

Chapter 14

Groundwater Contamination Forecasting Using Automated Machine Learning

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ABSTRACT

Because of the subsurface's inherent geologic unpredictability, it is difficult to forecast the fate and transit of groundwater contaminants. To solve the equation for advection, dispersion, and reactivity, forecasting the flow of pollutants has been done using simplified geology and accepted assumptions. It may soon be possible to use extensive groundwater quality data from long-term polluted sites to feed machine learning algorithms that predict the spread of pollution plumes and enhance site management. The objective of this study was to first utilise extensive historical data from groundwater monitoring well samples to better understand the complex relationships between groundwater quality parameters, and then to construct a useful model for predicting the time until site closure.

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INTRODUCTION

Goal of the United Nations' Sustainable Development Agenda is "By 2030, enhance the purity of water through decreasing pollution, eradicating dumping, and limiting release of dangerous substances and chemicals, halving the amount of wastewater that is untreated, and significantly boosting recycling and safe reuse globally." In order for this interdisciplinary objective, it is also important to clean up contaminated water. According to (Gleick, 1993), groundwater accounts for 99 percent of the world's fresh, liquid water supply (Groundwater, 1979). Shallow groundwater, which is used extensively for rural and municipal drinking water, has been contaminated due to industrialisation and the slow control of chemicals. Understanding how precious resource is harmed and how it will be used for good use, whether by human intervention or natural processes, requires the collecting and analysis of modern data. Goal of (EPA) is "to protect human health and the environment," however this goal can't be achieved without first conducting a thorough and open evaluation of groundwater data.

The battle to identify and trace the spread of contaminated plumes in soil and groundwater has advanced greatly since the emergence of contamination hydrology as a distinct field of study. Nonetheless, it is challenging to have a precise understanding due to the subsurface's inherent unpredictability. While the (ADR) equation has been around since the 1970s and offers a theoretical basis for contaminant transport, the underlying mechanisms are often obscured by complexity (Groundwater, 1979). This complicates both the study of subterranean pollution and the identification of groundwater plumes. With varying degrees of success, tracer experiments have compared model results with ground-truth samples. These problems originate from the irrational assumptions included in the governing equation.

The mechanisms that regulate the decomposition of contaminants have made strides in the lab and in the field, but it remains difficult to generalize results to specific sites because of the many site-specific elements that impact these processes (Elder, 2002). However, models built on empirical data may provide ground-breaking opportunities for improving our understanding of pollutant fate and transit at specific places as the quantity of data collected from contaminated areas grows. Emerging contaminants might possibly influence the regulatory goals at multi-contaminant sites or have an impact on previously unregulated regions. To identify the underlying structure and forecast the movement and fate of pollutants, new techniques must be developed.

At a large site in New Jersey, for instance, PMF was utilized to pinpoint attenuated plume components (Capozzi, 2018). Attenuation of 1,4-dioxane was shown using linear discriminant analyses on data from the California public database Geotracker

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