
38	There is limited access to eco-friendly or organic alternatives in my farming area. என் வேளாண் பகுதியில் சுற்றுச்சூழல் நட்பான அல்லது உயிர் வேளாண் மாற்றுத் தீர்வுகள் கிடைப்பது குறைவாகவே உள்ளது.			

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