# A MaxEnt based habitat suitability analysis of Panthera tigris tigris in a protected area landscape

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January 2, 2023

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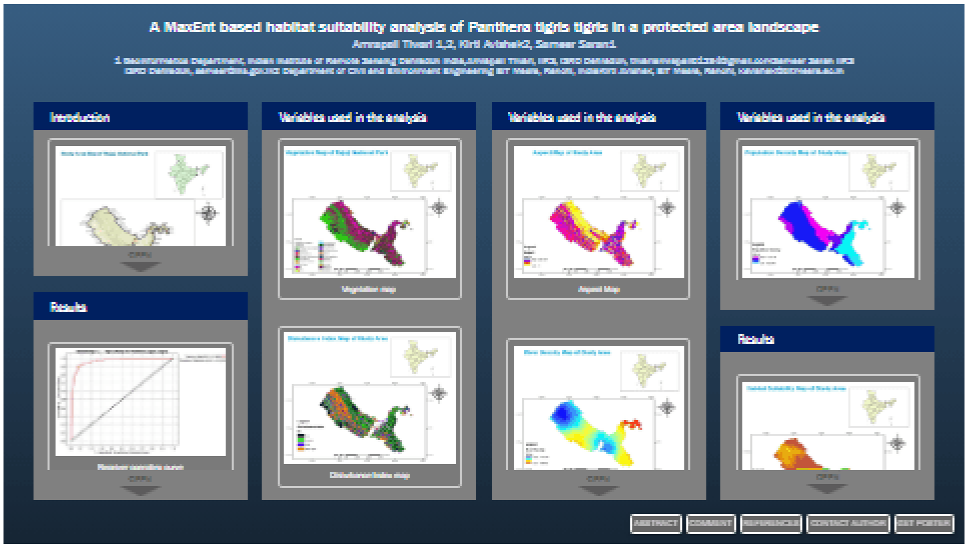


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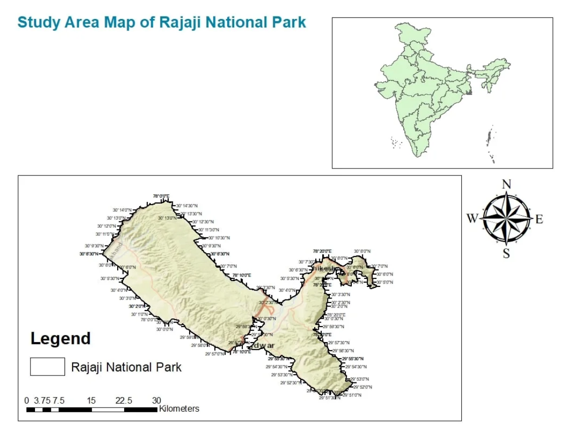
# INTRODUCTION




Study area map of Rajaji National park

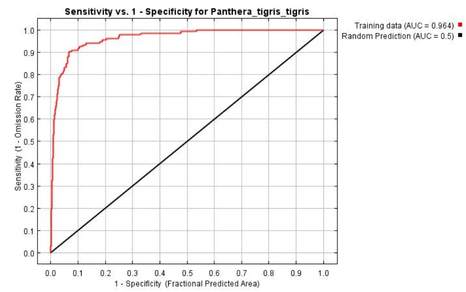
Habitat suitability analysis of *Panthera tigris tigris* in Rajaji National Park was executed using Maximum Entropy approach.

Habitat

Significant anthropogenic and topographical variables were used for the analysis.

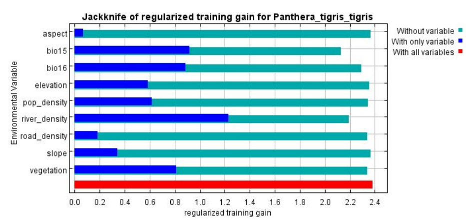
Occurrence points were obtained from camera trap data of WII. The data was downloaded from the GBIF portal.

# RESULTS




Receiver operating curve

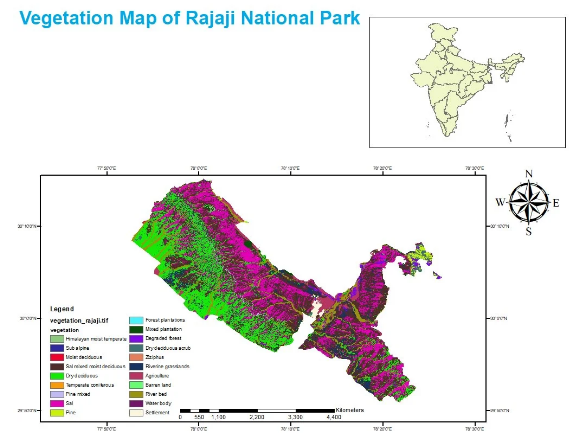
AUC = 0.95 shows high accuracy of the model



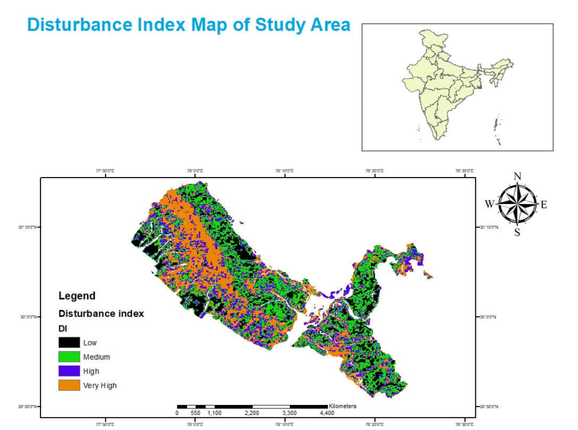

Jackknife analysis of

In Jackknife analysis firstly the model is run with only one variable, then without the variable and lastly with all the variables. It shows the importance of variables in the analysis. Here the results shows that river density contributes most in prediction of habitat suitability of tigers in landscape.

# VARIABLES USED IN THE ANALYSIS

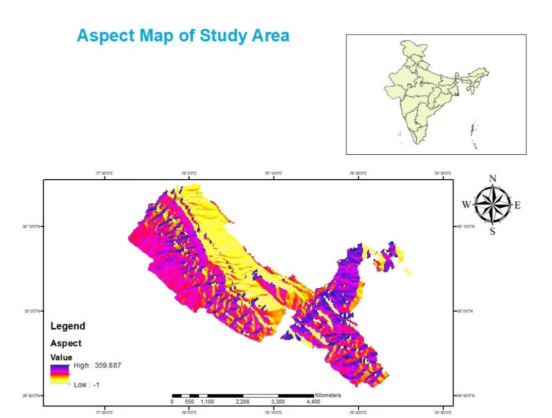



Vegetation map

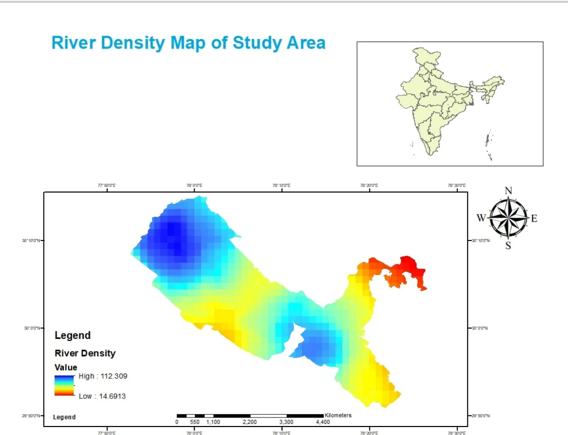



Disturbance Index map

# VARIABLES USED IN THE ANALYSIS

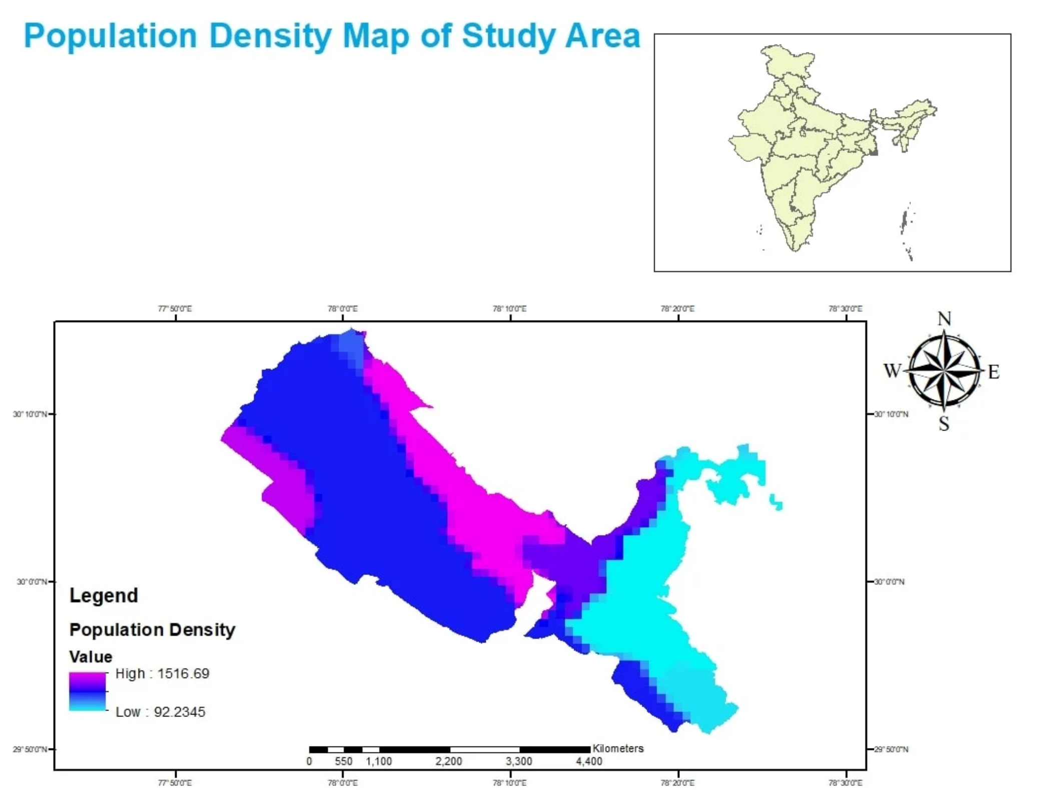



Aspect Map

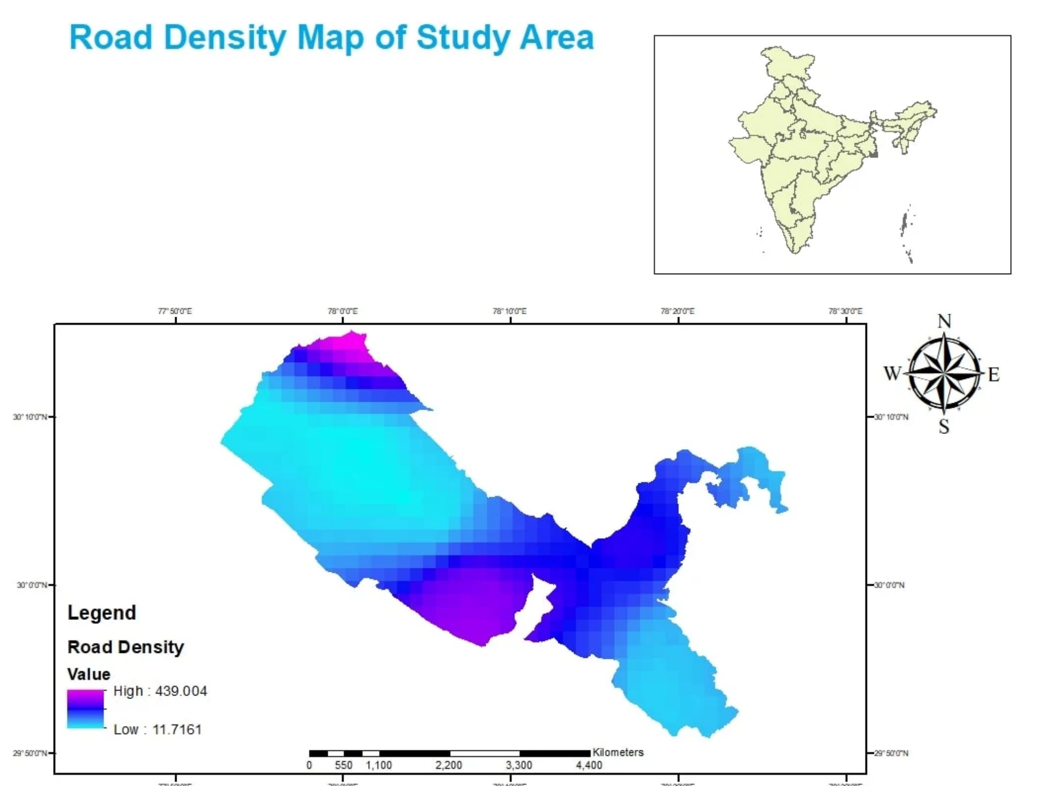



River density Map

VARIABLES USED IN THE ANALYSIS

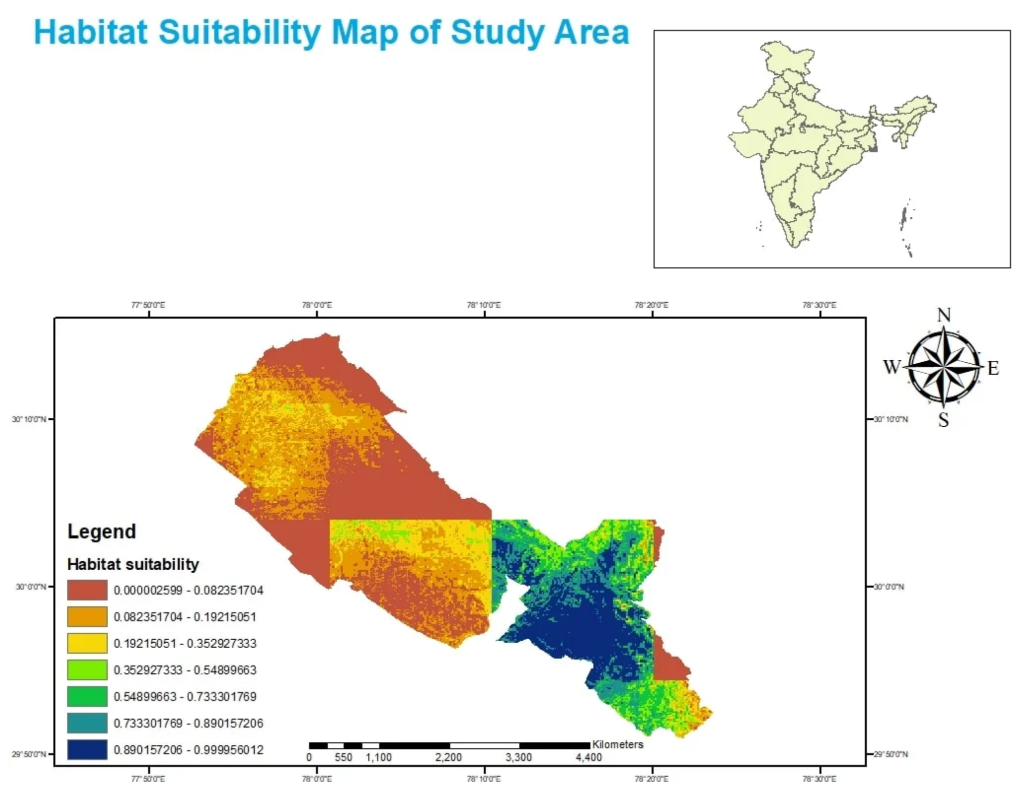



Population Density Map




Road Density Map

# RESULTS




Habitat suitability of panthera tigris tigris in Rajaji National Park

Results show that highest distribution is predicted in the area with high concentration of sal and mixed sal vegetation, river density and low disturbance index.

One of the limitations of the Machine learning approach is that the result is highly dependent on field points taken. As seen in this result high probability of distribution is predicted at regions where the highest density of occurrence points was noted.

Results of this study can be used in behavioural ecological studies , connectivity analysis and for overall conservation etc.

# ABSTRACT

Conservation of top carnivores like tigers are crucial for maintaining ecosystem integrity and evading cases of trophic cascade in a forest ecosystem. Around 70 % of Bengal tiger (*Panthera tigris tigris*) population is found in India and they are listed under the endangered category of IUCN redlist of threatened species. In this study, a habitat suitability analysis of tigers located in Rajaji National Park situated in Uttarakhand state of India is carried out. MaxEnt-A machine learning based model which uses a maximum entropy approach to define the distribution of species in a landscape is used in the study. Criteria such as vegetation type, fragmentation, disturbance index and biological richness along with anthropogenic (transportation, settlement) and topographical variables (elevation, ruggedness, slope and aspect) derived from satellite datasets were used in the estimation. Moreover, to make the study more realistic prey distribution was also taken into account. Presence data for the model were downloaded from GBIF. 70% of the data were used to calibrate the model and rest 30 % was used in validation of the results. Based on these criteria habitat suitability map of the study area was generated and further classified as highly suitable, moderately suitable, least suitable and not suitable for tigers. Furthermore, percentage contribution of variables and jackknife analysis for relative importance of variables was also carried out. The results indicated that the prey abundance highly contribute towards the habitat suitability of tigers in the region.

# REFERENCES

1. Adriaensen, F., Chardon, J. P., De Blust, G., Swinnen, E., Villalba, S., Gulinck, H., & Matthysen, E. (2003). The application of ‘least-cost’ modeling as a functional landscape model. Landscape and urban planning, 64(4), 233-247.
2. Ayad, Y. M. (2005). Remote sensing and GIS in modeling visual landscape change: a case study of the northwestern arid coast of Egypt. Landscape and Urban Planning, 73(4), 307-325.
3. Balaji, G., & Sharma, G. (2022). Forest cover in India: A victim of technicalities. Ecological Economics, 193, 107306.
4. Barnes, J. A., & Harary, F. (1983). Graph theory in network analysis. Social networks, 5(2), 235-244.
5. Bastille-Rousseau, G., & Wittemyer, G. (2021). Characterizing the landscape of movement to identify critical wildlife habitat and corridors. Conservation Biology, 35(1), 346-359.
6. Biewener, A. A., Bomphrey, R. J., Daley, M. A., & Ijspeert, A. J. (2022). Stability and manoeuvrability in animal movement: lessons from biology, modelling and robotics. Proceedings of the Royal Society B, 289(1967), 20212492
7. Castillo MG, Jaime Hernández H, Estades CF. Effect of connectivity and habitat availability on the occurrence of the Chestnutthroated Huet-Huet (Pteroptochos castaneus, Rhinocryptidae) in fragmented landscapes of central Chile. Landsc Ecol. 2018;33: 1061–8.
8. Chetkiewicz, C. L. B., & Boyce, M. S. (2009). Use of resource selection functions to identify conservation corridors. Journal of Applied Ecology, 1036-1047.
9. CK, S. (2019, September). Automated Wildlife Monitoring Using Deep Learning. In proceedings of the International Conference on Systems, Energy & Environment (ICSEE).
10. Clements, S. J., Ballard, B. M., Eccles, G. R., Sinnott, E. A., & Weegman, M. D. (2022). Trade-offs in performance of six lightweight automated tracking devices for birds. Journal of Field Ornithology.
11. Compton, B. W., McGarigal, K., Cushman, S. A., & Gamble, L. R. (2007). A resistant-kernel model of connectivity for amphibians that breed in vernal pools. Conservation Biology, 21(3), 788-799.
12. Crooks, A. T., & Heppenstall, A. J. (2012). Introduction to agent-based modelling. In Agent-based models



of geographical systems (pp. 85-105). Springer, Dordrecht.
13. Crowley, M. A., & Cardille, J. A. (2020). Remote Sensing’s Recent and Future Contributions to Landscape Ecology. Current Landscape Ecology Reports, 5, 45-57.