Geographic predictors of early 20th century northern Albanian tribal demography

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Abstract

As tribal social structures have long been prevalent in our species, understanding the drivers of tribal demography is of great importance. Here, we explore the potential effects of several geographic factors on population size among early 20th century northern Albanian tribes. Through a model comparison analysis of population data from forty-six tribes, we investigate how tribal population size was influenced by slope, net primary productivity, water availability, number of neighboring tribes, and distance to urban centers. Our results suggest that while slope and the number of neighboring tribes are the best available predictors, their overall ability to predict Albanian tribal population size in the early 20th century is poor. An unexplored factor such as tribal wealth (in terms of land, livestock, infrastructure, or marriage alliances) could be a more important driver of population size, but it is perhaps most likely that decades of conflict in the late 19th and early 20th centuries reshaped the demographic landscape of northern Albania and obscured any pre-existing geographic influences on tribal demography.

Keywords: *historical demography, population ecology, Balkans, fis, Robert Elsie*

Introduction

Many societies around the world have been - and continue to be - organized into what anthropologists have long called "tribes." While the term is common, nearly all of its definitional attributes have been contested since its earliest modern uses in anthropology (Sahlins 1961; Service 1962) and it has generated decades of debates around its meaning (Fried 1966; Crone 1986; Cohen 1978; Parkinson 2002). As we employ it here, the term "tribe" seeks to describe an organized collection of related families - whether consanguineal, affinal, or fictive kin - regardless of whatever other

characteristics tribes have been argued to possess or not. While the motivation for such group formation is unclear, one common explanation is that tribal societies emerged as a form of risk mitigation against environmental and social uncertainty as large and cohesive groups of kin can better solve problems (Anderson 2002; Braun and Plog 1982; Parkinson 2002). At the base of this argument is the observation that tribal organization allows for the creation and maintenance of a social network that functions across multiple scales (spatial and temporal) and can be tapped into in times of stress and conflict. The segmental nature of tribal societies allows for the fission and fusion of these segments as needed, affording autonomy while retaining the ability to call on other members of the kin network for help as needed (Braun and Plog 1982; Parkinson 2002).

As tribal societies have been, and continue to be, such prevalent social structures in our species, understanding the factors that influence the size and composition of tribal groups (i.e., their demography) is of great importance. The population size of tribes varies widely, with some like California's Augustine Band of Cahuilla Indians having only 16 members (Lopez 2019). On the other hand, the largest Pashtun tribes of Afghanistan and Pakistan may number in the hundreds of thousands or perhaps millions (Glatzer 2002; Khayyam, Inamullah, and Shah 2018), though these larger tribal societies illustrate the difficulties of attempting to categorically distinguish tribes from tribal confederacies or broader ethnic groups. Even so, the demographic attributes of tribes are likely shaped by a variety of forces, including cultural norms, social structures, economic activity, health and wellbeing, violence and genocide, and attributes of the physical environment (Codding and Jones 2013; Hewlett 1991; Johansson and Preston 2023; Maharatna 2000; Maharatna and Chikte 2004; Thornton 2005).

As such factors necessarily vary across time and space, we explore these questions through a targeted study of tribal demography in early 20th century northern Albania. Until the 20th century, Albania was home to one of the last surviving tribal societies in Europe (Elsie 2015b; Galaty 2002). As with other tribal societies around the world, these Albanian tribes possessed many common characteristics seen elsewhere: a cultural conception of personal honor (*besa/nderi*), a strong sense of hospitality (*mikpritja*), feuding and revenge killings (*gjakmarrja*), and community dispute resolution (Elsie 2015b; Gjeçov 1989; Galaty et al. 2013). Also similar to many other tribal societies, northern Albanian tribes survived for so long due to "strategic isolationism," preserving their traditional way of life with the help of the rugged mountainous landscape in which they lived (Galaty et al. 2013). In such an environment, families banded together for self-defense and mutual aid (Elsie 2015a, 8), allowing them to persist on the periphery of - and often in direct resistance to - states (Scott 1998; 2017).

Albanian tribal society was based on a kinship system surrounding what is called the *fis*. The term *fis* is often translated as tribe or clan but is specifically a kin group where all male members are of common patrilineal descent (Elsie 2015b, 3–5). Many Albanian tribes documented ethnohistorically traced their descent from ancestors several centuries in the past, sometimes a dozen generations ago (Elsie 2015b; Galaty et al. 2013, 53–59). Being patrilineal, each *fis* was headed by a male elder, or *krye*

plak (head elder), with men acquiring wives from an unrelated *fis* through exogamous marriage (though not all tribes/*fise* were exogamous).

During the Ottoman period, a separate but related form of group identity developed called the *bajrak*, which translates to "banner" but can also refer to a clan or tribe (Galaty 2002; 2018). Some have suggested that the *fis* and *bajrak* are distinct: that the term *bajrak*, as an Ottoman administrative unit, implies a territory while *fis* refers to a cultural relationship of common kinship or descent, but not necessarily a geographic territory (Elsie 2015b). Indeed, *bajrak* territories often incorporated multiple *fise*, and it may well be the case that the Ottomans instituted this separate political system specifically with the goal of dividing and destabilizing the earlier *fis* system (Galaty 2018, 126). Even so, others argue that the term *fis* does in fact imply geographical territory, and that these map onto the environment in places like northern Albania (Flannery 1972, 401–2; Galaty et al. 2013).

By the 20th century, however, these two systems - whatever their overlaps may have been - had become reified such that censuses and maps could be made by external administrators to enumerate tribal populations and attempt to define rough territories for such groups. The most complete set of population estimates from this period comes from the 1918 Austro-Hungarian census, which was conducted by Austro-Hungarian military officers, aided by Albanians, collecting detailed data on all persons encountered (Gruber 2019b; Gruber, Kera, and Pandelejmoni 2020). From these census data, Elsie (2015b) attributes population sizes to forty-six tribes, with associated territories, in northern Albania (Figure 1).

With this snapshot of early 20th century Albanian tribal demography, it becomes possible to consider the factors that impacted the size and density of populations living at this time and why population varied so much between different tribal groups. Previous studies in this region have identified numerous exogenous and endogenous factors that promoted or regulated population growth through time, including climatic changes affecting precipitation patterns, the introduction of crops from the Americas, emigration, female infanticide, and blood feuds (Galaty et al. 2013). Determining the precise impact of each of these factors on tribal demography is difficult, however, given the quality of available data for earlier time periods. Moreover, the history of northern Albania is punctuated by conflict capable of producing multigenerational effects on the regional population in ways that can be difficult to disentangle from local conditions.

Given these various complications, a useful first step for understanding the factors impacting the demography of Albanian tribes is to consider the geography of tribal territories themselves. That is, in addition to the various socioeconomic and historically contingent processes that no doubt impacted tribal demography, did the characteristics of the landscapes those tribes inhabited have any effect on inter-tribal differences in population size? Focusing specifically on such geographic aspects, we investigate the impact of these factors on the tribal population sizes. Through this work, we contribute to a broader understanding of the relationships between tribal demography and the physical and social environment.

Methods

To investigate possible geographic drivers of northern Albanian tribal population size, we first obtained data on Albanian tribal populations from the year 1918 CE. These data, as well as the spatial location and extent of each tribe's territory, were taken from Robert Elsie's (2015b) book *The Tribes of Albania*. Elsie provides population estimates for forty-six tribes from various years between the 17th and 20th centuries, drawn predominantly from travelogs but also census records. Of course, the number of tribes existing in northern Albania varied through time and this dataset simply provides one snapshot of tribal demography from the early 20th century. Additionally, there are disagreements over whether each of these forty-six "tribes" is truly a *fis* or *bajrak*: some are perhaps better understood as geographic regions in which tribal people lived (e.g., Mati), not as tribes themselves.
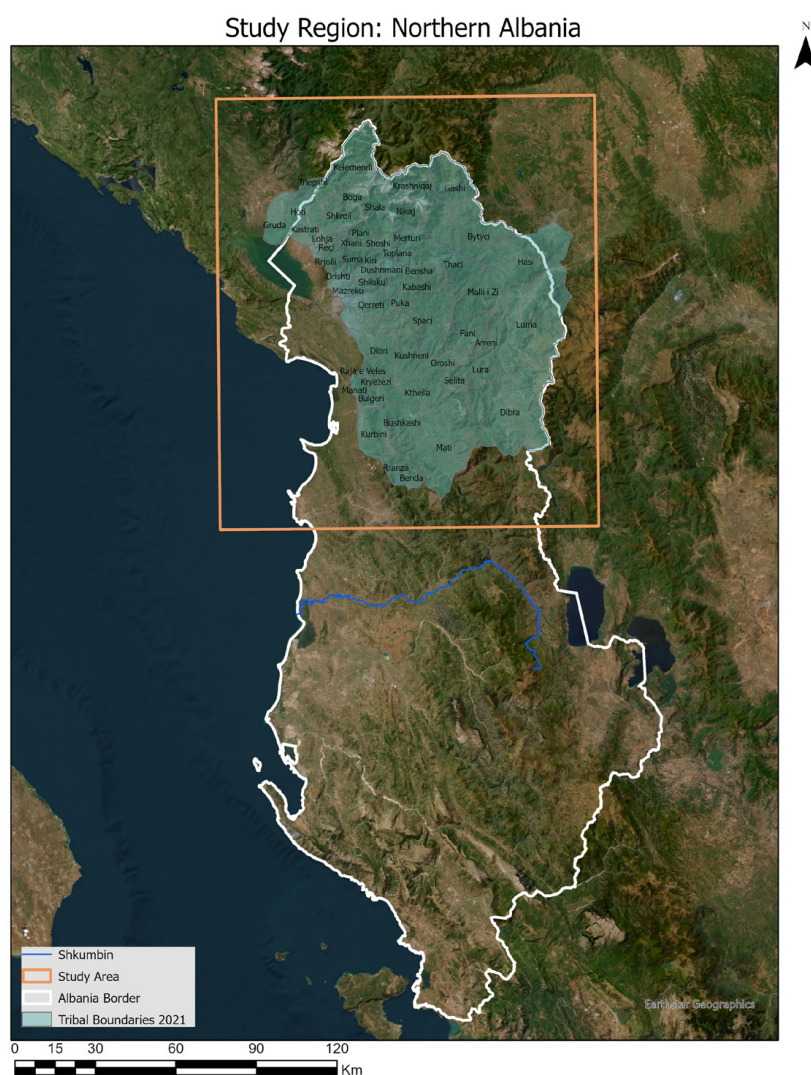

Figure 1: Map of the northern Albanian tribal territories analyzed here.

Despite such difficulties in determining whether a group was a "tribe" or not, Elsie's dataset nonetheless attaches demographic estimates to spatial territories: each of these data points represents some spatial configuration of tribal peoples for which we can obtain population and geographic data. As such, this dataset permits analysis of how geography impacts demography of a tribal society in a general sense, without requiring each unit of analysis to be a true "tribe" itself (and indeed, such a determination is often quite challenging in other regions and time periods given the vagueness of the concept of a tribe). Focusing on the 1918 census, we modeled raw population estimates provided by Elsie and also converted these counts into population densities by first digitizing the tribal territory maps provided by Elsie and then dividing the 1918 census counts by tribal territory area.

Geographic Predictors

With these data, we conducted a model comparison analysis in which we evaluated several candidate models that seek to explain tribal population using some combination of up to five geographic predictor variables. These predictor variables were mean net primary productivity, mean slope, water availability as measured by flow accumulation, the number of neighboring tribes, and the distance to the nearest major city (Figure 2). We chose these five variables due to suggestions in previous scholarship that these factors are likely relevant for demographic patterning in northern Albania.

Net primary productivity (Figure 2C) is a measure of energy availability in an environment based predominantly on photosynthetic activity of plants. This variable thus serves as a proxy for food availability and food production potential in an area, also known as carrying capacity. Tribal population sizes in other regions (e.g., western North America) are known to map onto net primary production (Codding and Jones 2013). This is because primary production provides the foundation of food energy in an ecosystem: primary producers (i.e., plants) are consumed by primary consumers (i.e., herbivores and omnivores) which are then consumed by secondary and tertiary consumers (i.e., omnivores and carnivores). Human subsistence thus relies both directly and indirectly on primary production. This variable also serves as a more immediate driver of population trends that encompasses upstream factors like precipitation, insolation, and soil chemistry which all impact human demography through primary production. We calculated net primary productivity for each territory from an annual global 500-meter dataset (MOD17A3HGF Version 6.1) provided by NASA's Land Processes Distributed Active Archive Center (LP DAAC) (Running and Zhao 2021). These analyses were conducted in Google Earth Engine (Gorelick et al. 2017).

Slope serves as a proxy for terrain ruggedness (Figure 2D), which impacts travel costs as well as the amount of land suitable for settlement and farming (Galaty et al. 2013, 138–39). Though settlement and agriculture can certainly take place on slopes, both would entail greater investments of time and labor into the construction and maintenance of slope stabilizing infrastructure such as terraces than settlement and farming of flatter terrain. We would therefore expect that regions characterized by

steeper slopes would be less attractive than those with more gradual slopes. To assess this variable, we calculated slope values from a 90-meter elevation dataset produced by the Shuttle Radar Topography Mission (SRTM) (Jarvis et al. 2008). Slope values were calculated per pixel and then averaged within each territory. These analyses were conducted in Google Earth Engine (Gorelick et al. 2017).

Water availability (Figure 2E) is another factor with direct relevance for supporting and sustaining human populations. Though northern Albania receives plentiful precipitation, most of this comes during the winter and, characteristically for the Mediterranean, the region can experience prolonged summer droughts (Merkoci et al. 2012). For this reason, sustained water availability year round is essential for successful food production, which during dry summer months depends on melt from high elevation snowpacks (Galaty et al. 2013, 37). As annual snowfall varies year-to-year, we have opted to approximate potential runoff by using calculated water flow accumulation for each tribal territory. Flow accumulation calculates the cumulative weight of all cells in an elevation model that flow through each downstream cell, thereby providing an approximation of total water availability in catchment areas (Connolly and Lake 2006, 258). For this study, we drew on the WWF HydroSHEDS Flow Accumulation dataset that provides near-global coverage at a resolution of 1 kilometer (Lehner, Verdin, and Jarvis 2008). We extracted the maximum flow accumulation value for each territory, which we take as a proxy for the maximum flow potential. These analyses were conducted in Google Earth Engine (Gorelick et al. 2017).

The number of neighboring tribes (Figure 2F) serves as a proxy for social connection. This can be understood as an Allee effect (Allee 1931), or positive density dependence. This concept refers to the fact that individuals often benefit from proximity to others due to the potential for cooperation. Neighboring tribes provide potential allies, economic collaborators, and marriage partners. However, proximity to other tribes is not universally beneficial. The prevalence of blood feuds in 19th and early 20th century northern Albania (Galaty 2013; Galaty et al. 2013) means that proximity to members of other tribes may have elevated the risk of violence, increasing male mortality. This would constitute negative density dependence: the imposition of costs for proximity to others, not benefits. On the other hand, the increased threat of violence from nearby tribes could have incentivized larger tribal populations to protect against said violence. For all these reasons, the demographic effect of proximity to other tribes is complex, but potentially relevant. We therefore include this variable in our models, derived for each territory by calculating the number of other territories that share a border with it.

The distance to the nearest major city (Figure 2G) also serves as a measure of social connection, or an Allee effect. This measure approximates the social benefits of economic opportunity, with proximity to urban centers permitting wage labor, social connections, and access to markets for both buying and selling. Expectations for culturally important commodities such as coffee, sugar, and tobacco meant that market access was necessary for Albanian households (Galaty et al. 2013, 234). Distances were calculated using Least Cost Path Analysis (LCP) in ArcGIS from the centroid of each tribal territory to the closest of ten urban centers in the region known to be important
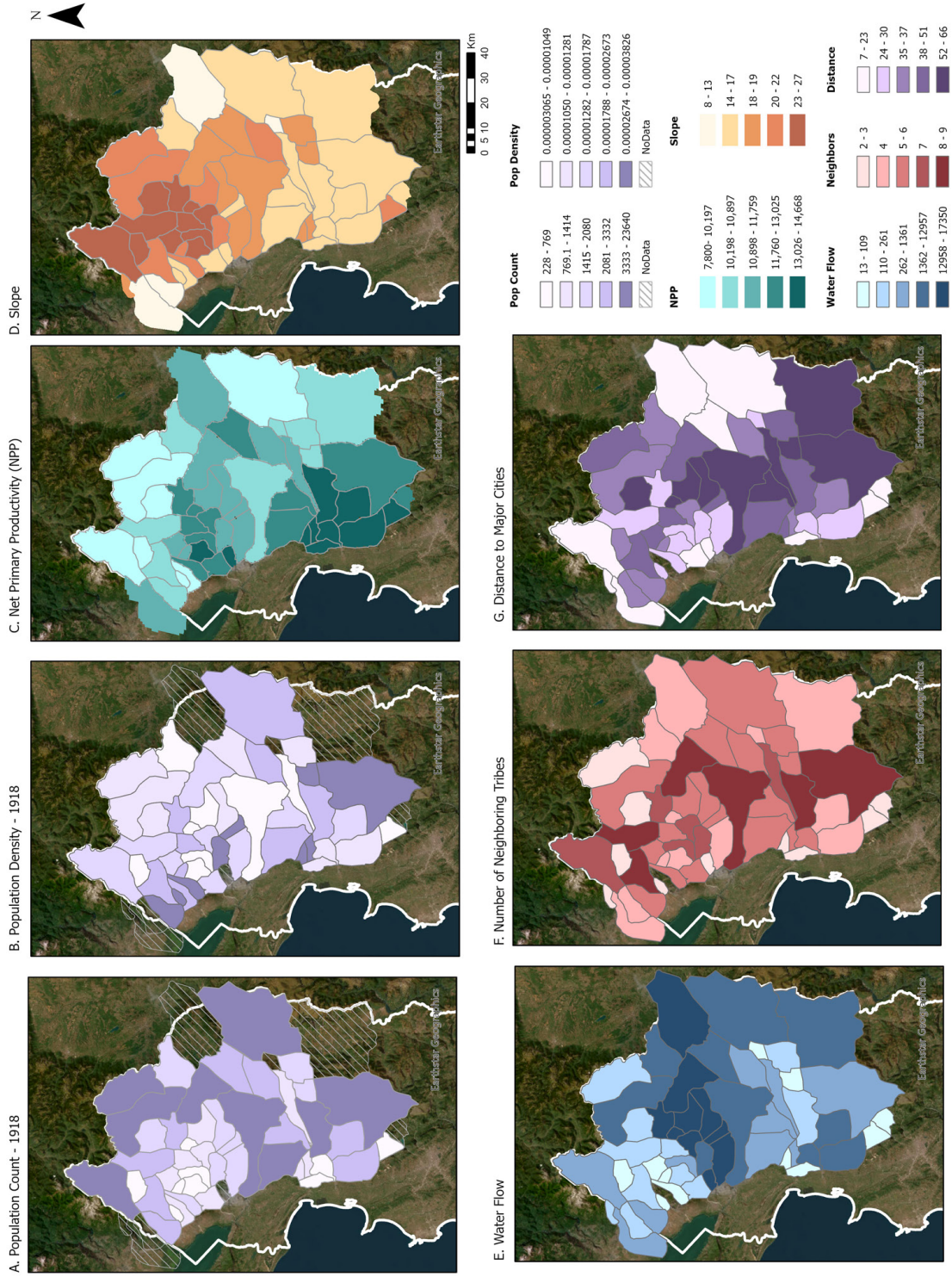
Figure 2: Maps of population count, population density and our five geographic predictor variables for each tribal territory.

locations of markets: either Shkodra, Lezha, Kruja, Durres, Ulqin, Kukes, Peja, Gusinje, Podgorica, or Prizren. A 30-meter resolution ASTER Digital Elevation Model (DEM) of the region was used as the cost raster for the analysis, while the input backlink raster was calculated using a slope roster calculated from the same DEM mentioned above (NASA/METI/AIST/Japan Spacesystems and U.S./Japan ASTER Science Team 2019).

Model Comparison Analysis

A model was built for each of the thirty-one possible combinations of these five predictor variables and for both raw population counts and population density as response variables. Therefore, a total of sixty-two models were assessed: one set of thirty-one models of raw population and one set of thirty-one models of population density. All were quasi-Poisson family generalized linear models with log link functions. Quasi-Poisson distributions were used to account for overdispersion but using such a quasi-likelihood distribution makes model comparison more difficult with the standard Akaike's Information Criterion (AIC). As such, we compared these models using generalized cross validation (GCV) scores, which reflect both a model's explanatory ability and its simplicity. As with the more familiar AIC, models which explain the data well and those which have fewer parameters have better GCV scores. Lower GCV scores reflect better models than higher GCV scores, but the scores have no independent or absolute meaning: they are only a relative measure of a model's goodness of fit and parsimony when compared with similarly specified models.

For each of the thirty-one models in our two candidate sets, we assessed the number of parameters (k) in the model, its GCV score, and its ΔGCV score: the difference in GCV scores between a model and the next worst ranked model in the candidate set. We also assessed the model's D^2 (deviance-squared) statistic (Guisan and Zimmermann 2000), which is a maximum likelihood measure of goodness of fit or effect size that can be interpreted similarly to the more familiar R^2 statistic. D^2 is a proportion between 0 and 1 with higher values indicating models that are better equipped to explain the deviance in the data: the discrepancy between the fitted and observed values. For the best performing model in each candidate set, we visualized the model fits for each covariate, holding any other covariates constant at their mean value.

Models were fitted using the *gam* function in the 'mgcv' package (Wood 2023) . The *gam* function was used to build these generalized linear models in lieu of the base *glm* function as the former automatically calculates GCV scores for quasi-likelihood models and the D^2 statistic. All model building, analysis, and visualization was conducted in R, version 4.3.0 (R Core Team 2023) and all code (both R and Google Earth Engine) used here is available at doi.org/10.17605/OSF.IO/V7E4Y.

Results

In sum, the 1918 census counted 127,638 people living in northern Albanian tribal territories, with considerable variation between each. Population density figures are

slightly right skewed, ranging from 0.003 to 0.038 individuals per square kilometer, with a median of 0.016 and mean of 0.018 (Figure 3a.). The raw population numbers reported by Elsie (2015b) are much more strongly right skewed, ranging from 228 to 23,643 individuals with a median of 1,652 and mean of 2,836 (Figure 3b.). However, the majority of tribes in 1918 had fewer than 5,000 individuals, with only three tribes having more than that number. The smallest tribe in this dataset is the Boga with 228 people, while the Mati tribal group (not a *fis*, but a collection of *bajraks*) was the largest in the dataset, with 23,643 people. Tribal territories also show considerable variation in size, ranging from that of the Xhani at 21.5 km^2 to that of the Luma at 817 km^2.

Model comparison for population densities (Table 1) indicates that the best performing model is that which includes only slope as a covariate. This model, with one parameter (excluding the model intercept), has a GCV score of 0.00355 and a D^2 value of 0.15. This model therefore only explains 15% of the deviance in population density, leaving 85% unexplained. Looking at the model of population density that includes all five possible predictors (Model 31), its D^2 value is still only 0.180 despite being the most complex model in the candidate set. This indicates that even taken together, all five of these geographic predator variables still only explain 18% of the deviance in population density. Other variables unaccounted for here therefore offer greater explanatory power.
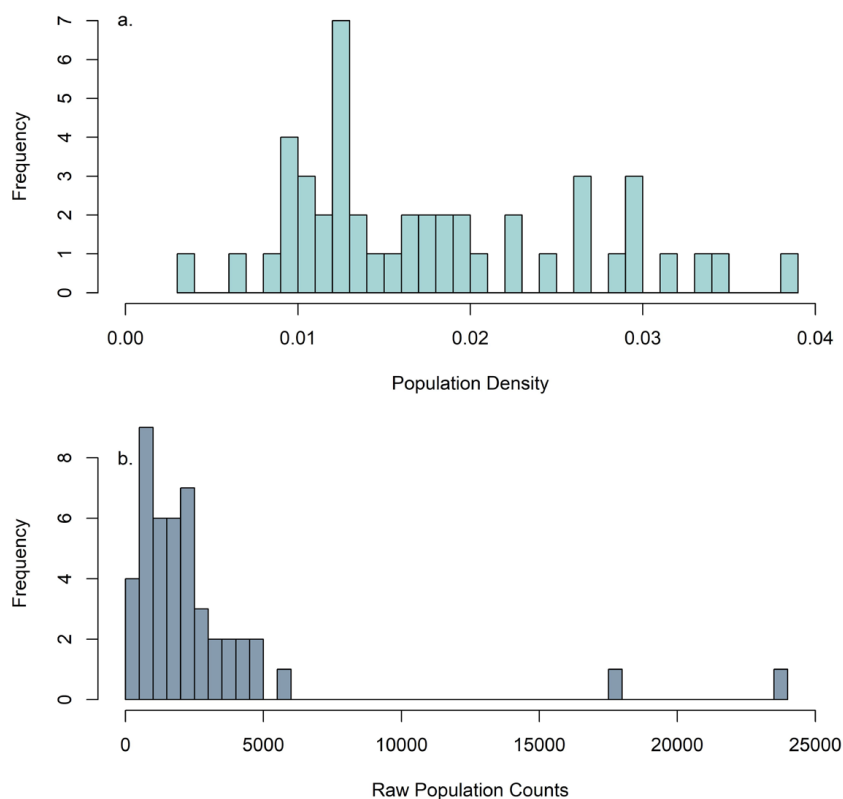

Figure 3: Population densities (a.) and raw counts (b.) from Elsie (2015b).

For raw population counts, the best performing model includes slope and the number of neighboring tribes (Table 2). This two-parameter model (excluding the intercept) has a GCV score of 2593.826 and a D^2 of 0.29. This model therefore leaves 71% of the deviance in raw population counts unexplained. While this model has a higher D^2 than the best model of population density, suggesting that these two variables do have some explanatory potential, the model is still far from perfect. The most complex model of this second candidate set (Model 31), including all five predictors, still only has a D^2 of 0.294. As with population density, the rather low D^2 values of these raw population count models indicates that additional variables not explored here are responsible for the majority of the patterning in tribal population size in 1918. Additionally, it must be noted that our variable counting the number of neighboring tribes is susceptible to edge effects. Tribal territories at the margins of our study area are only bounded by other territories on one side. This is an artifact of how these data are recorded and reported by Elsie, as of course people lived outside of the bounds of this study area. Caution should therefore be taken when interpreting whether the number of neighboring tribes is indeed a useful predictor of population.

The best model of population density, plotted in Figure 4, indicates that slope has a negative effect on population: as slope increases, tribal population density declines. The best model of raw population counts, plotted in Figure 5, reveals a similarly negative effect for slope. This model also reveals a positive effect of the number of neighboring tribes. Thus, as slope increases, population declines. But as the number of neighboring tribes increases, so too does the number of individuals who belong to a tribe.

Discussion

Our results indicate that, overall, the geographic attributes of northern Albanian tribal territories assessed here are not satisfactory predictors of tribal population in 1918 CE. These model comparison analyses suggest that, of the variables considered, slope is the most useful in predicting population size and density, with the number of neighboring tribes also being a potentially useful predictor. That these two variables explain less than a third of the deviance in models of population counts suggests that they are useful predictors of tribal demography, but not the most important. Primary production, water availability, and the distance to urban centers contribute less to models of population size or density.

In models of both raw population and population density, population declines as slope increases. This is consistent with what would be expected if more rugged terrain reduced the suitability of an environment through travel costs or perhaps more likely limited availability of farmland. Flatter terrain is preferred for farming, thus lower-slope tribal territories could have produced more crops and enjoyed higher carrying capacity as a result (Galaty et al. 2013, 138–39). Additionally, in the best model predicting raw population (not density), population size and the number of neighboring tribes positively covary. This is consistent with an Allee effect, suggesting that greater proximity to other tribes results in larger populations. As intertribal feuding (often

resulting from marriage disputes) was more deadly than intratribal feuding (Galaty et al. 2013, 81), higher risk of mortality associated with proximity to other tribes with whom feuds could occur may have thus been counteracted by the benefits of that proximity.
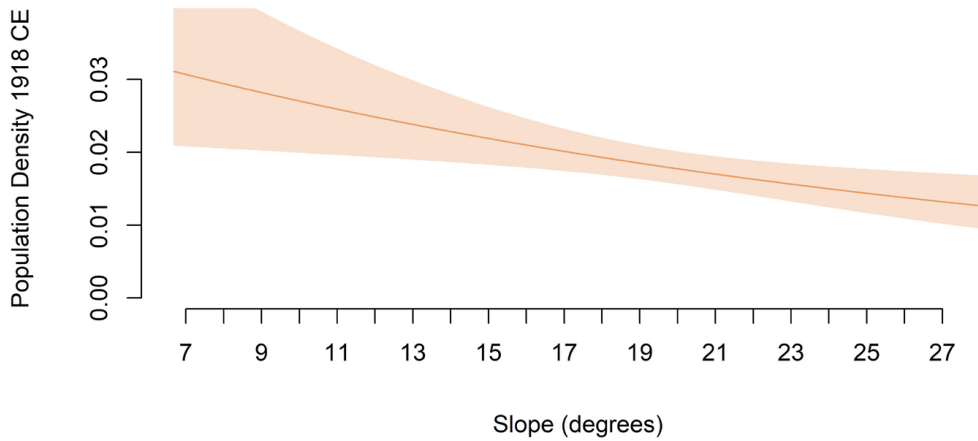

Figure 4: Effects of the covariates for slope on population density in the best model
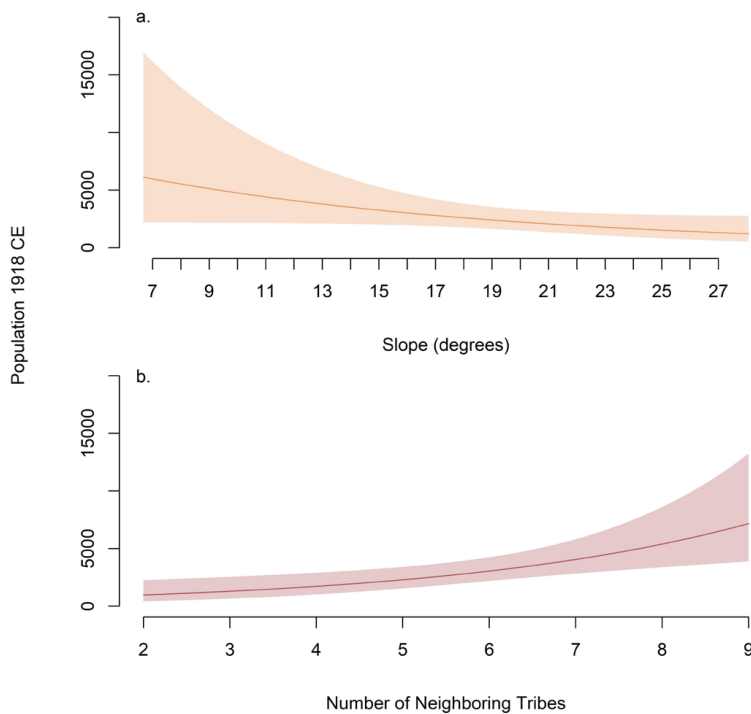

Figure 5: Effects of the covariates for slope (a.) and the number of neighboring tribes (b.) on raw population counts in the best model of the candidate set.

As for primary productivity, water availability, and distance to the nearest major city, the poor performance of these variables within our models is surprising given their direct relevance for food availability and consequently population size. That they did not perform better suggests that these factors were either inconsequential to demographic patterning or else their effects were mediated by other forces. Net primary productivity, for example, is largely similar across all tribal territories, which could contribute to it being a poor predictor of population size differences. On the other hand, water availability varies considerably between territories and would have been a critical component of agropastoral systems in the region (Galaty et al. 2013, 12, 37–39). It therefore seems clear that other, non-environmental variables played an important part in shaping tribal population sizes in 1918. We discuss some of these likely factors next.

Wealth

A potentially important driver of tribal population size that is not explored here may have been wealth. Wealth can be understood broadly as not only material possessions, but embodied and relational wealth as well (Borgerhoff Mulder and Beheim 2011; Borgerhoff Mulder et al. 2009; 2010). Factors like land, livestock herds, stored crops, houses, *kulla* (fortified towers), tools, and weapons all constitute material wealth. These things can shape demography by influencing carrying capacity—either directly (e.g., land, livestock, stored food) or indirectly (e.g., tools)—or by impacting the risk of mortality (e.g., weapons or *kulla*) (Colleran et al. 2015; Low 1990; Manfredini and Breschi 2008; Skirbekk 2008). In contrast, embodied wealth refers to factors like education, skills, health, and strength which can impact demography through fertility, life expectancy, and productive labor power (Kaplan et al. 1995; Skirbekk 2008; Snopkowski and Kaplan 2014; Stulp and Barrett 2016). Finally, relational wealth refers to social connections: marriage alliances, economic partnerships, and community structure. Relational wealth can impact demography via marriages, by permitting cooperative labor that shapes carrying capacity, or by promoting the flow of other forms of wealth through social networks (Chaudhary et al. 2016; Redhead et al. 2023). While these three forms of wealth and their specific manifestations in early 20th century Albanian tribes likely impacted demographic patterning in myriad ways, for the sake of space, we discuss only a few of these possibilities here.

Though our models include slope as a proxy for agricultural land availability (and models with population density as the response variable account for land area by definition) tribal land access was not as straightforward as territory maps suggest. The Kelmendi tribe, for example, is known to have pastured livestock along the Adriatic coast near Shkodra and Lezha in the autumn and winter, far from their formal territory in the northernmost mountains of Albania (Elsie 2015b, 20–21). Such non-contiguous land access makes true assessments of land availability difficult. We additionally do not have data on intertribal variability in livestock ownership, crop storage, or other possessions. As pastoralism was an important economic endeavor (Galaty et al. 2013, 109–11) and many species of livestock fare well at a variety of different slopes,

livestock herd size was also likely an important factor shaping tribal demography that is unaccounted for here.

Material wealth in the form of landscape investments also likely played an important role in shaping tribal demography. While our models explore the possible impacts of water availability, we have no means of assessing the importance of water-related infrastructure such as terraces and irrigation channels across tribal territories. Whether in territories with abundant or limited water availability, complex systems of irrigation and terracing would have been essential for capturing, storing, and distributing that water to fields and pastures (Galaty et al. 2013, 109, 139, 194). Such investments in the landscape (often termed landesque capital) may have thus compensated for differences in water availability between tribal territories, thereby reducing the effect of this variable on modeling population size.

Relational wealth as marriage ties could also have been an important driver of demographic patterning. While we do attempt to approximate the potential influence of marriage alliances through our inclusion of the number of neighboring tribes as a predictor variable, this proxy is imperfect and only appears to be impactful in models of population counts, not densities. In reality, marriages were often preferentially arranged between specific tribes such as the Shala and Shoshi (Galaty et al. 2013, 26, 91–94). Galaty et al. (2013, 91) note that while geographic proximity was certainly a factor in marriages, so too was strategic alliance formation in the context of historical events. Additionally, there is a question of causal direction with marriage ties. We expect that greater availability of extra-tribal marriage partners (i.e., the number of neighboring tribes) could increase population size, but it is also possible that larger tribes incorporating larger families are simply able to pursue more diverse marriage ties to different tribes (Galaty et al. 2013, 125).

Finally, the role of mountainous tribal communities as a demographic source for wealthier urban centers must be noted (e.g., Lozny 2013). Cities and towns generally had (and have) greater access to material and relational wealth and as such, were likely desirable places to live based on the benefits they confer (Weitzel and Codding 2022). While at various points in time, the Albanian highlands experienced influxes of people seeking to avoid the negative impacts of state control, residents of tribal communities in the mountains may have more frequently been incentivized to leave and immigrate to cities if possible (Schon and Galaty 2006), setting up the mountains as peripheries which served as sources of population growth for urban areas. Such out-migration from rural and mountainous areas to urban centers in Albania (and abroad) could have shaped early 20th century demographic patterns as it continues to today (D. R. Hall 1996; King 2005; Lerch 2014).

Conflict and Violence

It is possible that the poor fit of our models results from unaccounted for variation in tribal wealth, but it is perhaps more likely that endogenous and exogenous sources of interpersonal violence played a role in overwriting any preexisting geographic

patterning in population sizes. The blood feud (*gjakmarrja*) in particular is a well-known and long attested mechanism in northern Albania of resolving disputes and competing for resources while protecting one's honor (Boehm 1984; Galaty et al. 2013, 97–106; Hasluck 1954; Gjeçov 1989). Beyond its immediate impacts on population size through increased mortality, blood feuds also influenced settlement and residential patterns, the formation of marriage ties, and patterns of interaction and isolation, all of which impacted demography (Boehm 1984; Galaty et al. 2013, 97–106). Moreover, while many causes could initiate a blood feud, the most common factors were those most threatening to patrilineal and patrilocal social systems: adultery, marriage refusals, and bride abductions. While grievances associated with women were frequent causes of blood feuds, women and children were explicitly exempt from participating in them, with men almost exclusively being the perpetrators and victims of revenge killings (Fischer 1999). Even when not killed, the extended periods of time that men spent in hiding as a result of ongoing blood feuds likely still had detrimental effects on fertility, keeping men away from their wives and in turn requiring women to become the primary earners of the family (Galaty et al. 2013, 98). In the most extreme, though not uncommon cases, men would emigrate out of northern Albania entirely to escape the threat of death from ongoing blood feuds.

While it may be expected that the demographic consequences of blood feuding would be high incidences of male deaths, there is in fact little evidence to support this conclusion. Nopsca (1925, 52–53) famously provided a frequently-cited male death rate of 21 to 39 percent for northern Albania during the years between 1901 and 1905, but census records from 1918 suggest adult male deaths would have only reduced the total population by around 5 percent: a male death rate far lower than that reported by Nopsca. More impactful on tribal demography was how cultural expectations and fears associated with blood feuding appear to have inspired a strong cultural preference for male children, apparently manifesting in high rates of female infanticide (Szołtysek, Beltrán Tapia, et al. 2022; Szołtysek, Ogórek, et al. 2022). Indeed, examination of those same census records from 1918 shows that female infanticide may have accounted for an 11 percent decline in total population - twice that associated with male deaths from blood feuding (Galaty et al. 2013, 102). Thus, while the precise mechanisms by which blood feuding impacted demography - male mortality, female infanticide, and emigration - are complex and difficult to disentangle, the outcome was nevertheless likely a substantial epiphenomenal constraint on population growth that could have reshaped tribal demography irrespective of geography.

Further exacerbating these underlying cultural patterns of violence were the historical events and conflicts of the late 19th and early 20th centuries. The first of these conflicts were the anti-Ottoman rebellions of the late 19th century (Tallon 2012, 146, 189). At this time, areas still under Ottoman occupation witnessed periodic violence against the occupiers (Tallon 2012, 130). Albanian rebels who were not killed outright were often tried and punished with exile to Anatolia or other parts of the Empire, death by hanging or firing squad, or the burning of *kulla* or entire villages (Tallon 2012, 135–36). Disease is also known to have impacted Albanian populations during this

period. Cholera outbreaks had long been frequent in the Ottoman Empire and often had devastating effects in the regions where they occurred. An outbreak is known to have occurred in northern Albania in August of 1911, killing numerous inhabitants of the region, both Albanian and Ottoman (Tallon 2012, 115, 145).

Ottoman punishment of Albanian rebels also included conscription, which not only attempted to enforce peace by removing problematic individuals but continuously supplied their army with new soldiers. Albanian tribesmen were often conscripted to quell rebellions in other parts of the empire, which caused further discontent among the Albanians who were often willing to serve in the Ottoman army but preferred staying close to home (Tallon 2012, 139). The period between 1908 and 1912 in particular saw an increase in displacement, migration, and loss of life. In 1910, following a fragile "peace," 3,000 Albanians are said to have crossed the northern border into Montenegro and settled predominantly in Podgorica. Many were later forced to return in 1911 as part of an agreement between King Nicholas of Montenegro and Russia (Tallon 2012, 132–33). In Kosova, conflict caused an estimated 150,000 people to flee and migrate to neighboring regions (Tallon 2012, 176). Such forced and voluntary relocations, alongside mortality from Ottoman-Albanian conflict, would have been important drivers of heterogeneity in northern Albanian tribal demography at this time and may have overwritten any underlying geographic influences on population size.

Following these smaller rebellions and insurrections came the Balkan Wars of 1912-1913, culminating in the formation of the independent state of Albania (Blumi 2014; Galaty 2018, 126). During this war, Albanian guerilla forces fought on multiple fronts as other Balkan states tried to stake their claims: notably Montenegro and Serbia to the north and Greece to the south (Vickers 2019, 62–72). It was not until western European powers applied pressure to these other Balkan states that they withdrew out of Albania (Blumi 2014). Then, just one year after the conclusion of the Balkan Wars, World War I (WWI) broke out. While Albania was never fully involved in WWI, it is estimated that the number of casualties in the country amounted to 70,000 individuals out of its total population of about 800,000. In addition to the involvement of the "Great Powers" in the region, Balkan states who remained unhappy following the treaties and land allotments of the Balkan Wars (primarily Serbia) made a grab for Albania again and the young country "became everyone's battleground" (Vickers 2019, 83). This pair of large-scale conflicts assuredly impacted the demographics of northern Albanian tribes who were heavily involved in both. The population of the Shala tribe, for example, declined for the first time in centuries due to these conflicts (Galaty et al. 2013, 78).

The loss of life and large-scale assimilation of women in the workforce as a result of WWI left a pronounced and lasting impact on population numbers and social norms worldwide (Gruber 2019a, 119). As in the rest of Europe, fertility declined in Albania following the war (Gruber, Kera, and Pandelejmoni 2020; Gruber 2019a). This drop in fertility could also be due to the harsh living conditions of young married women in Albania, potentially exacerbated by the war. After WWI, men began marrying earlier than before while women married later. There was also an increase in the number of female household heads, which occurred due to higher male mortality from combat and

disease. Finally, there was also a decrease in local marriages and increase in mobility driven by WWI as the population moved from the rural areas to cities, specifically the new Albanian capital of Tirana (Gruber, Kera, and Pandelejmoni 2020). It is also of note that nearly 250,000 soldiers were stationed in Albania throughout the war: soldiers who had to be fed and housed, likely placing stress on local people. Disease, famine, violence, and poverty left the young country in poor shape by the end of WWI, with some villages "completely decimated" (Gruber, Kera, and Pandelejmoni 2020, 120). As all of these changes occurred immediately before the 1918 Austro-Hungarian census upon which the analyses herein are based, these events certainly had an impact on the population of this region as recorded in the census.

Conclusion

Albanian tribal population size in the early 20th century is not adequately predicted by the geographic variables of net primary productivity, slope, water availability, number of neighboring tribes, or distance to the nearest major city. Slope and the number of neighboring tribes do have some predictive power, suggesting that terrain ruggedness and the positive density dependence of Allee effects were relevant factors impacting tribal demography. Yet overall, the explanatory power of these models is low. Unexplored factors like tribal wealth - land access, irrigation and terracing, or marriage alliances - could represent better predictors of tribal population size, but it is perhaps most likely that decades of conflict and violence in the late 19th and early 20th century reshaped the demographic landscape of northern Albania and obscured any pre-existing geographic influences on tribal demography.

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