Commentary
Volume 12:09, 2022

Journal of Civil & Environmental Engineering

ISSN: 2165-784X **Open Access**

Predicting Soil Properties in Riparian Forests Using Machine Learning Models

Azhda Rpoor *

Department of Environmental Health Engineering, Shiraz University of Medical Sciences, Shiraz, Iran

Description

Planning, managing and utilizing soil resources all depend on the spatial variability of soil properties. As a result, the provision of maps of soil physicochemical properties relies heavily on the precise application of various digital soil mapping models. In Iran, soil spatial variability in forest stands is unknown. In the meantime, riparian buffers are crucial for a number of services, including the provision of high water quality, the recycling of nutrients and the buffering of agricultural production. Therefore, in order to evaluate the spatial variability of soil nitrogen, potassium, organic carbon and C, 103 Latin hyper cubic soil samples were taken in the Maroon riparian forest of behbahan and agricultural lands nearby: bulk density, N ratio, pH, calcium carbonate, sand, silt, clay and the estimation of soil properties was compared using a variety of machine learning models, such as artificial neural networks, random forest, cubist regression tree and k-nearest neighbour. In addition, as ancillary data, remote sensing images, a digital elevation model and climate parameters were utilized as the three primary sources of spatial information. According to our findings, the random forest model provides the most accurate estimates of bulk density, soil pH, nitrogen and potassium. Interestingly, the cubist relapse tree demonstrated the best assessment for natural carbon, C: Phosphorus, the N ratio and clay [1].

Additionally, artificial neural networks provided the most accurate estimations for the amounts of sand, silt and calcium carbonate. According to our findings, the spatial mapping of soil physiochemical properties in agricultural lands and riparian forests can benefit greatly from the use of geospatial data like satellite images, climate parameters and terrain parameters. For each soil property, a unique machine learning model must be used to produce highly accurate maps with lower error rates. When processing soil and evaluating ways to improve its condition, the physiochemical properties of the soil serve as convenient features. As a result, it is essential to provide this data on maps as a useful resource for planning and evaluating land use on a local and national scale. As a result, high-resolution soil information maps are in high demand. In addition, soil mapping is a representation of a soil information database that provides access to every spatial change in soil properties. The properties of the soil have a greater impact on plant coverage in the forest ecosystem than any other factor. Consequently, the assessment of soil supplement spatial planning in biological systems is a key device for observing changes in environments because of the work and related expenses of the examining. Additionally, despite having access to the high-resolution satellite, determining the state of the vegetation remains challenging [2,3].

Techniques, geological data frameworks (GIS) and remote detecting (RS) information. In the meantime, the DSM's most important soil factors are color, texture, soil horizons, classification, erosion and drainage. SVM was found to be the best method for predicting SOC stocks in the Afromontane Forest in Eastern Africa. ML models are one of the best ways to analyze point data, predict, interpolate and provide maps. The SVM approach, which was used to predict three soil properties—SOC, clay content and pH—had the smallest RMSE values. Among the various ecosystems, the forest ecosystem's spatial heterogeneity is a result of tree activities through a variety of means, such as root penetration into the soil, litterfall and dead wood. Timberland soil studies are a sign of soil quality and revealed by numerous specialists. Riparian monitoring is necessary because riparian areas are constantly altered by natural and human activities. The riparian buffer is crucial for improving water quality, preventing riverbank side erosion, recycling nutrients, providing fish and wildlife with habitat and increasing carbon stock. Populus euphratica and tamaris are the most common tree species in the riparian forests of arid and semi-arid ecosystems. Concerning the DSM of these ecosystems, little is known. Digital soil mapping in riparian areas is not covered by any data we are aware of. Since riparian backwoods are adversely impacted by human movement, expanding our insight about them would be a fundamental stage toward restabilising their regular potential.Utilizing RS data for riparian zone monitoring by managers remains a challenge for successful management, despite the fact that new methods and software processing have helped us gain a more detailed understanding at a lower cost. Additionally, we are unaware of any data regarding the spatial changes in soil in riparian forests. As a result, DSM can serve as a foundation for applying quantitative and statistical techniques to produce patterns of spatial changes in soil in the riparian forests using fewer laboratory and field experiments. The purpose of this study is to investigate the possibility of using ML techniques to provide DSM for the riparian buffer. In addition, the maps will be tested using K-nearest neighbors (K-NN), Regression Tree Cubist (RTC), Artificial Neural Networks (ANN), Decision Tree Model (DTM), Random Forest (RF) and RF. We hypothesized that maps of the riparian forest's soil physiochemical properties could be made using ML techniques with some degree of precision. In the vicinity of the river, soil particle spatial mapping revealed higher values for sand and higher values for clay in agricultural lands. Take note that plant species have no effect on the texture of the soil. As a result, the digital soil mapping of the riparian zones makes it easy to predict the effects of flood, leaching and soil erosion. The bulk density of soil with a fine texture was lower than that of soil with a coarse texture. The riparian zone displays this. Because of the sandy soil along the river's edge and the presence of the riparian forest there, bulk density was higher in these locations. On the other hand, the soil texture is mostly made up of fine particles in agricultural land near riparian forests and it contains more clay and silt [4,5].

Conclusion

As a result, populous euphratica and tamarix arceuthoides cover sandy-soil riparian forests and agricultural lands. Our prediction maps clearly indicate these pedology phenomena. Along with the riverside, sand had the highest value. However, agricultural land in the eastern part of the study site contained the smallest amount of sand. Clay, like sand, had a particular pattern at the study site. The lowest clay value was found along with the riverside, where riparian forests are present. Additionally, the agricultural lands in the east of the study site had the highest clay content. Along the riverbank where riparian forests are present, the bulk density values reached their highest levels. However, the agricultural lands had the lowest values. This demonstrates the

***Address for Correspondence:** Azhda Rpoor, Department of Environmental Health Engineering, Shiraz University of Medical Sciences, Shiraz, Iran, E-mail: azhdarpoor@ac.ir*

Received: 02 September 2022, Manuscript No. jcde-22-84656; **Editor assigned:** 03 September 2022, PreQC No. P-84656; **Reviewed:** 15 September 2022, QC No. Q-84656; **Revised:** 22 September 2022, Manuscript No. R-84656; **Published:** 29 September 2022, DOI: 10.37421/2165-784X.2022.12.473

detrimental effect of operation tillage on soil bulk density in agricultural lands. Agriculture receives more intensive tillage than riparian forests, which results in soil compaction and clogged pores.

Acknowledgement

None.

Conflict of interest

No potential conflict of interest was reported by the authors.

References

1. Kadlec, Petr, Bogdan Gabrys and Sibylle Strandt. "Data-driven soft sensors in the process industry." *Comput Chem Eng* 33 (2009): 795-814.
2. Teixeira, Bruno OS and Luis A. Aguirre. "Using uncertain prior knowledge to improve identified nonlinear dynamic models." *J Process Control* 21 (2011): 82-91.
3. Leontaritis, I. J. and Stephen A. Billings. "Input-output parametric models for non-linear systems part I: deterministic non-linear systems." *Int J Control* 41 (1985): 303-328.
4. Barbosa, Bruno HG, Luis A. Aguirre, Carlos B. Martinez and Antônio P. Braga. "Black and gray-box identification of a hydraulic pumping system. *IEEE Trans Control Syst Technol* 19 (2010): 398-406.
5. Chen, Sheng, Stephen A. Billings and Wan Luo. "Orthogonal least squares methods and their application to non-linear system identification." *Int J Control* 50 (1989): 1873-1896.

How to cite this article: Rpoor, Azhda. “Predicting Soil Properties in Riparian Forests Using Machine Learning Models.” J Civil Environ Eng 12 (2022): 473.