Creating a Circular Machine Learning Based Platform for Sustainable Agriculture, Climate Change Mitigation, and Plastic Waste Reduction

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Greenhouse gas emissions continue to accelerate global warming, contributing to plastic pollution, microplastics contamination, and food insecurity. This research investigates integrated carbon mitigation strategies through experimental validation and machine learning–based smart agriculture platform. Initial experiments quantified the greenhouse effect by comparing temperature variations in enclosed containers containing air vs carbon–rich environments. Kelp seaweed resulted in reduction of the heating effect thereby demonstrating its capacity for carbon sequestration and climate regulation. These findings led to an innovation that is referred to as "Smart Carbon Recycling", which maps carbon journey from the atmosphere to sea to soil. To optimize agricultural implementation, EARTH-ai, a Python-based machine-learning model, was developed to predict optimal plant selection based on soil and environmental parameters. In parallel, an organic kelp-seaweed fertilizer, KelpNutriBoost, was formulated and evaluated, demonstrating improvements in soil health, crop yield, nutritional content, at much lower cost compared to conventional fertilizers. Further investigation incorporated biochar as soil additive to enhance nutrient retention and long-term carbon sequestration. Collectively, this integrated approach demonstrates a closed-loop strategy for plastic waste management and sustainable agriculture. It also improves food security and reverses the declining trend of food nutritional quality. This multidisciplinary approach emphasizes scalability, economic feasibility, and real-world implementation, offering a model for future climate innovation that integrates chemistry, biology, and data science based solutions.

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