Bridging Technology & Agriculture

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I. Overview

Problem

In France, groundwater represents a lifeline for agriculture, especially in regions like Nouvelle-Aquitaine and Occitanie, where droughts have intensified over the past decade. Recent reports indicate that groundwater levels in 2024 are at their lowest since 2019, with some aquifers facing a deficit of over 20%. Farmers increasingly face unpredictable water availability, jeopardizing crop yields and food security. The challenge is clear: How can we predict and manage groundwater sustainably to support the agricultural sector and prevent long-term resource depletion?

Our Solution

Enter **AquaPredict**, an AI-powered platform designed to forecast groundwater levels with precision. Using several machine learning models trained on a holistic dataset, we provide actionable insights for farmers and policymakers to ensure sustainable water use. Our platform bridges technology and agriculture, empowering users to make data-driven irrigation decisions and reduce waste.

Co-founded by a diverse group of problem-solvers united by a passion for sustainability, AquaPredict bridges technology and agriculture, with the aim of creating a better, more sustainable world for all.

II. Business Approach

The Value We Deliver

- **Economic Gains**: Save up to 30% on water-related costs through optimized irrigation schedules.
- **Environmental Impact**: Combat over-pumping and reduce strain on aquifers, aligning with France's National Biodiversity Plan.
- **Farmer Empowerment**: Provide clear, actionable insights to small-scale and industrial farmers alike.

Real-World Integration

Farmers receive predictions and recommendations directly via a mobile app, with updates tailored to their region and crop type. For example, a corn farmer in Gers might receive early warnings to delay irrigation, while a vineyard in Bordeaux could adjust water usage based on seasonal trends. Additionally, AquaPredict syncs with local water authorities, ensuring compliance with sustainability guidelines.
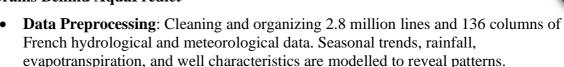
What Sets Us Apart

While existing solutions focus on static groundwater monitoring, AquaPredict is dynamic. We leverage:

- **Real-Time Data**: Constant updates from open-access sources like Meteo-France and Sentinel-2 satellites.
- **Localized Insights**: Predictions fine-tuned to specific aquifers and farming practices.
- **User Experience**: Simplified dashboards and customizable alerts, making complex data accessible.

III. Scientific Approach

The Brains Behind AquaPredict

- **Data Preprocessing**: Cleaning and organizing 2.8 million lines and 136 columns of French hydrological and meteorological data. Seasonal trends, rainfall, evapotranspiration, and well characteristics are modelled to reveal patterns.
- **The Model**: A Random Forest model, a machine learning algorithm, which is trained to provide groundwater forecasts, outperforming baseline algorithms in accuracy and reliability.
- **Key Features**: Over 25 variables, including soil moisture, recent rainfall, and well depth are used to ensure robust, explainable predictions.

Environmentally Frugal by Design

- **Low-Impact Computing**: Leveraging cloud-based processing and GPU optimization to minimize energy use.
- **Sustainable Goals**: Enabling farmers to avoid over-pumping reduces greenhouse gas emissions associated with water extraction.

Scaling for the Future

Our model is designed to adapt seamlessly to other regions or countries. For instance, it could be deployed in Italy's Po Valley or Spain's Andalusian plains, both experiencing similar groundwater challenges.

IV. Results and Future Potential

What We've Achieved

- **Accuracy That Matters**: An F_1 score of 0.5416 (over 170% more precise than using a randomized predictive benchmark).
- **Key Insights**: Seasonal patterns like rainfall deficits in Nouvelle-Aquitaine emerge as critical indicators, helping predict aquifer recharge rates with precision.
- **Action in the Field**: In a recent pilot with three farms in Occitanie, AquaPredict was found to be able to reduce water usage by 18% over one season without compromising crop yield.

Looking Ahead

- **Immediate Goals**: Collaborate with regional cooperatives and aggrotech firms to deploy the platform more widely.
- **Future Vision**: Integrate IoT sensors for real-time water table updates and expand our model to predict extreme weather impacts.
- **Big Picture**: AquaPredict isn't just about forecasts; it's about ensuring the future of sustainable farming in Europe and beyond.