



**Ferdowsi University Mashhad/ The second International Conference
Artificial Intelligence: Between Scientific Innovation and Human Responsibility**

**Using Deep Learning to Monitor and Predict Desertification and Land Degradation
Risks: A Research Review**

MM Shaimaa Khairy Zayer ^{1*}, M.D. Hanan Ahmed Abdel Karim ²

Department of Geography, College of Education for Women, University of Basra, Iraq

* Corresponding Author: MM Shaimaa Khairy Zayer

Article Info

ISSN (Online): 2582-7138

Impact Factor (RSIF): 7.98

Volume: 06

Issue: 06

November - December 2025

Received: 23-09-2025

Accepted: 25-10-2025

Published: 21-11-2025

Page No: 85-93

Abstract

Desertification and land degradation represent a global environmental, social, and economic challenge, affecting food security, biodiversity, and the livelihoods of millions. Effective management of these risks requires advanced tools for monitoring and prediction. In recent decades, deep learning—a branch of artificial intelligence—has emerged as a transformative tool in Earth sciences, offering unprecedented capabilities for analyzing complex spatiotemporal data.

This review paper critically examines the recent academic literature on the applications of deep learning models in monitoring and predicting the risks of desertification and land degradation. Published studies were analyzed to evaluate the methodologies employed, the data sources used (particularly multispectral satellite imagery), and the most prominent deep learning architectures applied, such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Generative Adversarial Networks (GANs).

The results show that deep learning achieves high accuracy in land cover classification, monitoring vegetation health through indicators such as NDVI, estimating soil moisture, and predicting drought as a primary driver of desertification. The paper also discusses emerging trends, including hybrid models and explainable artificial intelligence (XAI), which aims to open the "black box" of complex models, thereby enhancing trust in their outputs and supporting decision-making processes.

Nevertheless, significant challenges remain, particularly related to data quality, model transferability across different regions, and the need to integrate socio-economic factors. The study concludes that deep learning provides a powerful and evolving framework, but realizing its full potential requires multidisciplinary collaboration and systematic addressing of existing research gaps to ensure the development of sustainable and globally scalable solutions.