

CHAPTER I. INTRODUCTION

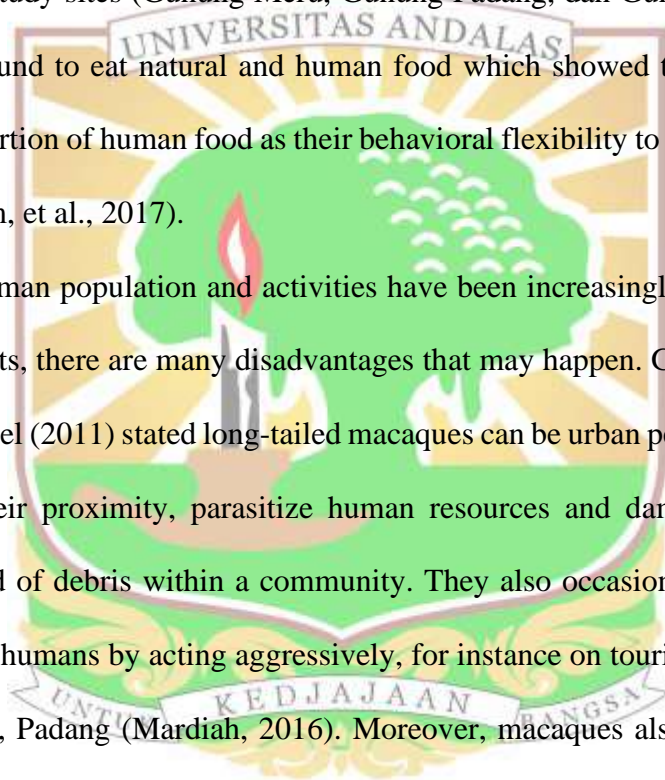
A. Background

Anthropogenic activity, which defined as activities that related to environmental change caused or influenced by people, either directly or indirectly (United States Geological Survey, 2015) is a significant determinant of species and biodiversity decline (Scheun, Greeff, and Nowack, 2019, Frances, et al., 2022). Several studies exhibited the decline of non-human primate populations due to forest conversion and fragmentation, road construction, and agriculture (Sarania, et al., 2017). In order to prevent the decreasing population, there are two options available: giving some considerable amount of areas to live for the primates population or just let the sharing and occupying landscape, a ubiquitous phenomenon these days (Lee, 2010). Therefore, in order to survive, many animal species, including primates, have to adapt to habitat structure and quality alteration, which will influence their distribution in a human-modified landscape (de Almeida-Rocha, et al., 2020). Furthermore, the occurrence of non-human primates in a human-altered ecosystem from many studies, undoubtedly has necessitated determining the ecological characteristics that define the human-altered landscape (Bryson-Morisson, 2016).

Macaca fascicularis is one of opportunistic and cosmopolite primates from subfamily Cercopithecinae which known as the most successful colonizers of nonarboreal habitats. This species has ability to live near humans. According to Gumert, Fuentes, and Jones-Engel (2011), the are some types of human-macaque interface zones: agricultural land, cemeteries, eco-lodges, metropolitan cities, rural

villages, roads, small islands, towns, temples/religious grounds, and recreation parks. This species also can be found in converted habitat with relatively small and isolated forest areas such as palm-oil plantations (Salendra, 2017). Haragus (2020) also found that this monkey prefers lowland altitudinal range (900 masl). Those characteristics make Padang as suitable areas for the primate to inhabit. In Padang, the sharing landscape example between long-tailed macaques and humans can be seen at three study sites (Gunung Meru, Gunung Padang, dan Gunung Panggilun) where they found to eat natural and human food which showed their capacity to alter the proportion of human food as their behavioral flexibility to survive in urban habitats (Ilham, et al., 2017).

As human population and activities have been increasingly widespread in primate habitats, there are many disadvantages that may happen. Gumert, Fuentes, and Jones-Engel (2011) stated long-tailed macaques can be urban pests and threaten humans in their proximity, parasitize human resources and damage dwellings, causing spread of debris within a community. They also occasionally threaten or cause harm to humans by acting aggressively, for instance on tourists as studied in Gunung Meru, Padang (Mardiah, 2016). Moreover, macaques also compete with humans for food and space and becoming crop raiders. Utami, Rizaldi, and Novarino, (2016) found in the study area in Padang (Bungus Teluk Kabung), the intensity of crop raiding by primates based on attack frequency and crop damage were high, and long-tailed macaque reported as the most problematic primates with the highest number of individuals in the groups as well as the highest intensity of the crop raiding event. This conflict has been an issue that seems to be of great



interest to conservationists and future conservation programs, as farmers and wild animals compete for resources (Hill, 2000). Conflicts between humans and wildlife caused by behaviors such as crop raiding, can represent a major threat to the survival and conservation of the species (Chiyo, et al., 2011).

Furthermore, with close biological similarity of macaques and humans, the potential exchanging of the pathogen will be higher, consequently affecting biodiversity conservation and global health (Kowalewski, et al., 2011). Some known zoonosis disease on the long-tailed macaque are hepatitis, amebiasis, schistosomiasis, tuberculosis, rabies, herpes B, tularemia, ebola, monkeypox, and malaria (Burgos-Rodriguez, 2011). Malaria caused by the parasite *Plasmodium*, and *Plasmodium knowlesi* is an important causative agent of malaria in humans of Southeast Asia (Wilcox, et al., 2019), as a natural zoonotic malaria species of several macaque species (Fooden, 1994; Moyes, et al., 2016; Wilcox, et al., 2019; Fungfuang, et al., 2020; Gamalo, et al., 2019). Moreover, Davidson, et al, (2019) stated that the increasing spread of zoonotic parasite disease in Southeast Asia has been affected mainly by land use alteration. According to Permana et al., (2023) it is found that there is a possibility of zoonotic malaria transmission in some areas in Indonesia including West Sumatra, where the mosquito carriers of this disease exist based on the level of nonhuman primate-interactions.

Besides, there is an urgent need to study this species due to the change of the conservation status. In March 2022, IUCN Red List of Threatened Species announced that based on the global assessment, the status of this species increased into Endangered. Previously, for twelve years since 2008, this macaque had been

known to be a Least-Concerned species before became Vulnerable in 2020. As a consequence of the decreasing habitat and exploitation, the long-tailed macaque's justification for the 2022 category was the declining of more than their half population in 36-39 years (three generations). Furthermore, this condition has been a concern too since the extinction that happened in Bangladesh.



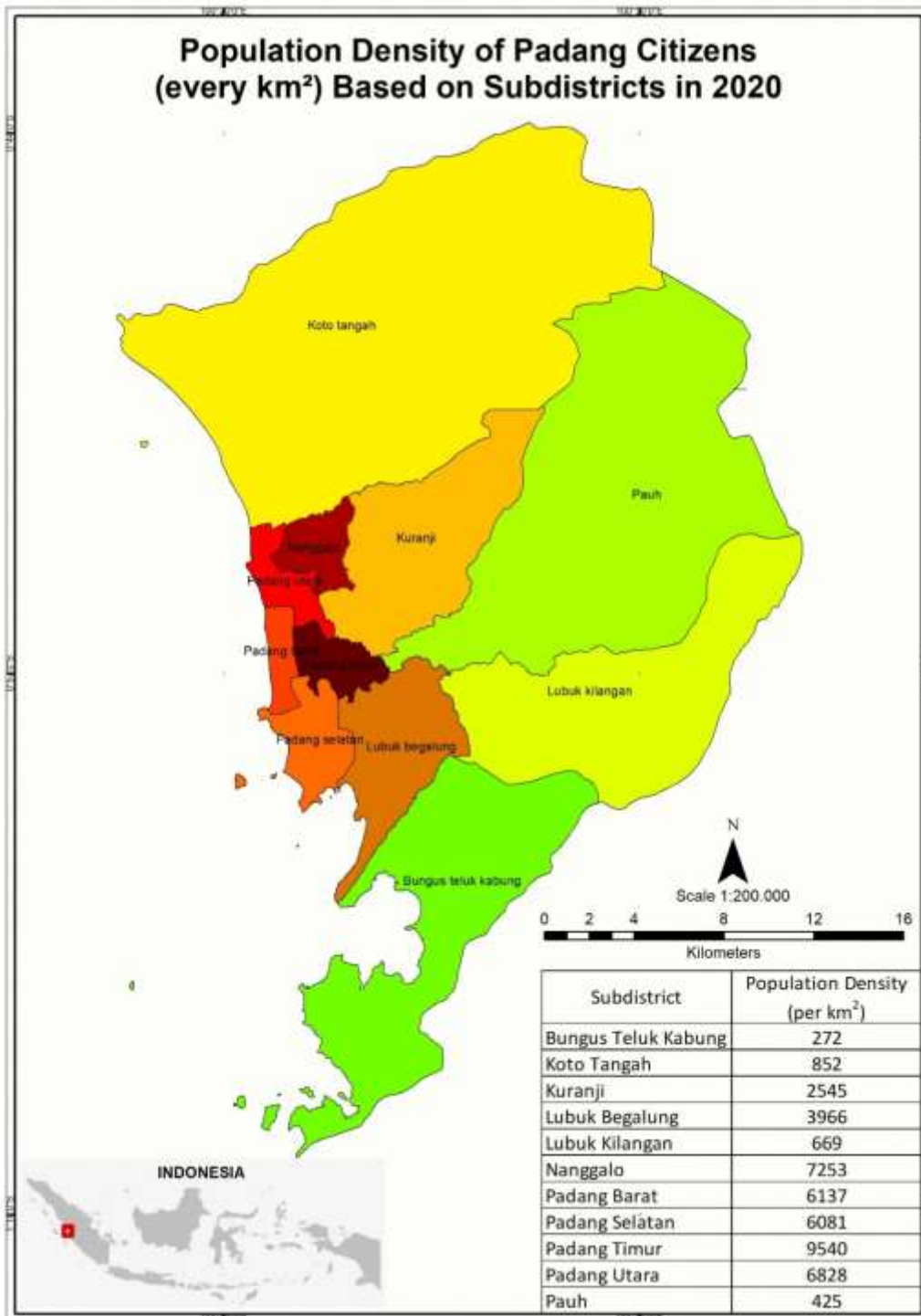


Fig. 1 Population Density of Padang Based on Subdistrict

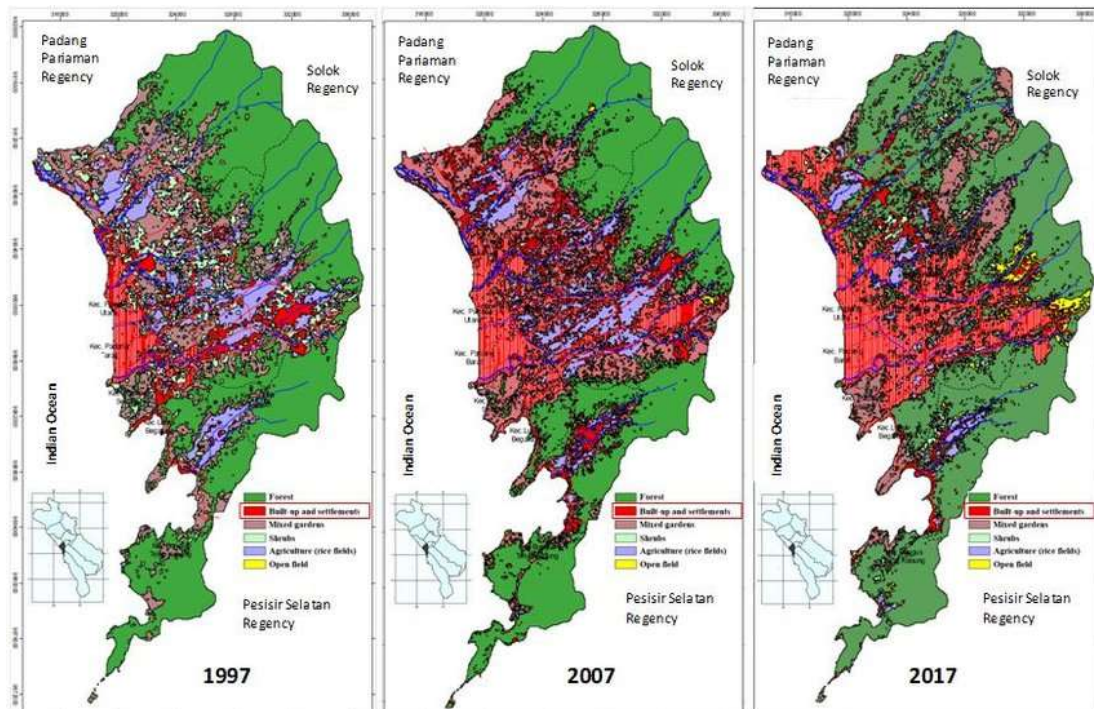


Fig. 2 Map of land-use change in 1997, 2007, and 2017 in Padang City (Hermon, 2019)

As human population density (Figure 1) and land use change (Figure 2) could influence the macaque's distribution, it is necessary to understand the contexts and patterns of human-macaque interactions (Fuentes and Hockings, 2010) and it is essential to predict the macaques' distribution in Padang and environmental variables affect it. The species distribution model using the Maximum Entropy (MaxEnt) program will predict species distribution which only requires positive cases (Philips, Dudik, and Schapire, 2004). The models created by MaxEnt can be interpreted probabilistically in a natural way, providing a smooth transition from best to worst conditions (Methods for Modelling in Ecology and Conservation Biology, 2022). Given its reliance on merely presence sites, maximum entropy

(Maxent) modeling offers significant potential for identifying wildlife distributions and habitat preferences (Baldwin, 2009).

B. Research Questions

Based on the background, the questions of this study are:

1. How is the distribution of the long-tailed macaque based on direct observation?
2. How is the potential distribution of the long-tailed macaque according to habitat suitability using species distribution modelling (MaxEnt)?
3. What are the environmental variables that significantly influence the long-tailed macaque's occurrence?

C. Aims of the Study

This study aims to determine:

1. The distribution of the long-tailed macaque based on direct observation
2. The potential distribution of the long-tailed macaques according to habitat suitability using species distribution modelling (MaxEnt)
3. Environmental variables that significantly influence the long-tailed macaque's occurrence

D. Significance of The Study

This study will give information on long-tailed macaques spatial distribution and environmental variables that significantly influence their occurrence as the feedback for conflict management, species conservation and habitat management, as well as provide baseline data for the potential zoonosis disease transmission risk in the future.