# FELIDS LIVING ON THE EDGE:
Assessing Risk Factors to Iberian Lynx (*Lynx pardinus*) in Spain

INTRODUCTION

The Iberian lynx (*Lynx pardinus*) is one of the four extant lynx species and one of the two carnivore species endemic to Europe. In the 1950s, the northern population extended from the Mediterranean to Galicia and northern Portugal, and the southern population covered central to south Spain.

Over the years, the lynx's range has diminished to small scattered areas throughout south Spain and Portugal. This has resulted in extremely isolated populations that are low in numbers. Between 1960 and 1990, the Iberian lynx lost around 80% of their range. In the early 2000s, the population dropped to 100 adult individuals, with only 25 breeding females (Araujo, 2024). The cause of large population depletion among the species is due to human encroachment and activity. Specifically, their threats are decreasing prey availability (declining European rabbit populations due to rabbit hemorrhagic disease), car collisions, habitat loss/ fragmentation due to urbanization and agriculture, and illegal hunting.
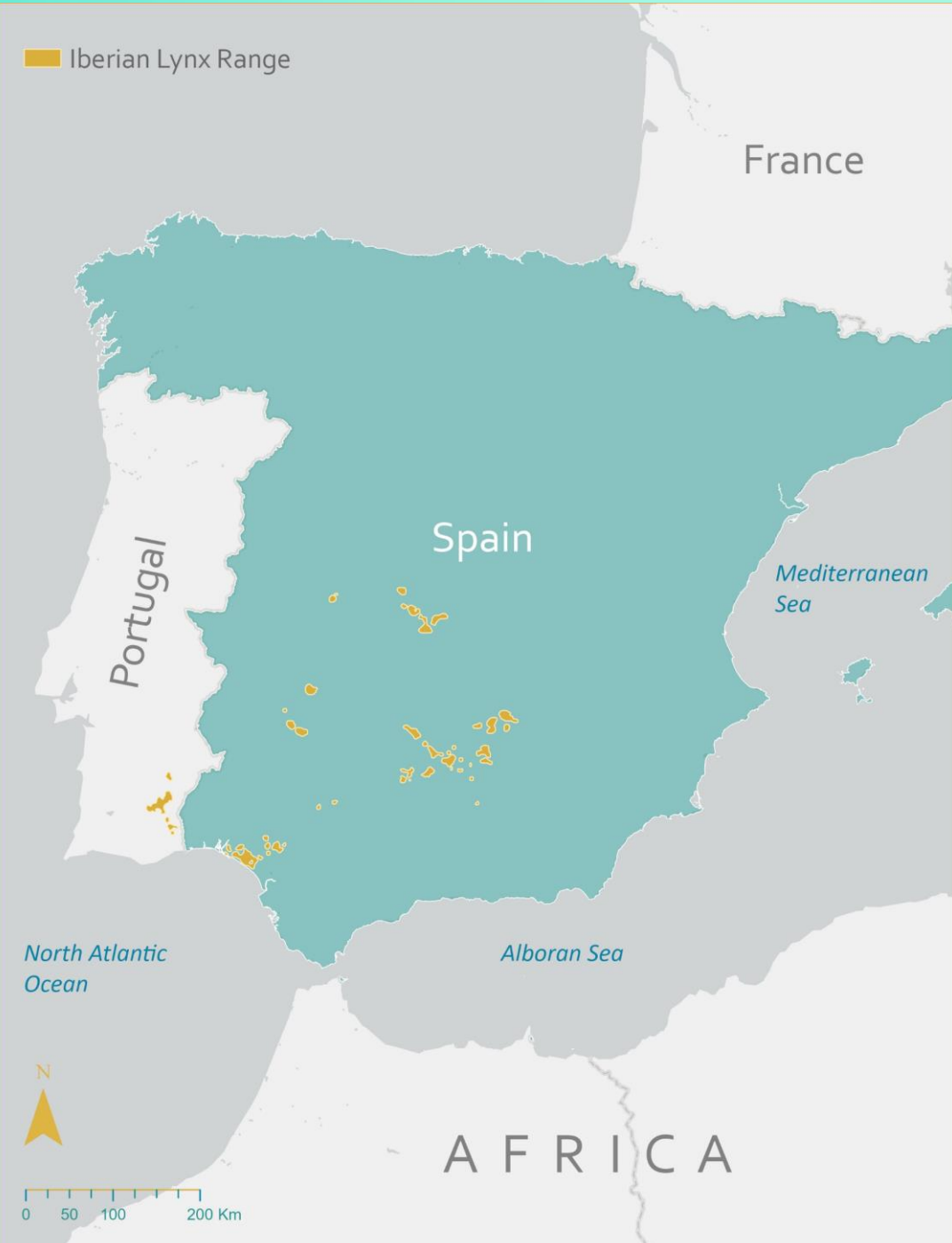
The population has increased in recent years because of conservation efforts, reaching around 650 individuals and recovering 22% of their range. Despite these successes, population monitoring, further protection, and future translocation projects are still needed to reinforce the species   populations (Garrote, 2020).

PURPOSE:
Thus, this project aims to conduct a risk factor assessment for the Iberian Lynx to determine the areas where the population is most threatened or experiencing the most pressure from human activity in Spain. This can be utilized to highlight areas most suitable for reintroduction and reinforcement translocation projects to further support Iberian Lynx population growth.


WEIGHTED RISK ANALYSIS
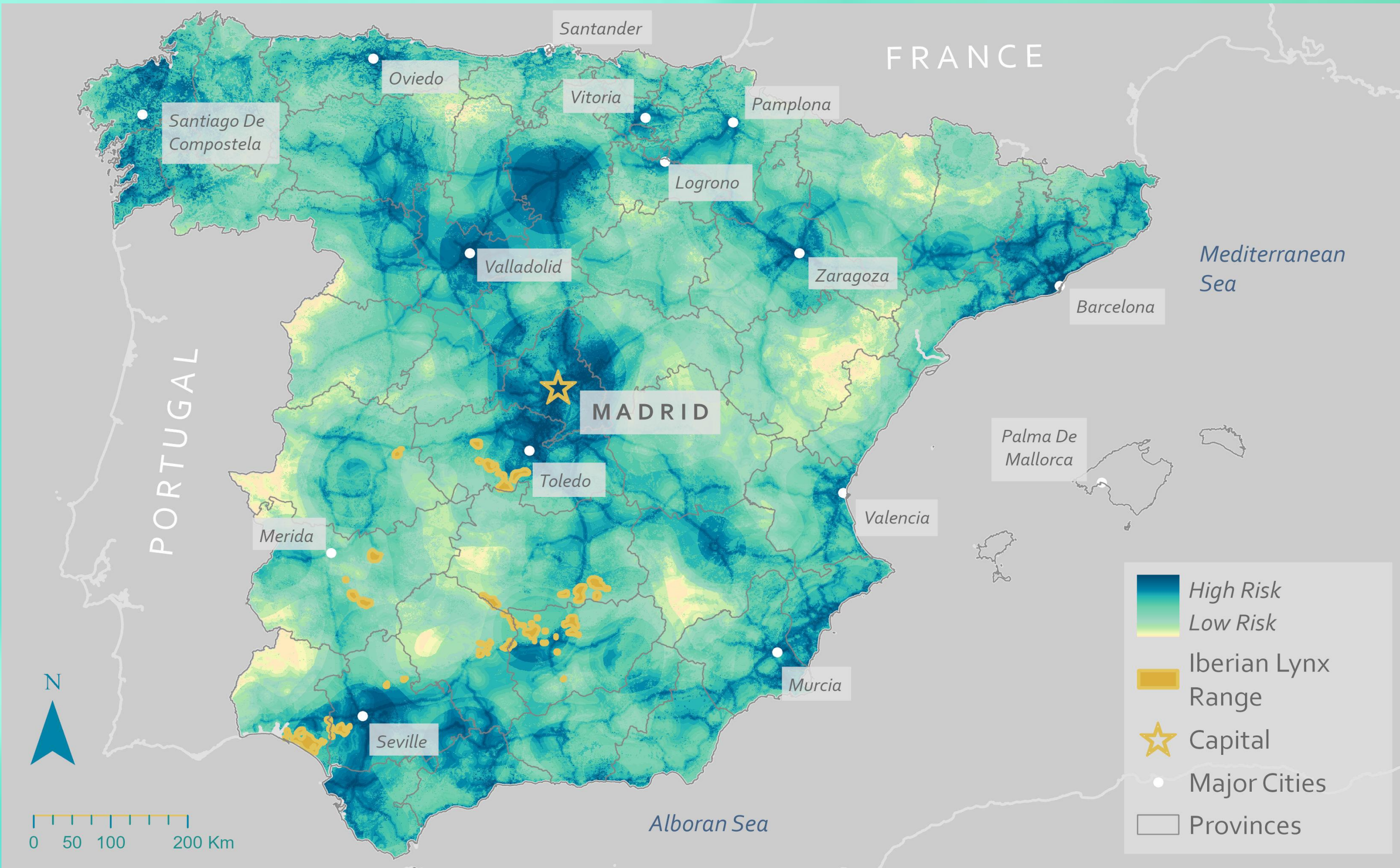
METHODS

A weighted risk analysis assessed the significant threats to the Iberian lynx in Spain. Weight was assigned to each factor as follows: prey availability (30%), human disturbance (20%), road collision risk (20%), and habitat availability (30%). Geoprocessing tools such as kernel density and distance accumulation were used. The risk factors were also converted into rasters and reclassified on a scale of 1(low risk) to 5 (high risk). Then, using the raster calculator, factors were summed together to display a final risk assessment.

IBERIAN LYNX THREATS
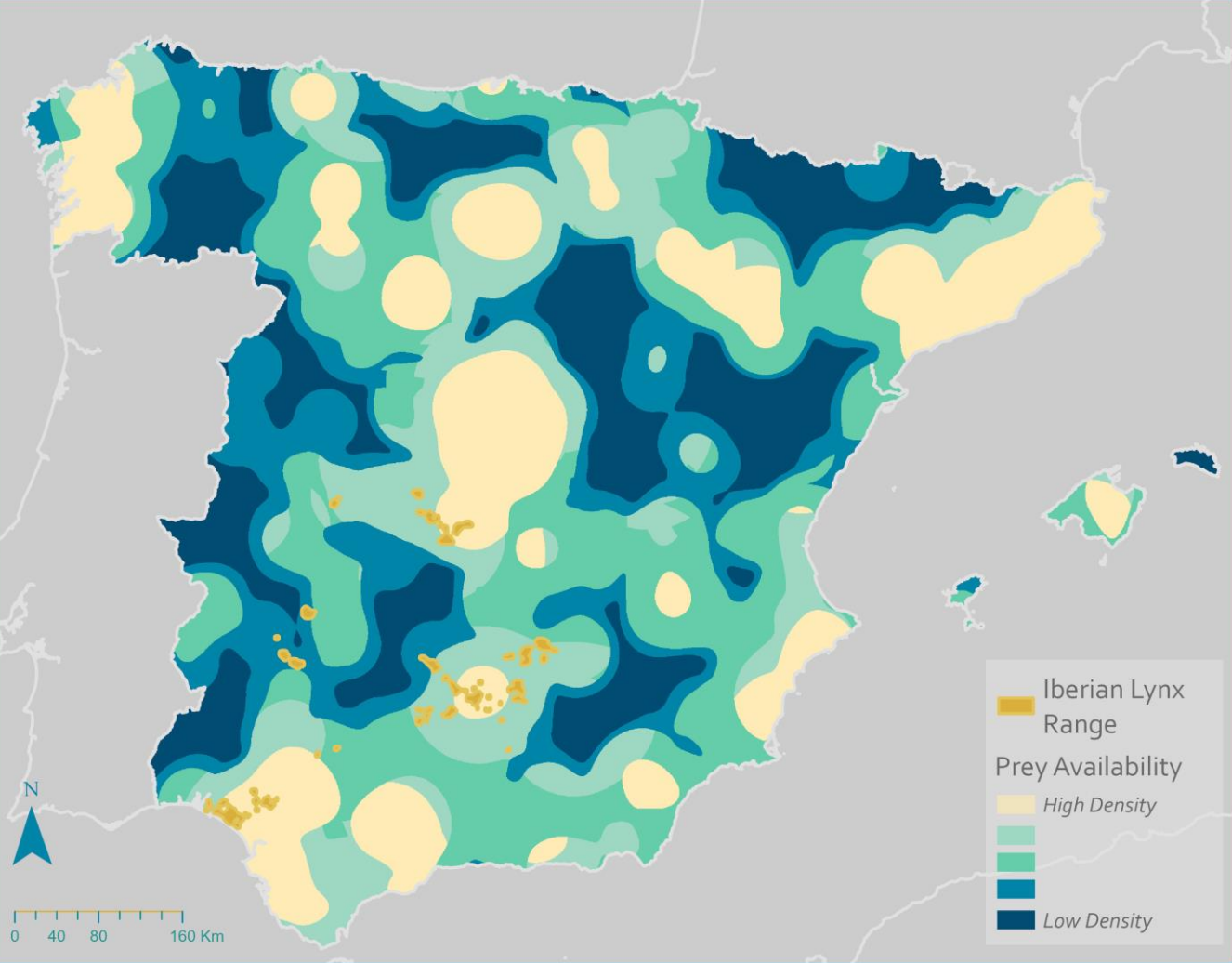
PREY AVAILABILITY

European rabbits are their main prey source. However, epidemics like myxomatosis and hemorrhagic disease have caused drastic declines in the rabbit populations, which in turn has negatively impacted the lynx population. Decreasing prey availability is a huge threat to the species and should be considered in the risk assessment. Thus, the areas with the most prey options will be considered low risk, whereas the areas lacking in prey options will be considered high risk. The data of prey species (red legged partridge, European rabbit, Fallow deer, Roe deer) sightings were merged and reclassified for analysis.
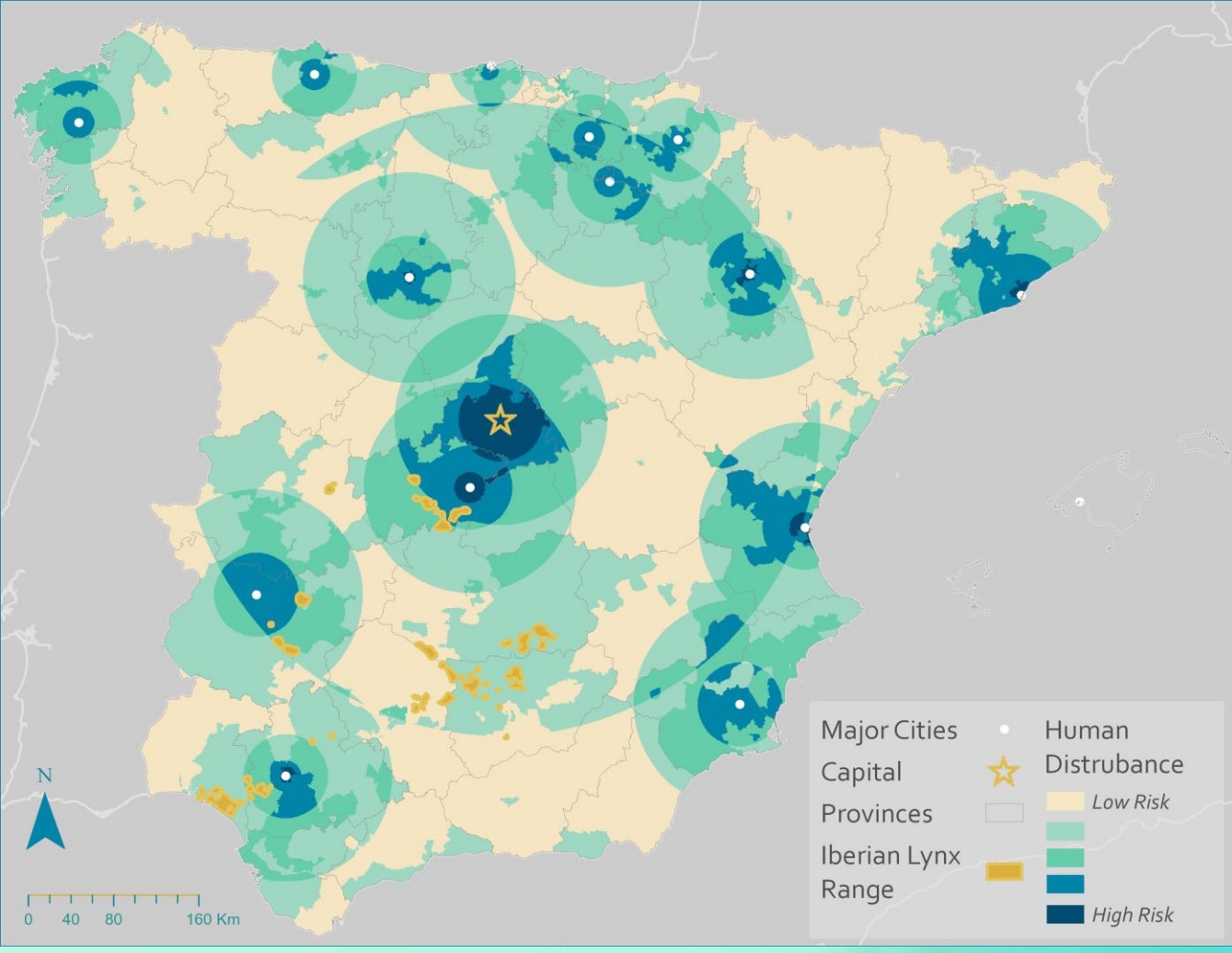
HUMAN DISTURBANCE

Fragmented areas caused by urbanization are not ideal for encouraging gene viability, and other threats like car collisions occur in major cities; thus, areas furthest away from highly populated places will be considered low risk, whereas areas close to cities will be considered high risk. To assess human disturbance human population density by zip code and distance from major cities raster were merged and reclassified.
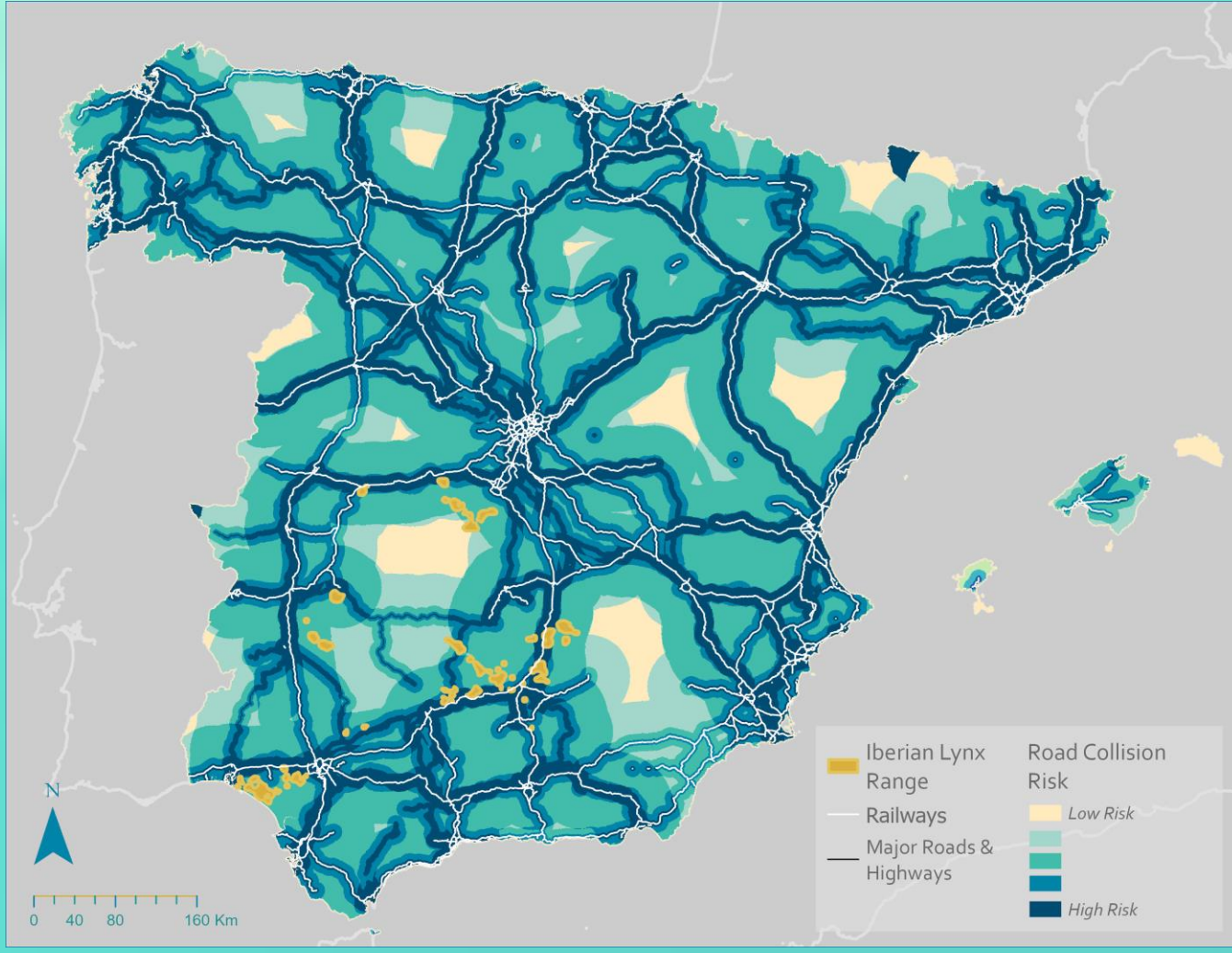
ROAD COLLISIONS

The expanding road network has increased accidental lynx mortalities. Thus, areas near major roads and railroads will be considered high risk, whereas areas further from roads/transportation networks will be considered low risk. Spain's railroad data and major highway data were merged and reclassified to perform the analysis.
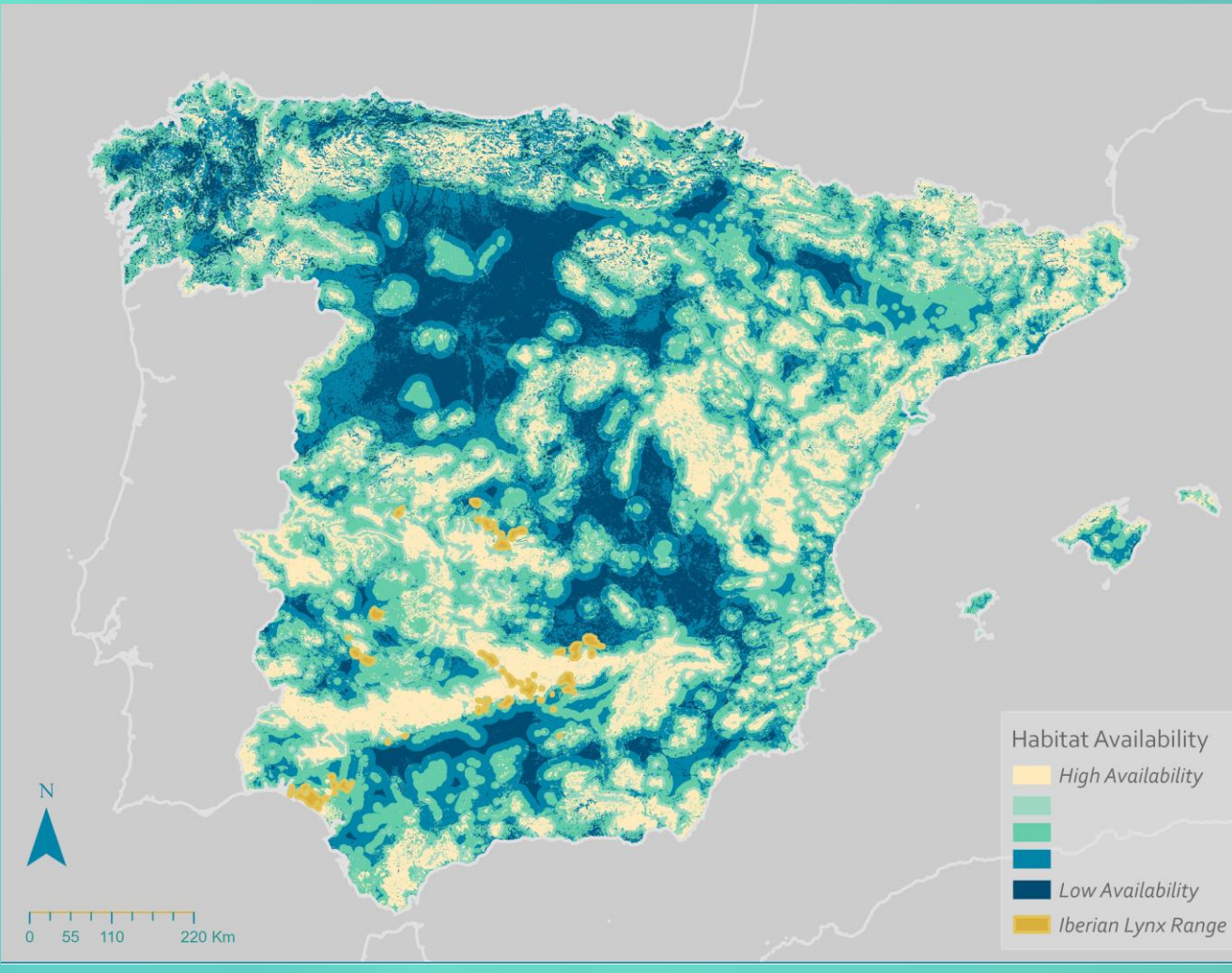
HABITAT AVAILABILITY

As a result of human encroachment, Iberian lynx numbers are also dwindling due to habitat loss and fragmentation. Areas considered open pasture, scrubland, oak and cork oak forests, grasslands, and marsh ecotones will be high habitat available ideal areas for the lynx. In contrast, urbanized areas, croplands, etc., will be leveled as low habitat availability. Additionally, distance from protected areas was considered during this analysis, where locations closer and within protected areas were considered high habitat availability, and areas further away were considered low habitat availability.

CONCLUSION

The weighted risk analysis shows the areas in Spain with the highest and lowest risk of Iberian lynx. The highest risk areas are in the lynx range's most northern and southern parts, illustrated by the dark blue areas near Madrid and Seville. These areas overlap with major roads and are close to large cities. They are also high in human density and low in prey availability. The rest of the Iberian lynx's range lies within medium-risk k areas. These areas mainly consist of farmland with protected areas, like Parque Natural Sierra de Hornachuelos and Parque Natural de la Sierra de Andujar, scattered between. This illustrates the lack of habitat connectivity among the lynx's range.

These factors threaten the isolated Iberian lynx populations' viability and success and suggest the possibility of an increase in the risk of disease emergence among the species. This risk analysis is a tool for a more holistic and adaptive approach to conserving the species.

DISEASE RISK

With the increased human encroachment, climate change, and decreased habitat connectivity and availability, disease risk has increased among the Iberian lynx, further impacting their conservation. Below are different diseases that are impacting the population due to their increased exposure to domesticated animals (Millan, 2008; Najera, 2024).

Feline Leukemia Virus (FeLV)
Domestic cats are significant reservoirs of FeLV and are considered the primary source of infection for the lynx .

Bluetongue Virus (BTV)
Cattle and other ungulates are natural hosts of BTV. Thus, with the encroachment of cattle farms, the Iberian lynx are at higher risk of being exposed to BTV.

Canine Distemper Virus and Parvovirus
Unvaccinated domestic dogs are significant sources of CDV transmittance. Thus, increased exposure to urban settings and stray dogs can increase the lynx's CDV exposure risk.

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Projection: Madrid 1870 Madrid Spain & WSG 84 Web Mercator

Data Sources: ESRI, Worldpop, IUCN Redlist, Inaturalists, Centro Nacional de Informacion Geografica (CNIG), Protected Planet

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References: