

## Strengthening Agricultural Sustainability Through Climate Resilience

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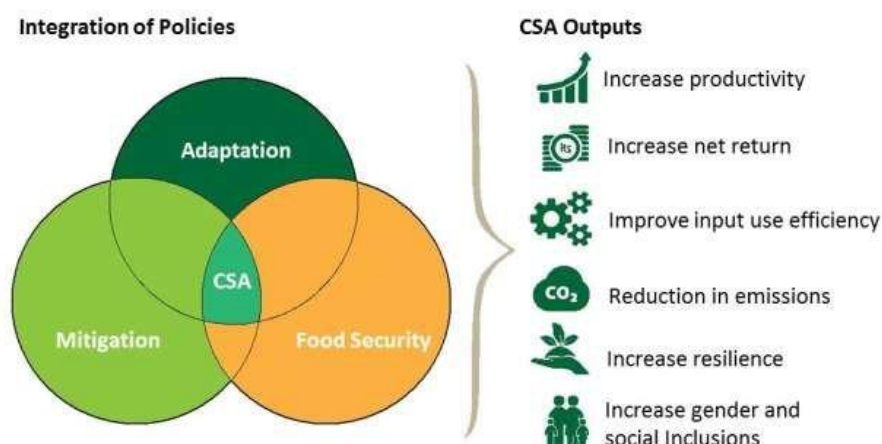
### Introduction

Climate change is significantly impacting the lives of farmers, causing upheaval in their traditional practices. Unforeseeable weather patterns, abbreviated growing seasons, droughts, extreme temperatures, and heightened exposure to pests and crop diseases present formidable challenges to smallholder farmers globally, particularly in tropical regions where communities heavily depend on natural resources. Both population growth and changing dietary habits are driving an increased demand for food. Traditional farming practices are becoming less productive due to climate change, prompting farmers to reassess their methods. Adopting climate-smart agriculture techniques can assist farmers in adapting to and mitigating these impacts, thereby safeguarding and potentially enhancing their livelihoods. Smallholder farmers currently play a vital role, supplying over 80 percent of the food consumed in significant areas of the developing world, notably in South Asia and sub-Saharan Africa.

### Understanding Climate Resilient Agriculture Essentials

Climate Resilient Agriculture (or) Climate-Smart Agriculture is not a separate concept from sustainable agriculture; instead, it involves integrating diverse sustainable methods to address the specific climate challenges of a particular farming community. The initial step is to evaluate the specific climate risks faced by a farm, as strategies will differ for a farm dealing with extended water shortages compared to one experiencing frequent flooding. We utilize various tools to assess the climate risk and vulnerability of an area, considering local ecosystems and specific crops. The key is to identify the optimal combination of strategies to manage a farm's unique climate challenges and enhance resilience against future impacts, which defines the intelligence of climate-smart agriculture.

## Three Pillars of Climate Resilient Agriculture and Their Outturns



Martin Noponen, Director of Environment at Rainforest Alliance, highlights that in areas facing drought and prolonged dry seasons, a climate-smart strategy could prioritize planting cover crops or using mulch to enhance soil structure, water infiltration, retention, and overall fertility. Conversely, in regions prone to heavy rain and flooding, a climate-smart approach might emphasize trenching, cover cropping, and managing surface water runoff through methods like vegetation barriers.

### Climate Resilient Agriculture Practices

Climatically smart agriculture incorporates practices like boosting soil carbon absorption and reducing greenhouse gas emissions to mitigate climate change's detrimental effects and boost agricultural production and profitability. CSA practices are very similar to precision agriculture in their focus on understanding the elements that influence crop output, soil health, air pollution, and other farming outcomes. We'll move on to the fundamental practices of climate smart agriculture next

### Crop Management

Climate resilient agriculture practices such as selectively breeding crop varieties that are better adapted to local environmental conditions. These climate-resilient varieties are designed to exhibit improved yield stability and reduced susceptibility to climatic hazards like drought, heat stress, or excessive rainfall. By cultivating crops that can thrive under changing climate conditions, farmers can enhance food security and sustainability in agriculture. This approach supports the long-term resilience of farming systems amid ongoing climate challenges



Implementing climate-smart techniques such as no-till and reduced-tillage cultivation, drought tolerant seed varieties, flood tolerant varieties, short duration crops, legume intercropping, planting date adjustment, utilizing crop residues and cover crops to maintain permanent soil cover, and practicing crop rotation to safeguard soil quality. These methods aim to enhance soil health, reduce erosion, and improve water absorption and land drainage, thereby enhancing agricultural resilience to climate change.

### **Soil management**

Heavy rainfall poses risks of soil erosion, particularly on sloping terrain where fertile topsoil can be washed away. Planting ground cover serves a dual purpose by preventing soil erosion during heavy rains and aiding moisture retention in drought-prone regions. In flood-prone areas, farmers can implement drainage systems and trenches to prevent nutrient-rich topsoil from washing away and to manage excess water effectively. Planting on contours, such as hills or natural terraces, is another effective method to reduce soil erosion.

Additionally, mulching with organic crop residues contributes to soil health and structure. Healthy soils act as carbon sinks by sequestering carbon dioxide, thus playing a vital role in combating climate change.

### **Nutrient Management**

Climatically smart nutrient management involves practices like organic fertilizer application, precision fertilizing, and crop rotation to enhance soil fertility and reduce nutrient runoff and greenhouse gas emissions from synthetic fertilizers. Implementing these strategies promotes efficient nutrient use and minimizes waste. By applying fertilizer at variable rates based on this requirement, farmers can achieve cost savings and promote soil conservation.

### **Pest and Disease Management**

Global warming can lead to the proliferation of pests and diseases, posing significant threats to agricultural yields and even causing the destruction of entire farms. Changing climate, traditional methods of pest and disease management often prove ineffective; some farmers, in desperation, may resort to increased pesticide use, which can escalate costs, harm beneficial insects, and pose risks of contaminating people and the environment.

Climate resilient agriculture training equips farmers with knowledge to effectively combat newly emerging pests by using the right amounts of pesticides at the appropriate time. Investing in pest-resistant seedlings is also beneficial. Regarding weed management, we

encourage farmers across all climate conditions to prioritize manual weeding, targeting harmful weeds while preserving beneficial ones that contribute to soil health and prevent erosion of nutrient-rich topsoil.

### Water management

Irrigation efficiency, micro irrigation technologies, conjunctive use of surface and ground water, desalinization and water reuse, development of formal and informal water markets, rain water harvesting, less water intensive crops, revival of watersheds and village ponds. Agriculture currently utilizes 70 percent of the world's available freshwater, and with continued global warming, water shortages already prevalent in many regions will become increasingly severe. Rainwater harvesting is a proactive approach for farms to mitigate water scarcity. Communities can construct ponds lined with bamboo to enhance water retention. On individual farms, rainwater can be collected using simple methods like placing barrels outdoors or more complex systems involving gutters and pipes to channel rain from roofs into storage containers.



Implementing drainage systems and trenches can effectively manage excess water, safeguard crops from water-related diseases, and mitigate the impacts of fluctuating moisture levels on agricultural lands.

### Livestock Management

Agroforestry, Crop livestock integrated farming, crop diversification, rice- fish farming, reclamation of cultivable wasteland, migration. The three key principles of sustainable livestock management: 1. Enhanced nutrition, 2. Reduced waste, and 3. Efficient grazing. Implementing climate-smart agricultural practices such as rotational grazing, specialized feed



formulations, and effective manure management can assist ranchers in reducing methane emissions while enhancing livestock productivity.



Monitoring vegetation cover across multiple pastures is essential for effective pasture management under climate-smart principles. Grazing systems often involve moving livestock between pastures, necessitating the maintenance of healthy vegetation.

### **Information and Counseling on Climate-Related Issues**

Community based informal associations, village level seed banks to combat seed shortages, Farmers require accurate and timely meteorological and climatic information for informed decision-making. By accessing weather forecasts, climate projections, and advisory services, farmers can enhance agricultural practices, anticipate climate-related risks, and enhance resilience. To adjust to climate change, farmers need to combine traditional practices with innovations. Precision agriculture technologies can support farmers and large agri-tech companies in effectively implementing climate-smart agricultural techniques.

### **Conclusion**

Climate-resilient agriculture is no longer a choice but a necessity in the face of increasing climate variability and environmental challenges. By integrating sustainable practices such as crop diversification, water management, soil conservation, and innovative technologies, farmers can not only adapt to changing climatic conditions but also improve productivity and reduce environmental impacts. This approach strengthens the resilience of agricultural systems, safeguarding food security and rural livelihoods.

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