Chapter 13
Harnessing AI and GIS Technologies for Climate-Resilient Agriculture and Environmental Sustainability

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ABSTRACT

Climate change poses a significant threat to global food security and environmental sustainability. Traditional agricultural practices often struggle to adapt to increasing

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weather variability and extreme events. This chapter explores the potential of AI and GIS technologies to build climate-resilient agriculture and promote environmental sustainability. AI algorithms can analyze vast datasets, including weather patterns, soil characteristics, and crop productivity data, to identify vulnerabilities and recommend strategies for farmers to adapt to changing conditions. Some applications that can help improve agricultural production are mapping climate risk, predicting drought, and finding the best places to put different crops. The chapter explores the context-specific solutions that combine technological innovation with traditional practices, fostering collaboration among farmers, researchers, developers, and business leaders to optimize resource use, enhance crop yields, and mitigate environmental impacts despite challenges like data availability and equitable access.

1. INTRODUCTION

Climate change poses a significant and immediate threat to agriculture, with escalating global temperatures, shifting precipitation patterns, and an increased frequency of extreme weather events already having profound impacts on agricultural productivity and sustainability (Syed et al., 2022). This introduction delves into the intricate relationship between climate change and agriculture, highlighting the complex interplay of factors such as temperature rise, altered rainfall patterns, and extreme weather events that disrupt farming practices. The pressing need for adaptive strategies and innovative technologies is underscored to ensure the resilience and sustainability of agricultural systems. The following image encapsulates these challenges and showcases the integration of modern technologies like AI, GIS, and IoT in mitigating the adverse effects of climate change on agriculture. Figure 1 shows an illustration depicting the multifaceted impacts of climate change on agriculture: drought-stricken areas with cracked soil, flood-damaged fields, and healthy crops supported by advanced technologies like drones, IoT sensors, and AI-driven decision support systems.