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Integrating Geographic and Prehistoric Data to Determine Conservation Needs and Reintroduction Potential for the Guam Kingfisher

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ABSTRACT

Conservation efforts for native birds on the island of Guam are currently being hindered by the invasive brown tree snake (*Boiga irregularis*) which has decimated the island's native bird populations. Many of Guam's endemic bird species, including the Guam kingfisher (*Todiramphus cinnamominus*), are now extinct and others are critically endangered. A habitat suitability analysis of Guam using physiographic datasets with respect to habitat preferences of the Guam kingfisher was carried out, using raster analysis in ArcMap 10.8.1. Results found suitable habitat that still existed in northern Guam, which correlated to this bird's previously disjunct geographic range. These potential areas of habitation for the kingfisher also correlated to fossil remains of this species, derived from the northernmost point of the island. These results from associating environmental data and this bird's limited fossil distribution on the island through cartographic methods offer a snapshot into the potential to reintroduce this species into the wild once the brown tree snake epidemic is mitigated.

INTRODUCTION & LITERATURE REVIEW

Insular species, especially birds, are highly susceptible to extinction, especially due to invasive predators, including humans (Steadman 2006). The Guam kingfisher is a species of tree kingfisher endemic to Guam. This species persists today as captive-bred populations that have the prospect of eventual release into the wild (IUCN RedList). Guam and the Northern Marianas have a considerable fossil avifauna record that sheds light on formerly high diversity in birds (Pregill and Steadman 2009). Utilizing concepts derived from Franklin and Steadman (1991), this study aims to provide framework for the question: **using habitat analysis and avian fossil records of the Marianas, which species of locally extinct or endangered birds are most feasible in being reintroduced to suitable areas of Guam?**

STUDY AREA

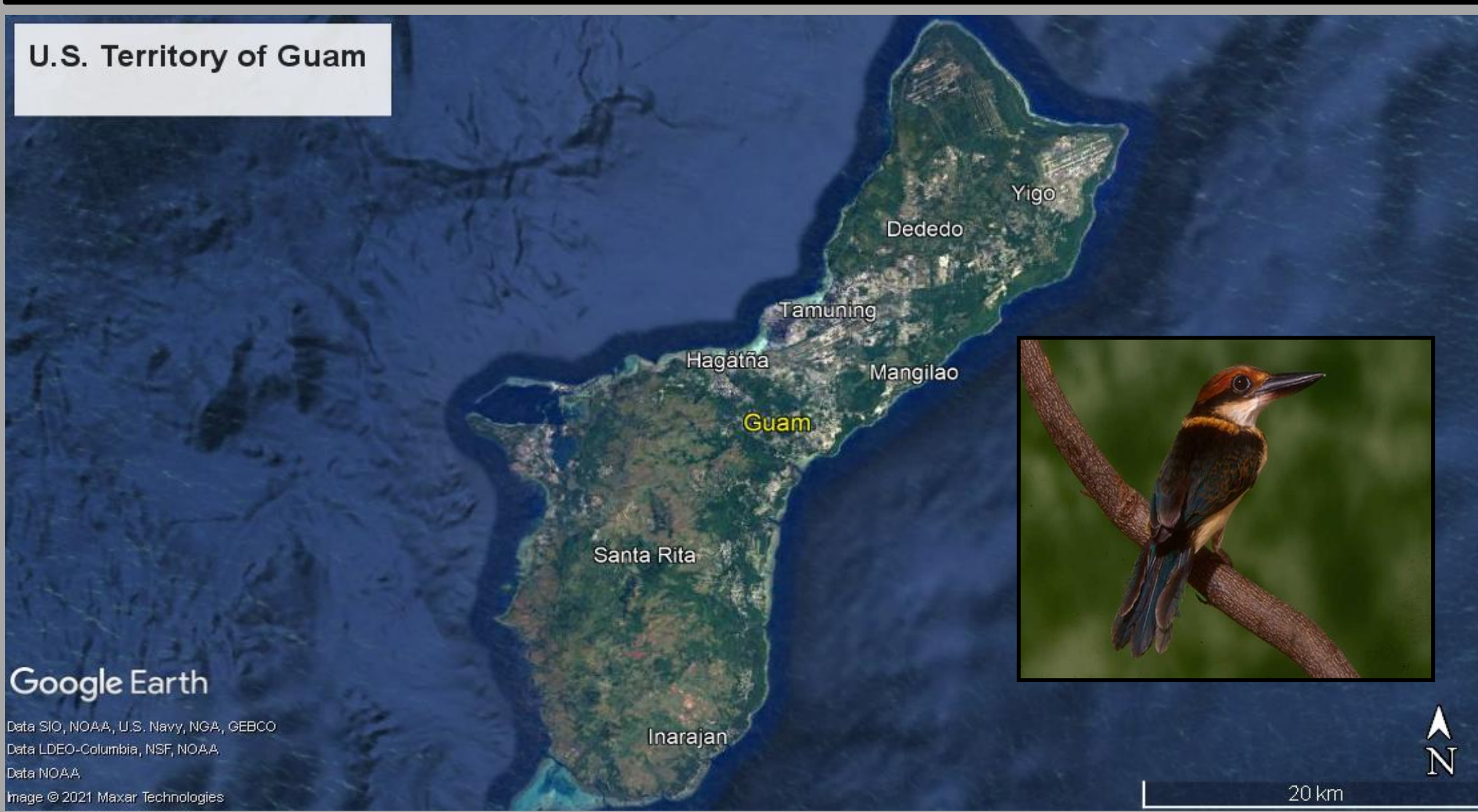
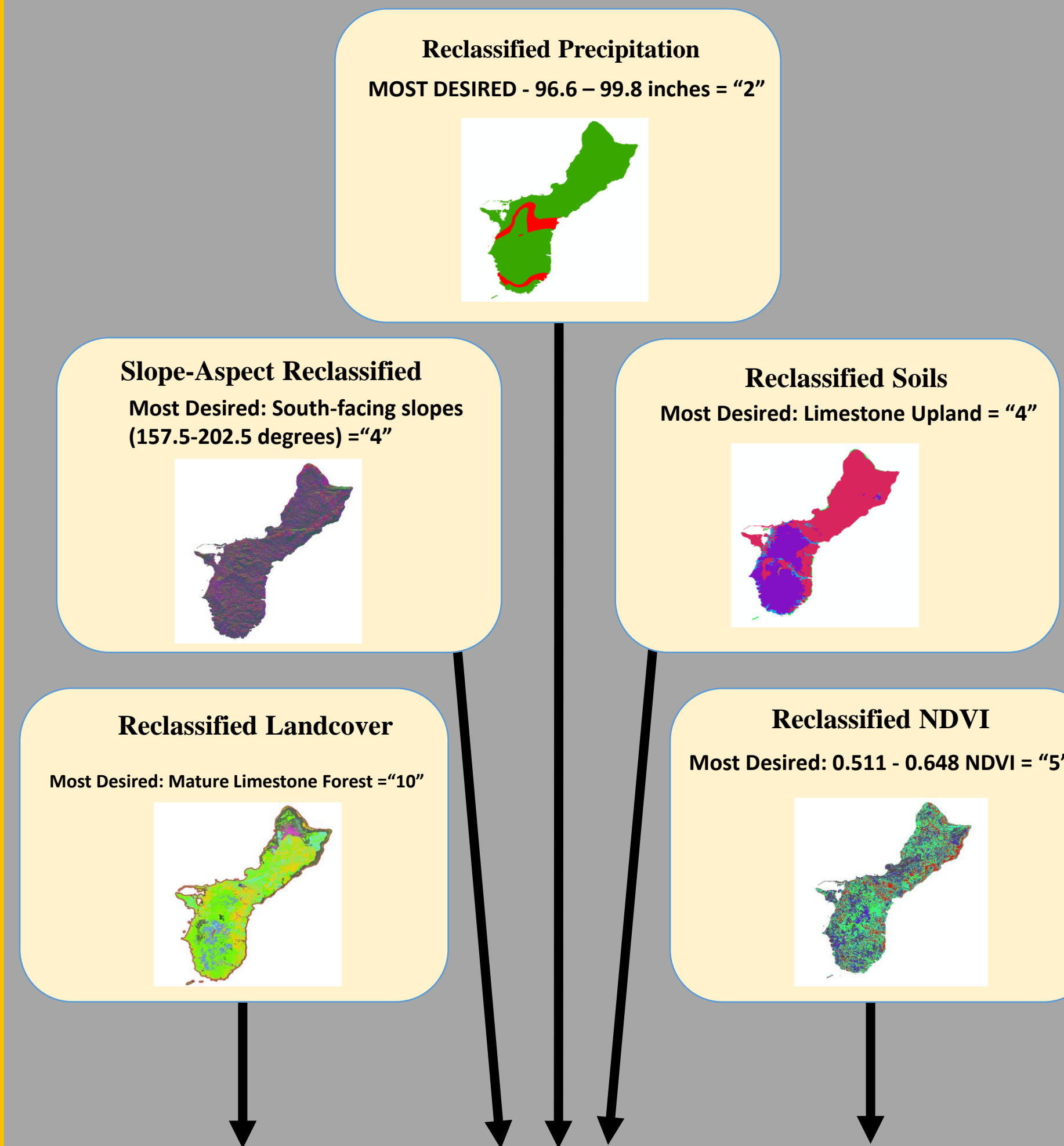


Fig. 1. The unincorporated U.S. Territory of Guam, formerly home to the Guam kingfisher.

METHODOLOGY

Datasets

- 2-m resolution raster depicting vegetation and land usage,
- Slope aspect to show different topographic relief across the island
- Average yearly precipitation in inches for the island
- A general map of soil types across the island, emphasizing limestone and volcanic soils
- Naturalized difference vegetation index (NDVI) of Guam to assess overall vegetation health across the island. Calculated from applying the NDVI formula to bands 4 and 5 of Landsat 8 imagery of the island.



SUITABILITY MAP

Key Criteria:

- Native limestone forests and ravine forest
- South-facing slopes
- Uniform precipitation patterns
- Limestone soils
- High NDVI values for healthy vegetation

RESULTS

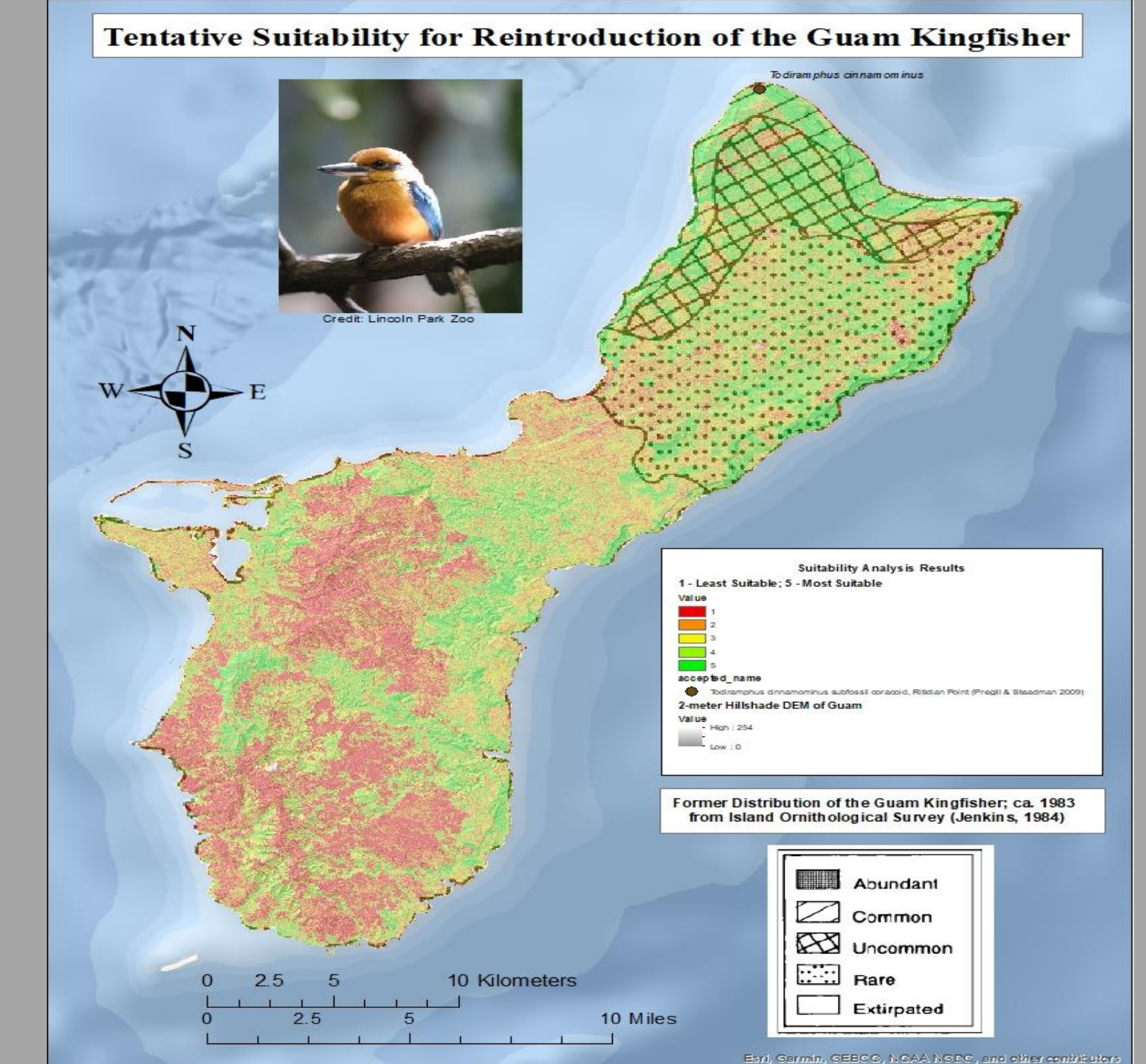


Fig. 2. The reclassified rasters were added together in a raster calculation and a tentative habitat suitability map based on terrain, landcover, precipitation, soils, and vegetation health was created. The sum values of this calculation was divided into five final suitability classes.

CONCLUSION

- Sites most suitable for reintroduction (Fig. 3) align with the former distribution of the kingfisher from Jenkins (1984) prior to the bird's extinction in the wild
- Subfossils of the kingfisher found at Ritidian Point by Pregill and Steadman (2009) correlate to suitable habitat (Fig. 3)
- Eradication efforts of the brown treesnake should continue and the northern half of Guam should be given priority for reestablishing a wild population of kingfishers
- Finding suitable relocation areas based on terrain modeling in GIS holds applications for more threatened/extirpated birds of Guam and the Marianas

References

- Engbring, J. and F.L. Ramsey. 1984. Distribution and Abundance of the Forest Birds of Guam: Results of a 1981 Survey. U.S. Fish and Wildlife Service, Honolulu, Hawaii.
- Franklin, J., and D.W. Steadman. 1991. The potential for conservation of Polynesian birds through habitat mapping and species translocation. *Conservation Biology*, 5(4): 506-521.
- Jenkins, J.M. 1983. The Native Forest Birds of Guam. Washington, D.C.: The American Ornithologists' Union.
- Pregill, G.K. and D.W. Steadman. 2009. The prehistory and biogeography of terrestrial vertebrates on Guam, Mariana Islands. *Diversity and Distributions*, 15(6): 983-996. doi: 10.1111/j.1472-4642.2009.00603.x
- Steadman, D.W. 2006. Extinction and Biogeography of Tropical Pacific Birds. Chicago: The University of Chicago Press.
- US Fish and Wildlife Service. 2008. Final Revised Recovery Plan for the Sihek or Guam Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*). Portland, Oregon. 2008: i-117.