# Chapter 3
# Flood Risk Assement Using AHP, Frequency Ratio, Logistic Regression, and Random Forest in Naraipur Municipality

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## ABSTRACT

*Floods, a natural hazard characterized by the overflow of water from its normal riverbed onto dry land, are a recurrent problem. The study area we choose is Narainapur Municipality. This study aims to develop a detailed flood risk assessment*

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*using the Analytic Hierarchy Process, Frequency Ratio, Logistic Regression,and Random Forest models. A flood inventory map was created, with 102 flooded and 95 non-flooded points Flood conditioning factors include slope, NDVI, soil type, distance from streams and roads, rainfall, TWI, aspect, and curvature. The Logistic Regression model (AUC = 0.944) achieved the highest AUC value, indicating superior predictive accuracy compared to other models. The Random Forest model (AUC = 0.936) also performed well, followed by the Frequency Ratio model (AUC = 0.855) and the AHP model (AUC = 0.822). These results highlight the effectiveness of machine learning-based models in our study area.The findings of this study provide valuable insights for flood risk management, offering a scientific basis for better planning and decision-making in vulnerable regions.*

## I. INTRODUCTION

Natural disasters triggered by heavy rainfall influence on environment which affects day to day human life inviting various socio-economic consequnces. (Djalante, 2018). Climate change acts as driving factor for flood conditioning factors such as land use patterns, geology, terrain slope, rainfall intensity, elevation, and land cover (Stefanidis and Stathis, 2013; Gacu et al., 2022). This trend points to a future where seasonal floods may become more frequent, larger in scale, and harder to predict. It highlights the urgent need for strong flood risk management strategies, with hazard assessment at the heart of efforts to protect not just ecosystems, but also the communities and economies that depend on them (Liu et al., 2016; Danumah et al., 2016).To effectively identify flood prone areas, physically based models like HEC_RAS and MIKE11 become expensive, suggesting more appropriate statistical methods and Multi-criteria decision analysis (MCDA) techniques like FR, LR and AHP respectively. However, newer machine learning approaches like RF, Artificial Neural Networks (ANN), and Support Vector Machines (SVM), stand to be the present time best alternatives for analysis of complex spatial relationships. 80% of population at considerable risk shows, how vulnerable is Nepal from geographically and climate invited challenges (multiple hazards, including floods, landslides, and earthquake s(Khatakho et al., 2021).Floods are one of the most occurring disasters causing several impacts on human life and livelihoods. The causing source for flood risk susceptibility can be tough topography like mountainous and steep slopes, unpredictable monsoon seasons and variations in rainfall pattern. These conditions create an environment ripe for catastrophic flooding, resulting in tragic annual losses of life and property (Khanal et al., 2007). Nepal should have clear strategies over flood risk causes, effect and control measures by thorough reviews of existing research. Given with the factors contribution for structured decision- making tools

# Modeling Environmental Impacts on Viticultural Ecosystems: A First Case Study in a Regulated Wine Producing Area

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