Japan's Declining Population:

Using GIS Data To Explore Contributing Factors

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Abstract:

The goal of this study was to explore through GIS data the theories behind Japan's population decrease and what may lead to a solution. We investigate some of the solutions posed by the media and government, and find them groundless. We discover that there may be a convincing relationship between the elderly population and the low birth rates in the theory of double care: caring for both children and elderly parents.

Article:

Japan has become synonymous with a declining birthrate and aging population. The media loves to mention Japan's elderly population and the negative population growth of the island nation. Upon looking at WorldBank's data, Japan does not have the lowest population growth (-0.209 in 2019), the lowest fertility rate (1.42 in 2018), or the highest death rate (11 in 2018), but if we compare the nation to other first world countries the numbers are discouraging. The United States had a population growth of 0.474 in 2019, a fertility rate of 1.73 in 2018, and a death rate of 8.6 in 2018. The effects of this combination include a workforce shortage and rising taxes to cover the aging population, which will continue to impact an already wounded Japanese economy.

In response, the Japanese government under the leadership of Prime Minister Shinzo Abe set forth a plan to raise the fertility rate to 1.8 by 2025 ("An Uphill Battle"). Included in the plan was increased parental leave, addressing work life balance issues, increasing childcare availability, and more. The media has been critical of the efforts. It is looking like the fertility rate won't reach the government's goal by 2025. Are the efforts in the right areas but too little? Have they completely missed the mark? Is this an issue government policy can't fix?

Going into this research I had a few statistical areas on my mind, but my methodology was first and foremost exploratory. At the time I was aware of how the media portrayed Japan, with an abysmal work life balance, crowded cities, dying country, and a stale economy. I had seen general data similar to the WorldBank info previously mentioned, and some scant theories on what may hinder a nation from birthing.

There was one story of a town in Japan achieving a high birth rate due to a childcare program whereby parents could drop off children on their way to work at the local train station, and the children would be whisked away in a colorful bus to childcare facilities in town. I would come to learn that towns often try gimmicks like this, including simply paying families to have children, in order to raise the town's birth rates (Jozuka). It hits the news, families come, the birth rate goes up, time goes by, people stop moving there, the rate goes back down. In my judgement, this may bring more families into a given town, but does not influence the country's birth rate. Even still, a lack of childcare facilities was a focal point in the Shinzo Abe plan, and

the often pointed to symptom is Tokyo's long waiting lists for childcare facilities. We will explore this later.

My initial feelings led me towards social factors being the primary influence. I had in mind the decline in marriages seen in first world countries, and would look for a connection in birth rates. The Japanese tend to have children only when married, counter to the recent trends of the western world ("Changing Patterns"). Additionally in Japanese society, caring for your elderly parents is commonplace. In the United States, we throw old folks into old folks homes, whereas in Japan the elderly often live with their adult children. Seeing an increase in elderly population may contribute to burdens on the adult children.

Onto the data. I decided early on that I wanted to acquire data per Japanese municipality, the small unit of governance. There are over 1900 municipalities, and ESRI Japan is gracious enough to have it available free for download ("全国"). The dataset used is the Statistical Observations of Municipalities 2020 by the Statistics Bureau of the Ministry of Internal Affairs and Communications of Japan ("System of Social"). This dataset is "the systematic compilation of statistical data collected and processed by districts demonstrating the real living conditions of the country's population".

In this dataset there are 10 different "classifications" including Education, Labor, Economic Base, and dwelling. Combining these 10, there are a total of 92 attribute values. The specific classifications used in this study were "Population and Households" and "Welfare and Social Security". The attributes used were Total Population (Both sexes) in 2015, Live Births in fiscal year 2017, Deaths in fiscal year 2017, Nuclear Families in 2015, No. Of Nuclear Families with Household Members 65 Years of Age and Over in 2015, Marriages in fiscal year 2017, Number of Nursery Centers in 2017, Number of Infants Enrolled in Nursery Centers in 2017, and others that were used in exploration. Nuclear Families are defined as households with two parents and at least one child. The other attributes are self-evident.

For the sake of good map design, I made my focus around the city of Tokyo, where the distinction of countryside, city, and suburb can be seen. This should be noted as all data unless specified otherwise (the suburb maps) includes every municipality's data, so the visual field is not totally representative of the data. Additionally, certain municipalities were giving outlier results, in particular ones impacted heavily by the 2011 Tohoku earthquake, tsunami, and resultant nuclear power plant destruction. I have omitted all municipalities with a population less than 1000, which rids the study of most outliers. These areas appear on the map as the grey color of the basemap, though only one is visible in the Tokyo centered view I chose.

To establish my bearings, I began with the creation of a choropleth map (all maps in this study are choropleth) showing the births of each municipality normalized by the population, and will call this the birth rate henceforth. With that I noticed a clear distinction between the cities and the countryside. Cities had consistently higher birth rates than the countryside (Figure 1). On the map, located in the center is the major metropolitan area of Tokyo, the countryside tending to be larger municipalities. This makes sense globally, as more young people of birthing age are located in the cities.

From here, I created a map where the deaths are subtracted from the births. I used a two color classification scheme to show blue as above 0 and red as below. This gives an idea of where there are more deaths than births. Sure enough, the cities are some of the few places in the positive, and even then some areas of cities are deep red (Figure 2). By my existing knowledge, the areas of deep blue are the more affluent areas of Tokyo, but I did not explore monetary influences in my study. It should be noted that immigration and emigration is not considered in this map, so it is not precisely the population growth of each municipality.

An assumption could then be made that these areas of the city are also experiencing more marriages than the average municipality. In Figure 3 we have what I call the marriage rate, or the marriages normalized by population. Sure enough, the cities in general have the higher average marriage rate and more in the affluent, higher birth rate areas. What I drew from this is younger people live in the cities, get married, and have children. One could consider unmarried births, but as I mentioned before, the Japanese have a strong tendency to have children only when married.

Now let's observe just how fertile these newlyweds are. In Figure 4 we have births normalized by marriages. Here the results are interesting. The lightest color indicates more marriages than births, while the other classes indicate the opposite. Despite the cities having more births and more marriages, their ratio of births to marriages is less than that of the country. We might derive from this that young people are getting married more than they are having children. From this we should think about who of the newly married couples, already married couples without children, and already married couples with children, are having children. A common complaint among all young urbanites is the inability to have a child in the city for reasons like cost and childcare.

Figure 5 shows the amount of children enrolled in nurseries per nursery facility. If preschoolers are truly on waiting lists, then one would think the cities have the highest ratio of children to nurseries. This is not what we find. The cities have a consistently average ratio, whereas the countryside varies heavily. The conclusion I would come to is that children are on waiting lists for the select nurseries that the parents want them to get into, not because there is a lack of nurseries. The counter argument might be a smaller average nursery size in the cities, making the national average of attendance too high for their nursery sizes. *Upon further research, I have found some insight into the nature of the nursery situation in Japan. It is complex, but I would stand by my inklings. One can judge for themself (Osaki).*

As for cost, Figure 6 shows us births to nuclear families. We can work around a lack of financial data if we are aware of generally where the affluent neighborhoods are in Tokyo. Here we see some affluent neighborhoods with a higher ratio of births to existing nuclear families. We might then conclude that affluence allows for more children, but let's first observe the concentration of nuclear families.

Here it is in Figure 7. The municipalities that we saw with higher ratios of births to nuclear families have a lower concentration of nuclear families. These neighborhoods have large business and entertainment districts, not especially suitable for family living like the suburbs. We can then conclude that newlyweds who have children in the inner cities then might migrate out into the suburbs. Looking at the same figure, the suburbs can be clearly defined as the outer areas of Tokyo with the highest nuclear family to population ratio.

I decided to take a closer look at the suburbs of Tokyo, selecting only those municipalities within the highest classification of nuclear families to population. Then I recalculated the classifications with only the data of all the municipalities defined as suburbs in Japan. With Figure 8, we will stay centered on Tokyo. The trend is not terribly strong, but we can see higher birth rates towards the city center.

It gets interesting when we compare Figure 8 to Figure 9: nuclear families with a member over the age of 65 normalized by the population. This equates to households with two parents and a child, and at least one member is over the age of 65. This could be one of the two parents being 65 or over, or a grandparent 65 or over living with two parents and their children. When compared to Figure 8, there is a stark inverse correlation. The higher the ratio of households with a member 65 and over, the lower the birth rate in that municipality.

This observation supports the theory that having an elderly parent in your house is not conducive to having more children. This is the idea of double care, or the reluctance to have children while also caring for parents ("The 'Double Care' Generation"). This could be why we see a fertility rate of around 1.42. Though the actual distribution is more complicated, women can be seen as having between one and two children on average. With an elderly parent to take care of, that second child is looking more like a third child. We can go further by exploring what exactly an elderly parent in the home means. How much of a financial, time, and social burden are they? A counter argument could be that elderly parents can assist in child rearing, offsetting costs they might incur.

As for pitfalls, the data might not be as conclusive as it seems. Children are staying with their parents later, especially in Japanese society. The age at which people are having children grows later ("The 'Double Care' Generation"). This could lead to parents 65 and older with an adult child who is not dependent, but lives with their parents. If the definition for nuclear families used by the data source excludes non-dependents living with their parents, then this problem is alleviated. The data source does not specify this. Another angle of attack is the idea that parents don't have children outside the first couple years of marriage. One couple might have 3 children in the first three years of their marriage, then their parents move in, and then they stop having children. Not because of their parents, but because they are finished having children. This could comprise most of the relationship between these two figures.

More information is needed to be confident, but it does fall in line with the existing theories of double care. Especially if you consider the fact that 28% of Japan's population is over 65 in 2019, which, in this case, is the highest of any country (WorldBank). The elderly population will continue to increase, and the burden will fall on the next generations. A natural continuation of this study would be looking into elder care, and getting a better idea of what burdens younger married couples. What could be done to address the problem, I will leave to the politicians.

References

“An Uphill Battle to Reverse the Falling Birthrate.” *The Japan Times*, www.japantimes.co.jp/opinion/2020/06/04/editorials/uphill-battle-reverse-falling-birth-rate/.

"Changing Patterns of Nonmarital Childbearing in the United States". *CDC/National Center for Health Statistics*. May 13, 2009. Retrieved September 24, 2011.

“Countries and Economies.” *Data*, data.worldbank.org/country.

Jozuka, Emiko. “Inside the Town That Pays Cash for Kids.” *CNN*, Cable News Network, 4 Feb. 2019, www.cnn.com/2018/12/27/health/japan-fertility-birth-rate-children-intl/index.html.

“System of Social and Demographic Statistics Statistical Observations of Municipalities 2020 Basic Data: File: Browse Statistics.” *Portal Site of Official Statistics of Japan*, www.e-stat.go.jp/en/stat-search/files?page=1&layout=datalist&toukei=00200502&tstat=000001141146&cycle=0&tclass1=000001141147&collect_area=200&tclass2val=0.

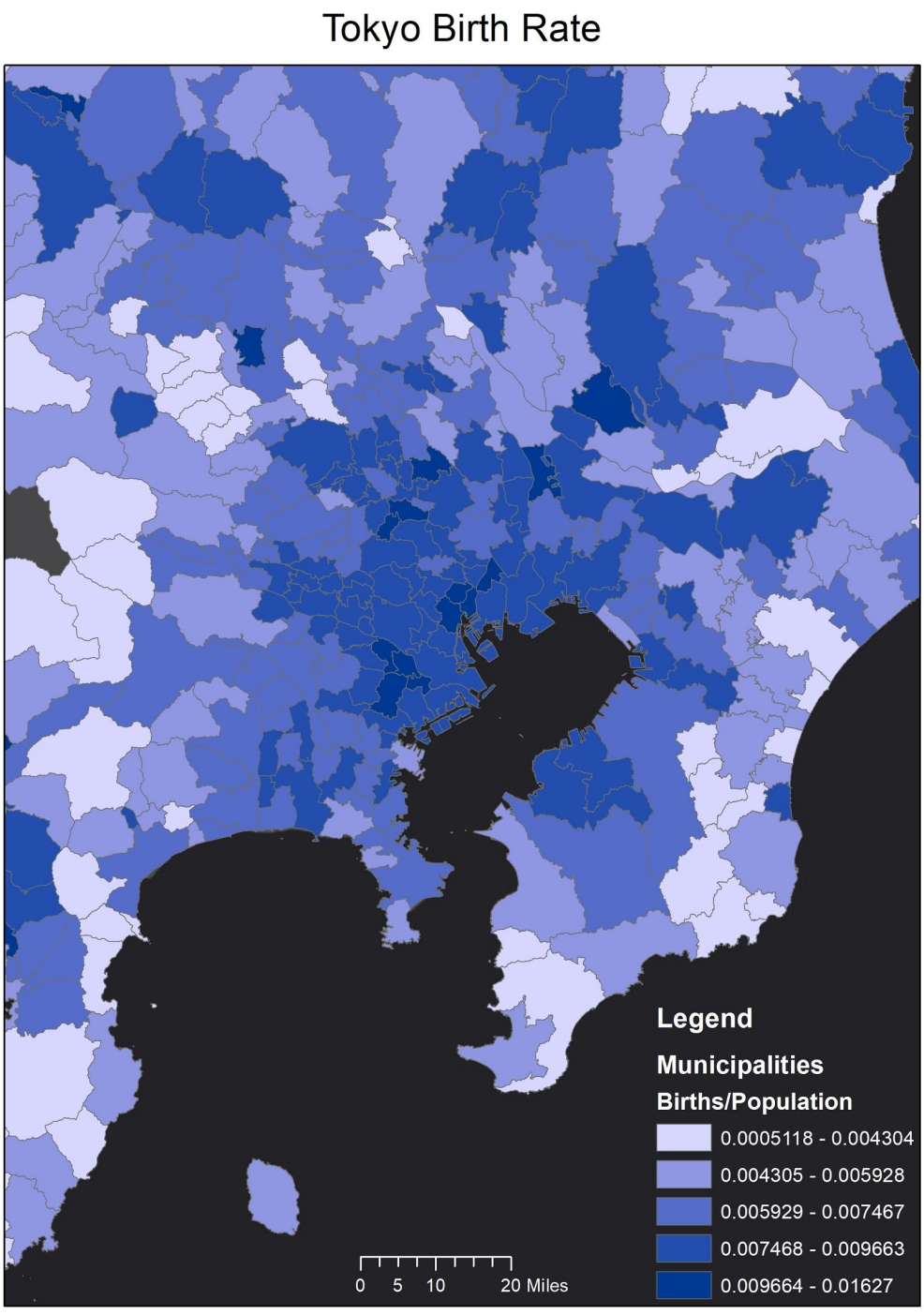
“The ‘Double Care’ Generation Looking After Both Children and Parents.” *Nippon.com*, 30 May 2020, www.nippon.com/en/features/h00263/.

Osaki, Tomohiro. “Day Care Crisis Stuck in Vicious Cycle.” *The Japan Times*, www.japantimes.co.jp/news/2016/04/17/national/day-care-crisis-stuck-vicious-cycle/.

“全国市区町村界データ: ESRIジャパン.” *ESRI*ジャパン株式会社, www.esrij.com/products/japan-shp/.

Appendix

Figure 1



Data Source: Statistics Bureau, Ministry of Internal Affairs and Communications, Japan

Figure 2

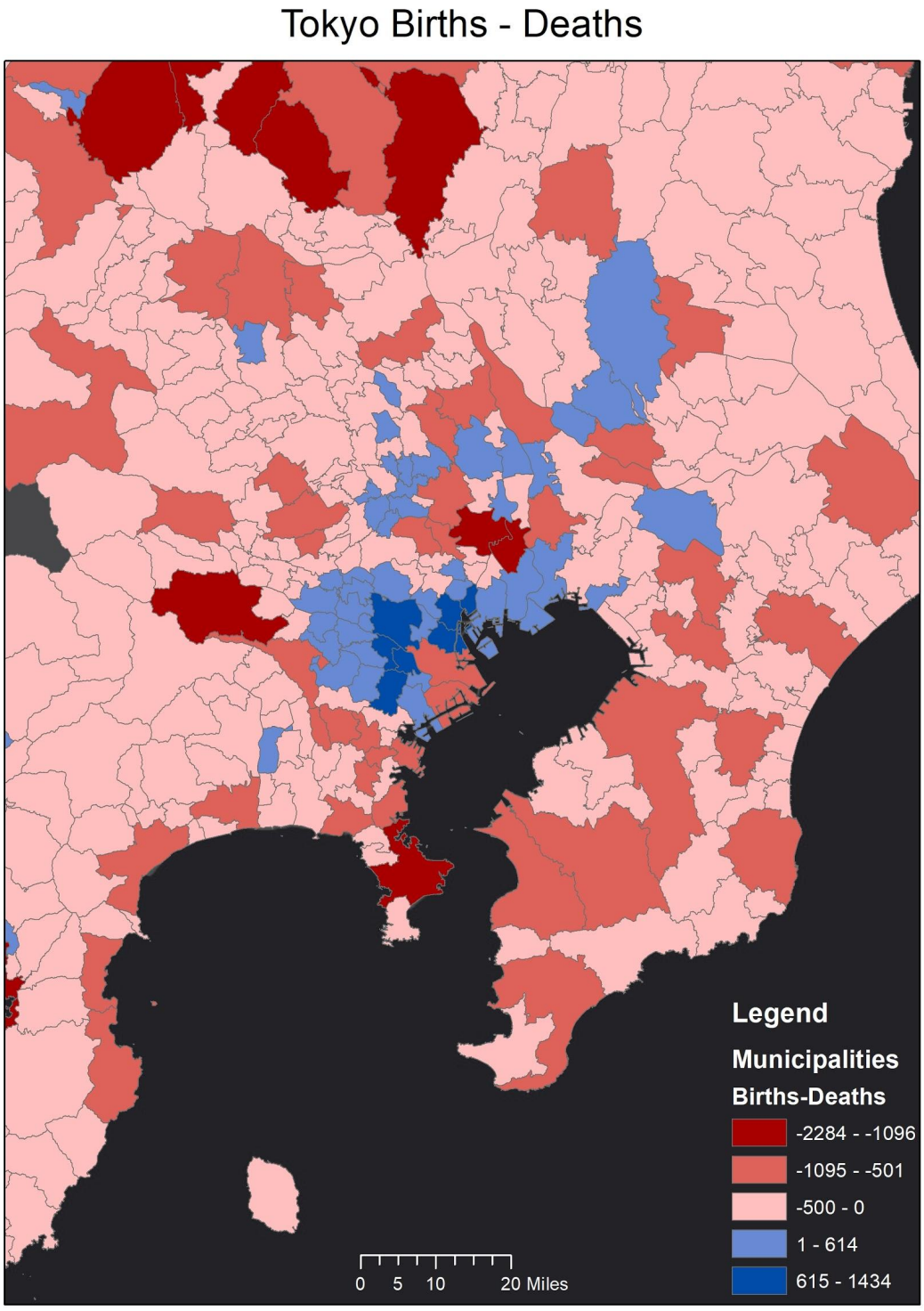


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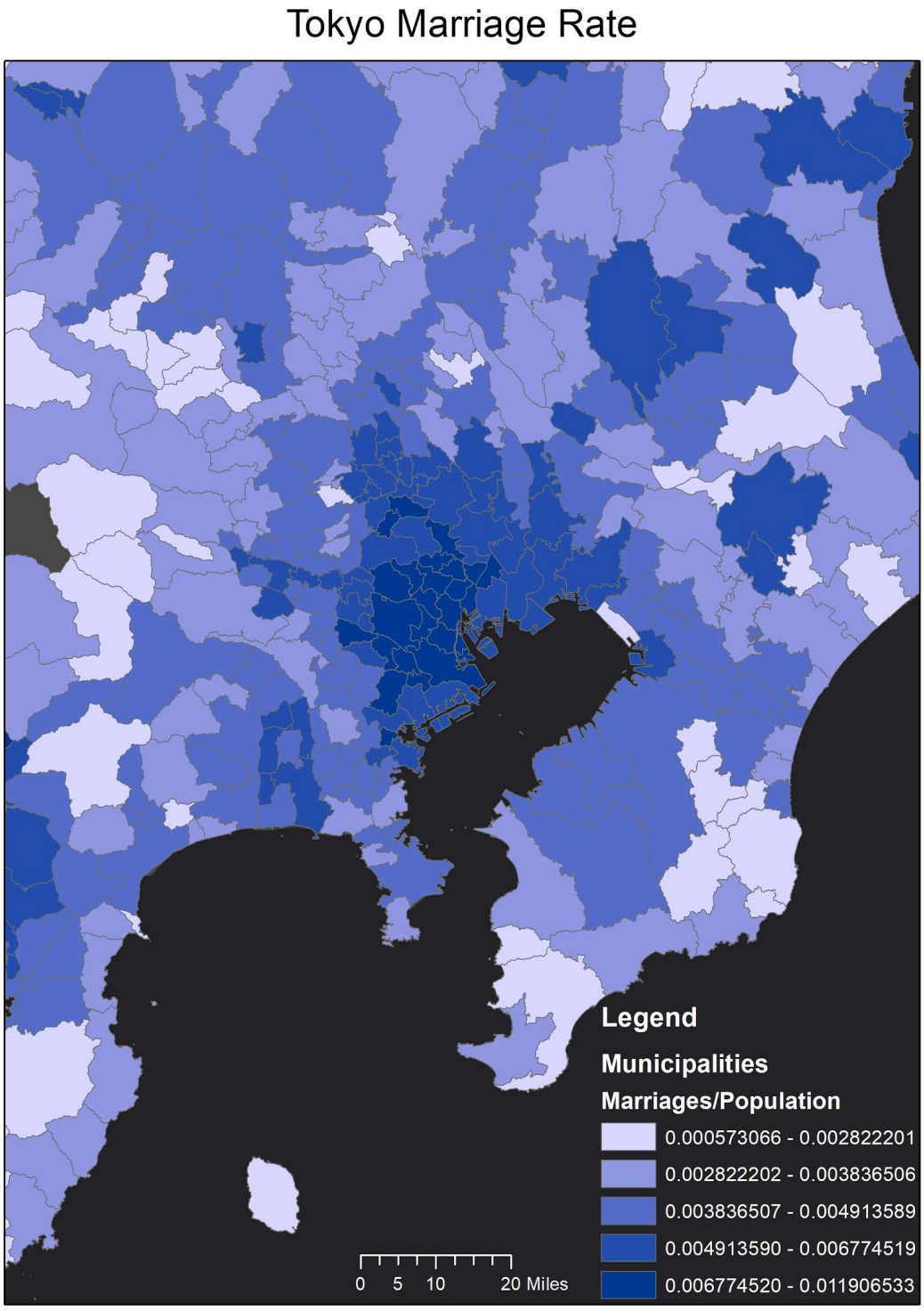
Figure 3



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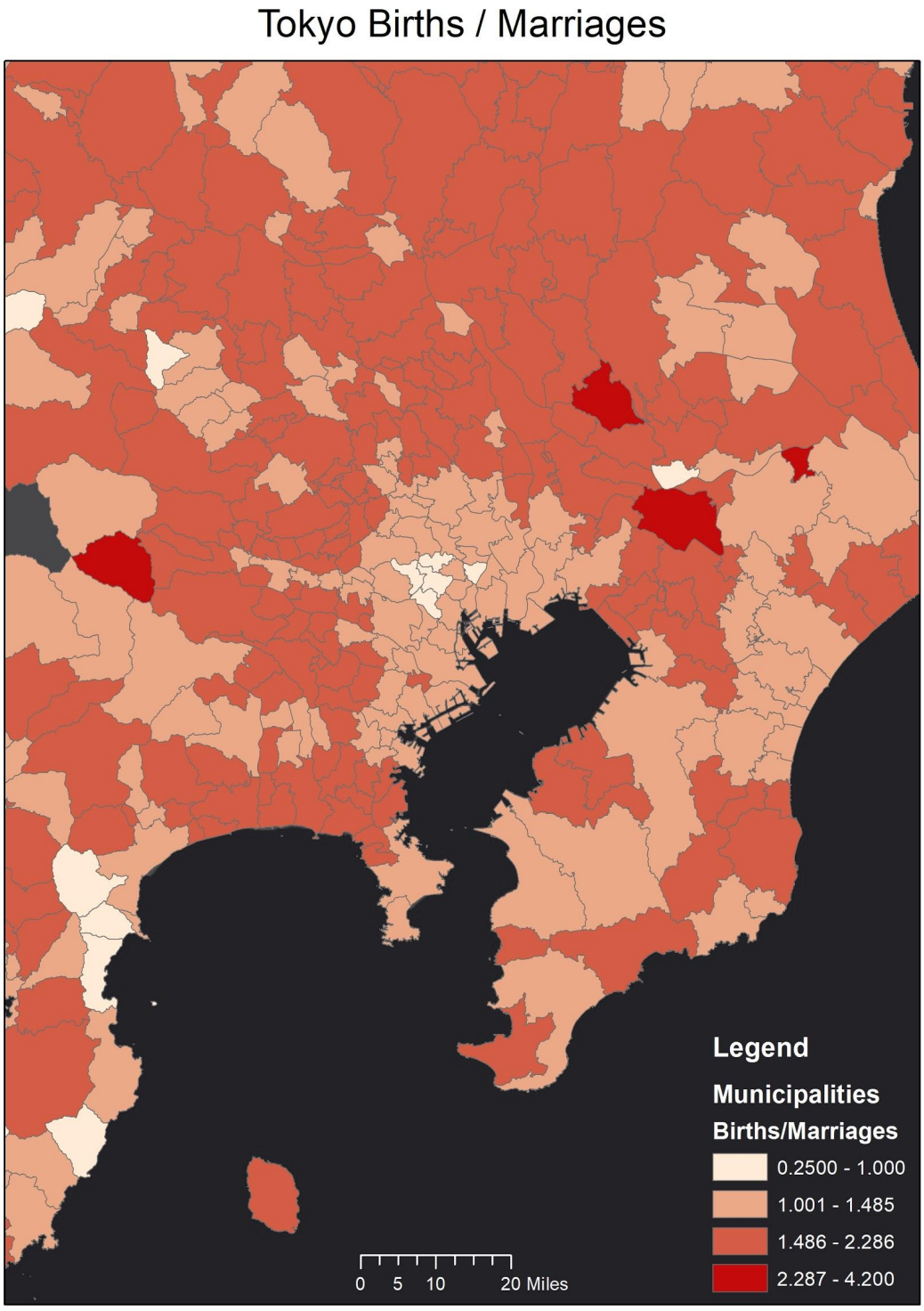

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Figure 5

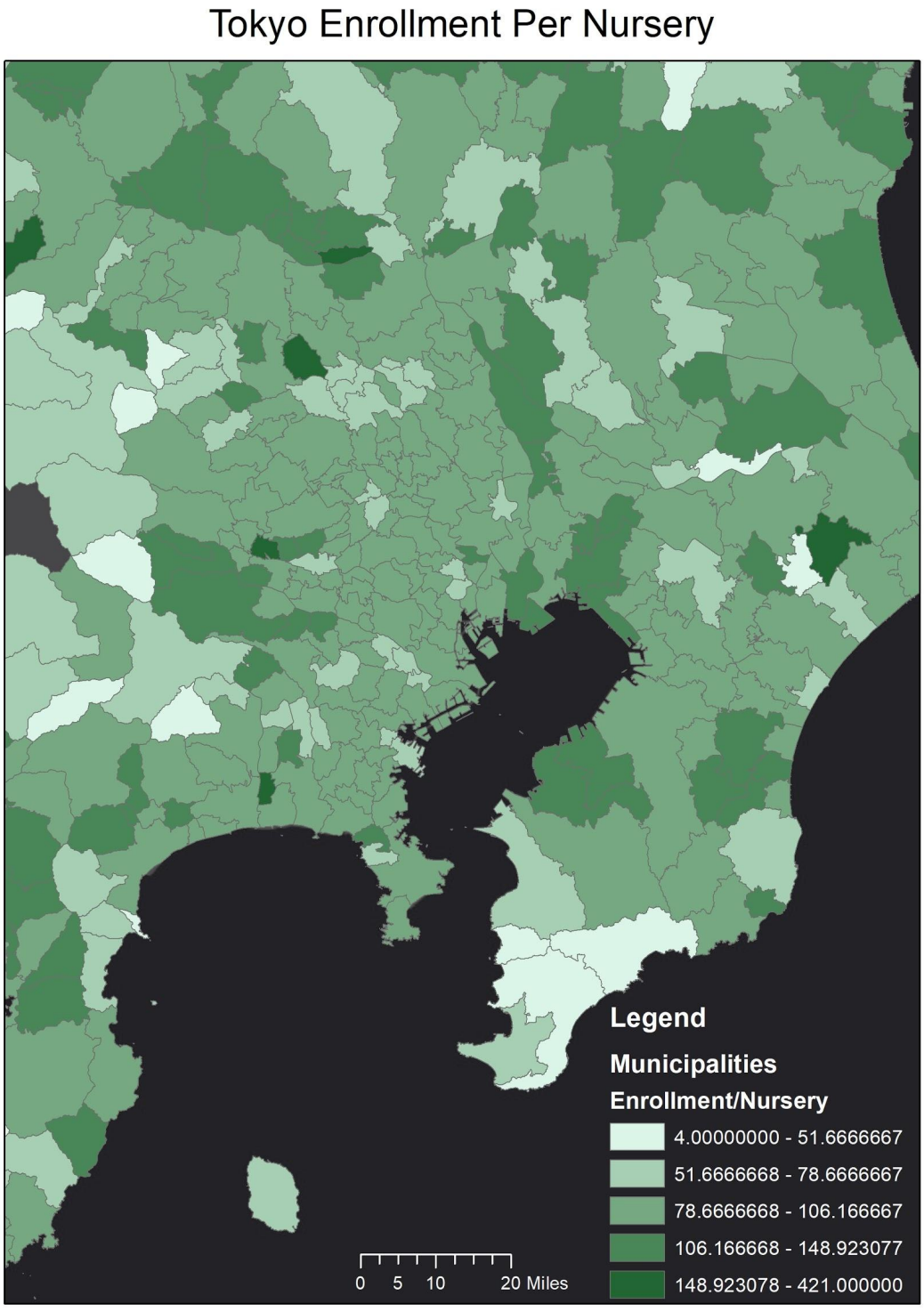

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Figure 6

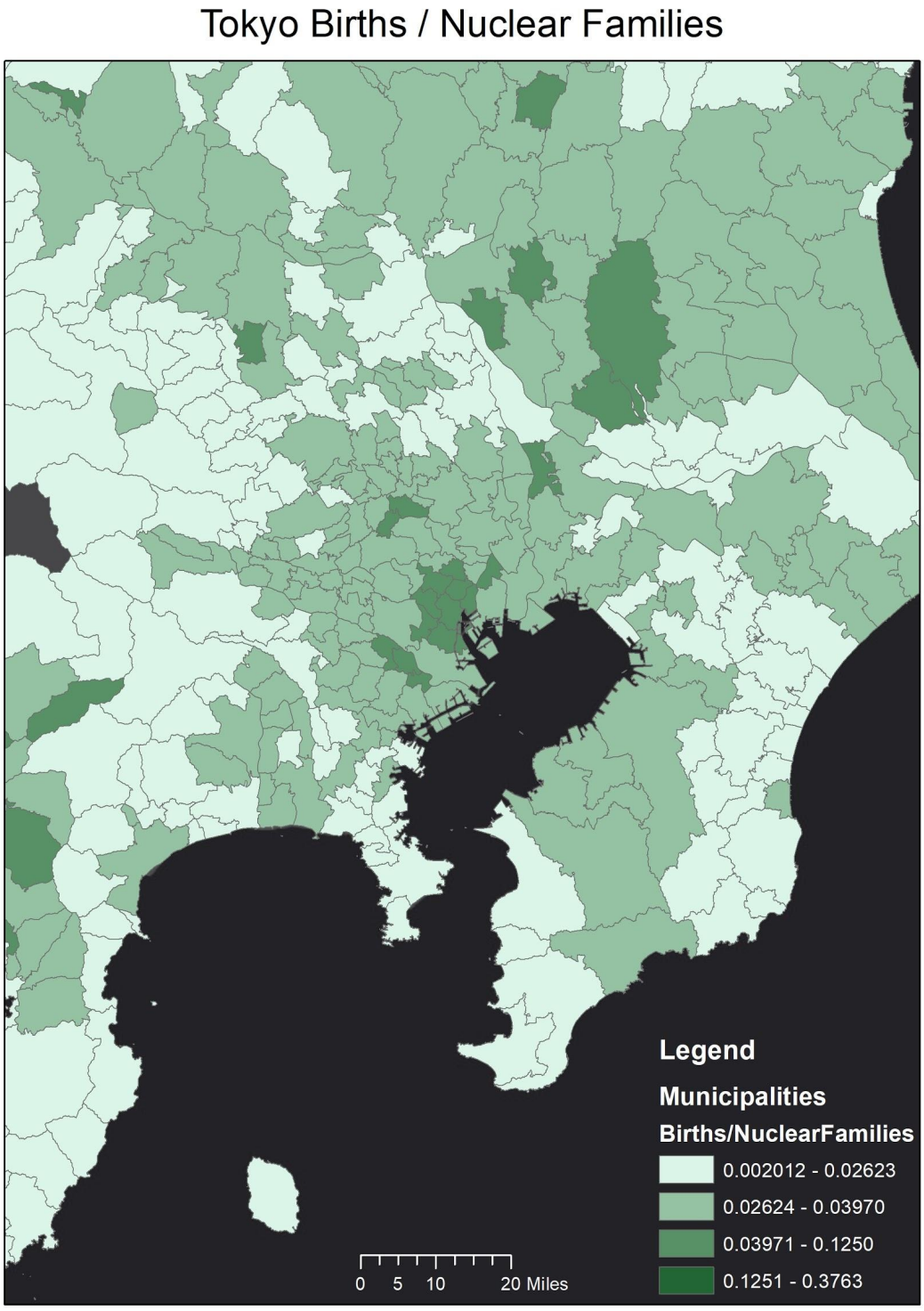

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Figure 7

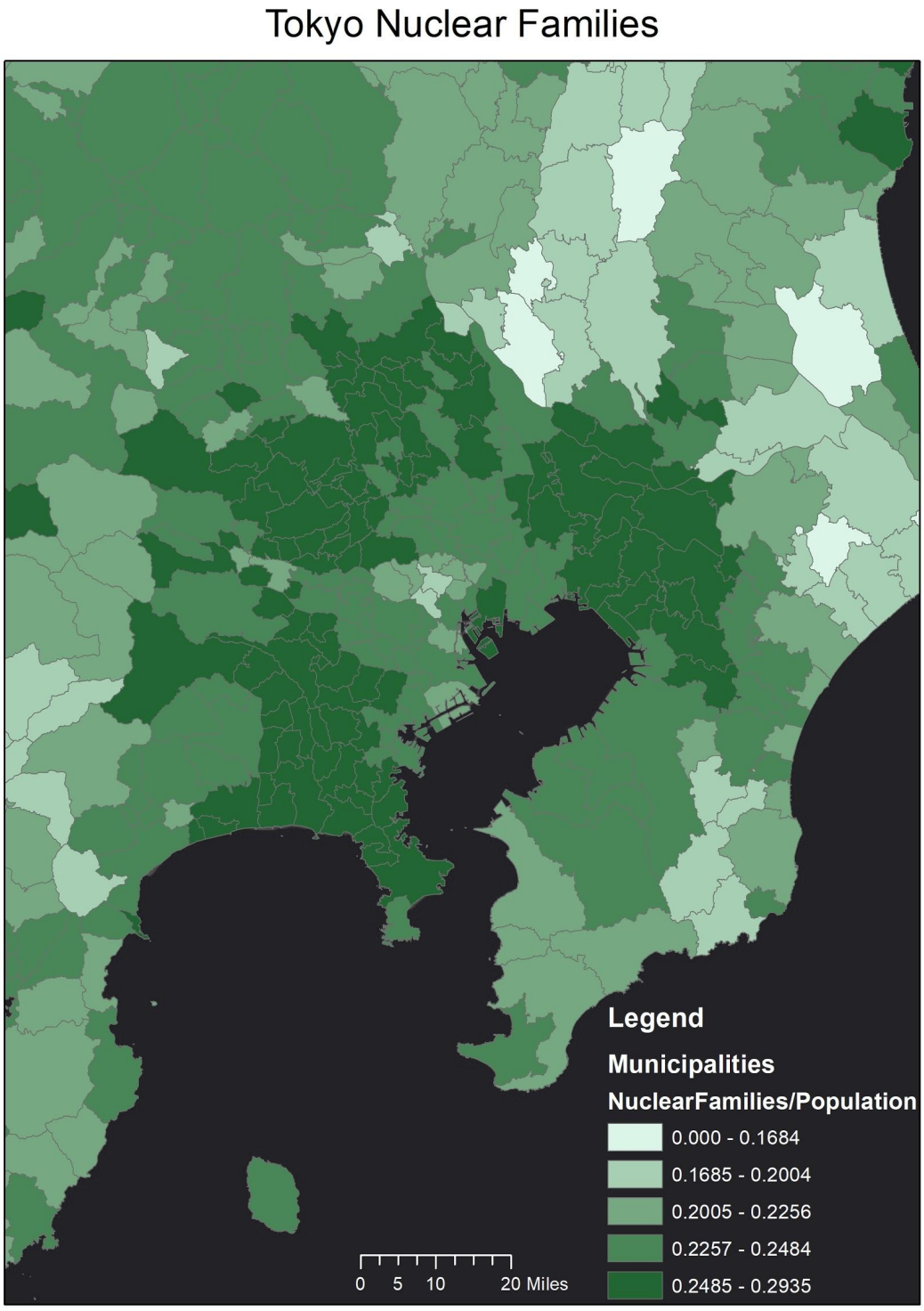

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Figure 8

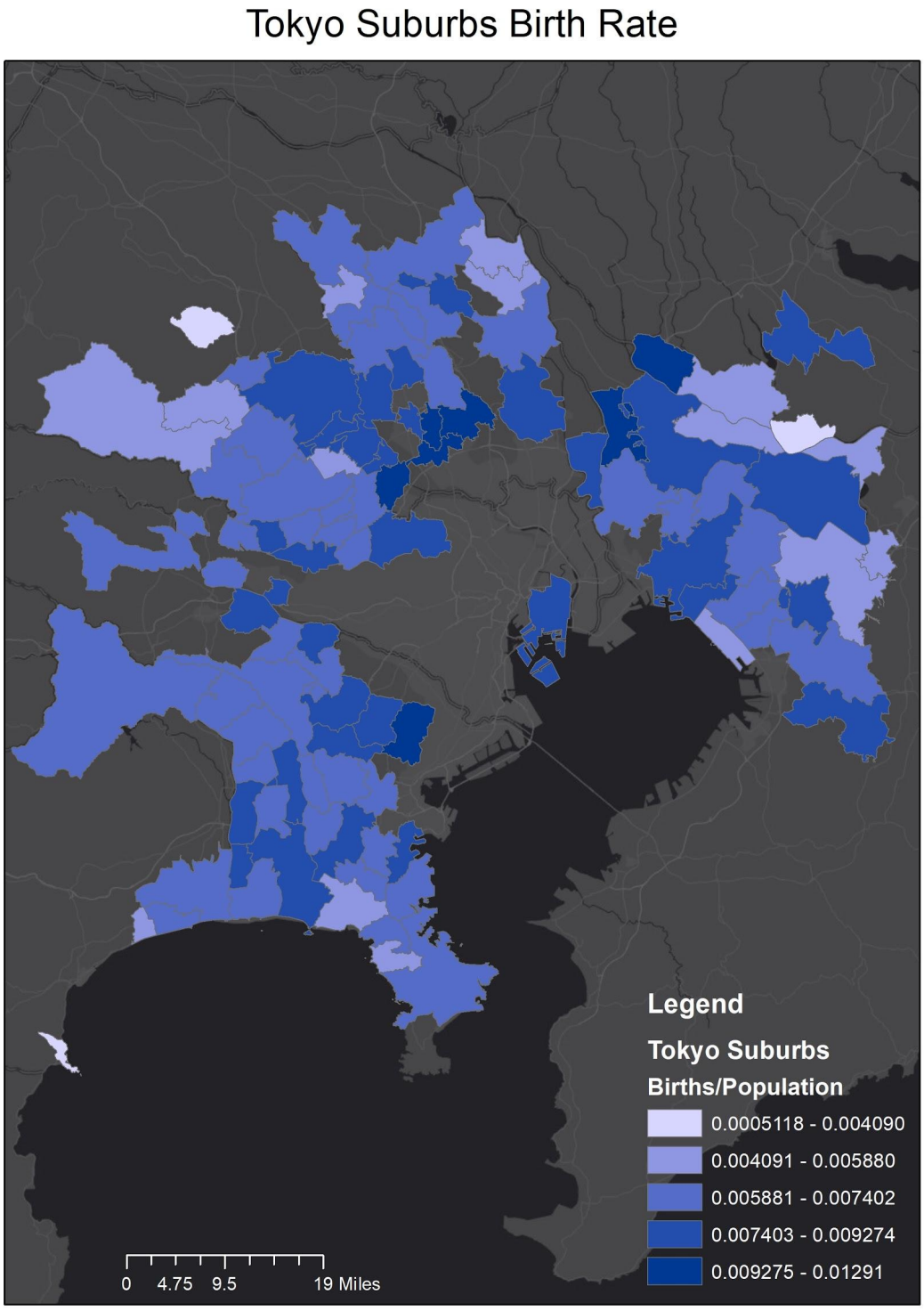

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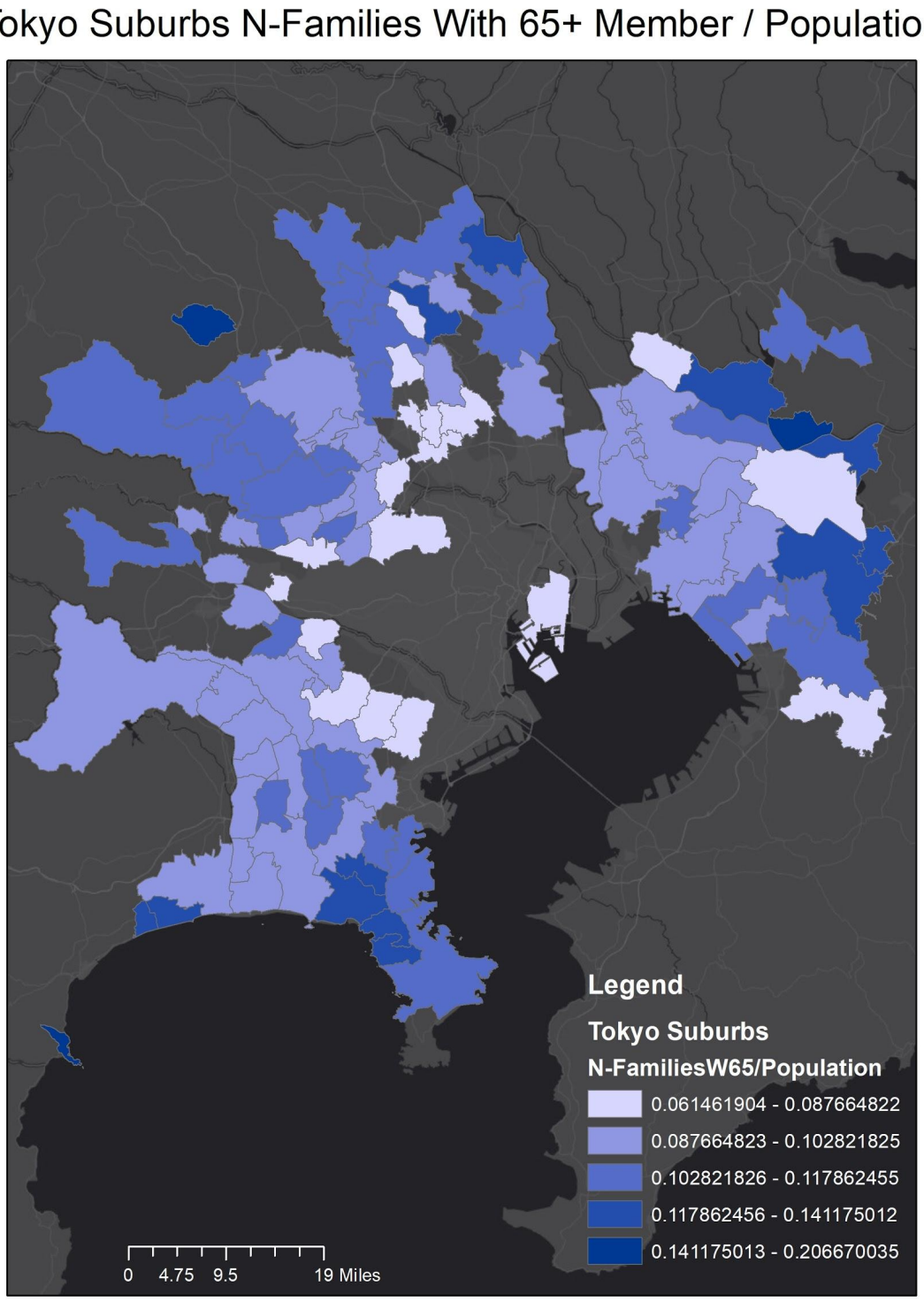
Figure 9



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