

## Is Climate Change Costing Farmers More Than We Think An Economic Reality Check

\*Deepak Meena<sup>1</sup>, Abhay Thakur<sup>2</sup>, Akash Motilal Nathjogi<sup>3</sup> and Chirag B. Channe<sup>4</sup>

<sup>1</sup>Ph.D Scholar, Department of Agricultural Economics and Management, Rajasthan College of Agriculture, MPUAT, Udaipur

<sup>2</sup>M.Sc. Scholar, Department of Social Sciences (Agricultural Extension Education), College of Horticulture and Forestry, Neri, Hamirpur, H. P. - Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh

<sup>3</sup>M.Sc. Scholar, Department of Agribusiness Management, College of Agriculture, Pune (MPKV, Rahuri), Maharashtra, India

<sup>4</sup>Ph.D Resarch Scholar, Department of Agricultural Economics, Sam Hinggingbottom University of Agriculture, Technology and Science, Prayagraj, U.P.

\*Corresponding Author's email: [dm196140@gmail.com](mailto:dm196140@gmail.com)

Climate change is no longer a distant scientific prediction it is a daily economic reality for farmers. Rising temperatures, erratic rainfall, prolonged droughts, unexpected floods, and increasing pest attacks are not only affecting crop production but also significantly increasing the cost of farming. Traditionally, agriculture has always depended on climate, but the rapid and unpredictable changes in recent decades have made farming riskier and more expensive than ever before. Farmers now face a double burden: higher production costs and lower or uncertain returns. These financial stresses are pushing many small and marginal farmers into debt, threatening their livelihoods and food security. Climate change is not just an environmental crisis it is an economic crisis for agriculture.



## Understanding Climate Change and Agriculture

Climate change refers to long-term changes in temperature, rainfall, and weather patterns caused mainly by greenhouse gas emissions. Agriculture is one of the most climate-sensitive sectors.

Major climatic changes affecting farmers include:

- Rising temperature
- Irregular rainfall
- Drought
- Floods
- Heat waves
- Cyclones and storms
- Increased pest and disease incidence

Each of these changes has direct and indirect economic impacts.

### Rising Temperatures: Increasing Production Costs

Higher temperatures increase farming costs in several ways:

#### Increased Irrigation Requirement

Hotter conditions increase evaporation and plant water demand.

Economic impact:

- More irrigation required
- Increased electricity and diesel costs
- Higher investment in irrigation infrastructure

Example: Wheat and rice require more frequent irrigation during heat stress.

#### Reduced Crop Yield

Heat stress damages:

- Flowering
- Pollination
- Fruit development

Economic result:

- Reduced production
- Lower income

#### Increased Fertilizer Requirement

High temperature reduces nutrient efficiency. Farmers must apply more fertilizer, increasing costs.

### Erratic Rainfall: The Biggest Financial Risk

Rainfall has become highly unpredictable due to climate change, creating serious challenges for farmers. Irregular precipitation patterns often result in prolonged droughts, which reduce soil moisture, limit crop growth, and lower yields. At the same time, sudden heavy rainfall can cause floods that damage standing crops, erode fertile soil, and destroy farm infrastructure. In addition, delayed onset of the monsoon disrupts sowing schedules, shortens the effective growing season, and affects crop productivity and quality. These uncertainties increase production risks, raise cultivation costs, and threaten the livelihoods and income stability of farming communities.

Economic impacts include:

#### Crop Failure

- Drought often leads to complete crop failure, leaving farmers with zero income from their fields. In such situations, farmers not only lose their expected earnings but also suffer financial losses from the money already invested in cultivation, including the cost of seeds, fertilizers, and labor. This increases their economic burden and makes farming more risky and unsustainable.

#### Re-sowing Cost

- If crops fail due to delayed rainfall, farmers are forced to re-sow their fields, which means buying seeds again and paying for labor a second time. This results in double expenditure

without any guaranteed return, increasing financial stress and reducing farmers' overall profitability.

### Flood Damage

- Floods cause severe damage by destroying standing crops, washing away fertile topsoil, and damaging farm infrastructure such as irrigation systems, machinery, and field boundaries. As a result, farmers must make additional investments to restore soil health, repair infrastructure, and restart cultivation, which increases their financial burden and delays recovery.



### Pest and Disease Increase: Hidden Economic Burden

Climate change creates favorable conditions for the rapid growth and spread of insect pests and diseases, increasing the economic burden on farmers. As pest incidence rises, farmers are forced to use pesticides more frequently, which raises pesticide costs and increases labor requirements for spraying and monitoring. This leads to higher production costs and lower profit. Fruit crops such as mango, citrus, and apple are particularly vulnerable, as pest attacks reduce yield, damage quality, and decrease market value.



### Increased Cost of Irrigation

Water scarcity is increasing, forcing farmers to invest in alternative irrigation sources such as borewells, drip irrigation systems, and water pumps. These technologies require high initial investment as well as regular maintenance costs. In addition, the rising prices of electricity and diesel needed to operate these systems further increase the cost of cultivation, putting additional financial pressure on farmers.

### Labor Cost Increase

Climate change indirectly increases labor costs.

Reasons:

- Re-sowing
- Pest control
- Irrigation management
- Soil conservation

Heat waves also reduce labor productivity.

### Soil Degradation: Long-Term Economic Loss

Climate change contributes to soil erosion, nutrient depletion, and a decline in overall soil fertility, which negatively affects crop growth and productivity. To restore soil health and maintain yields, farmers are forced to spend more on fertilizers, organic manure, and soil conditioners. This increases cultivation costs and reduces their net income.

### Impact on Fruit Crops: Higher Economic Risk

Fruit crops are highly sensitive to climate change, and crops such as mango, apple, citrus, and banana are particularly vulnerable. Adverse climatic conditions lead to reduced fruit size, poor quality, excessive flower and fruit drop, and overall lower yields. These effects directly reduce the market value of the produce, resulting in significant economic losses for farmers.

### Increased Risk and Farmer Debt

Climate change increases financial risk in agriculture, as farmers often take loans and invest heavily in crop production with the expectation of good returns. However, when crops fail due to drought, floods, or other climate-related stresses, farmers are unable to recover their investment and repay their loans. This pushes them into debt and creates a serious economic crisis, affecting their livelihood and financial stability.

**TABLE 1: Economic Impact of Climate Change on Farming Costs**

Climate Change Factor	Impact on Farming	Economic Effect
Rising temperature	Increased irrigation	Higher electricity and diesel cost
Drought	Crop failure	Total income loss
Flood	Crop damage	Re-investment required
Pest increase	More pesticide use	Increased input cost
Soil degradation	Reduced fertility	Higher fertilizer cost
Erratic rainfall	Re-sowing	Double seed and labor cost
Water scarcity	Irrigation investment	High capital cost
Heat waves	Reduced productivity	Lower yield and income

**TABLE 2: Climate Change Impact on Farmer Income and Profit**

Factor	Before Climate Change	After Climate Change
Yield	High	Reduced
Irrigation cost	Low	High
Fertilizer cost	Moderate	High
Pest control cost	Low	High
Risk level	Low	High
Profit	Higher	Reduced
Debt risk	Low	High
Income stability	Stable	Unstable

### Economic Impact on Small and Marginal Farmers

Small farmers suffer the most.

Reasons:

- Limited resources
- No irrigation
- No insurance
- Limited savings

Climate change increases their vulnerability.

### **National Economic Impact**

Climate change affects food production, food prices, and the overall national economy. When climate-related stresses such as drought, floods, and heat waves reduce agricultural production, the supply of food declines. This reduced availability leads to an increase in food prices, affecting consumers and increasing economic pressure at both household and national levels.

### **Hidden Costs Often Ignored**

Climate change also causes indirect costs:

- Health cost due to heat stress
- Migration cost
- Loss of traditional crops

These hidden costs are significant.

### **Psychological and Social Impact**

Financial stress leads to:

- Mental stress
- Migration
- Farmer distress

This is an indirect economic cost.

### **Future Economic Risk**

Climate change is expected to increase.

Future risks include:

- More crop loss
- Higher farming cost
- Increased farmer poverty

### **Solutions to Reduce Economic Loss**

Farmers can reduce losses by adopting:

Climate Smart Agriculture includes efficient irrigation and improved varieties, while crop insurance provides financial protection to farmers against climate-related losses. Government support through subsidies and policies and diversification by growing multiple crops help reduce risk and improve income stability.

### **Conclusion**

Climate change is silently increasing the economic burden on farmers. It is not only reducing crop yield but also increasing farming costs, making agriculture less profitable and more risky. Small farmers are the most affected, and without proper adaptation and support, farming may become economically unsustainable. Climate change is not just an environmental problem it is an economic crisis affecting farmers' survival. Immediate action is necessary to protect farmers and ensure food security.