Applied Geography 100 (2018) 55–67

Contents lists available at ScienceDirect

Applied Geography

journal homepage: www.elsevier.com/locate/apgeog

Linking geomorphological and demographic movements: The case of Southern Albania

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ARTICLE INFO

Keywords:
Migration
Erosion
Remote sensing
Demography
Anthropology
Southern Albania

ABSTRACT

Albania has experienced one of the Europe's highest population migration rates in recent decades. At the same time, the landscape of this country has very dynamic geomorphological behaviour (erosion and ground subsidence), as an effect of various drivers. This paper examines the correlation between the population migrations and geomorphological dynamics in the wider Vlora area in Southern Albania between 1979 and 2016. In social studies and the humanities this interplay is largely unrepresented, whereas in the environmental sciences these two issues have been conceptualized as having a causal relationship. The article develops a tripartite analytic-synthetic model consisting of (A) remote sensing analysis based on automated land/water detection from satellite data; (B) demographic analysis focusing on population changes using the methods of statistical analysis; and (C) extensive anthropological fieldwork grounded on participant observation, archival work and gathering previously inaccessible statistical and other relevant data. The results of this study show that the coastal erosion or water inundation along with other geomorphological (site-specific relief, place-bound ground subsidence and water bodies distribution) and geotectonic characteristics of the wider Vlora area are inextricably bound up with the population migrations. The paper foregrounds new methodological approaches that correlate coastal or peri-coastal erosion with geomorphological, geotectonic and population movements, and provides a holistic framework that can be applied to examine this issue in similar areas elsewhere.

1. Introduction

Due to accelerated coastal and peri-coastal processes like rising seas, land degradation and anthropogenic pressures, such as building infrastructure, deforestation, migration, etc., coastal erosion (or the "loss of coast") is becoming a pervasive issue in many areas of the world (Cellone, Carol, & Tosi, 2016; Dunjó, Pardini, & Gispert, 2004; Ford, 2013; Pranzini, Wetzel, & Williams, 2015). This can also be detected in the Mediterranean (e.g. Özhan, 2002) and Black Sea coastal plains (Furlani, Pappalardo, Gómez-Pujol, & Chelli, 2014). Given their complex geotectonic and geomorphological makeup with varying relief over the shortest distances, the low lying coasts of the Mediterranean so far remained under-researched (Furlani et al., 2014). In contrast, macrogeosynclinal areas around the globe have become centres of data collection for measuring the extent of coastal losses due to maritime transgression as a consequence of the complex climate changes. The renowned Mississippi delta in Louisiana is nowadays seen as offering the most striking evidence of land loss through soil erosion.[1] However, the transnational European CORINE project designated the Adriatic coast, with 25% of the land subject to erosive processes, as the most exposed to the soil erosion among all Mediterranean coasts (CORINE, 1998, 2003). Struck by these changes, the research team visited the longest stretch of the low-lying coast of the Eastern Adriatic Sea, where the same danger of land loss was envisaged. Owing to the previous research results, the authors teamed up to test and explain these processes from different disciplinary points of view. As a research case the authors limited themselves to the wider Vlora area in Southern Albania, and applied a cross-disciplinary approach.

Albania is a geotectonically very dynamic area (Meço & Aliaj, 2000), and various geomorphological and geotectonic movements can be discerned within its 28.748 km^2. This causes the area to be under constant seismic activity, with this activity being one of the strongest in

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[1] Since the mid-1930s, the total amount of land lost has been about 5120 square kilometers. Today, Louisiana loses about 41 square kilometers a year. Twenty or 30 years ago, the rate of land loss was as high as 128 square kilometers year. All of this results from three processes that reinforce and amplify each other's effects: levee construction, oil and gas exploration and a rise in the sea level (Wernick, 2014).

https://doi.org/10.1016/j.apgeog.2018.09.002
Received 22 April 2017; Received in revised form 27 July 2018; Accepted 27 September 2018

Europe, resulting in high relief energy and high vertical gradients (Favretto, Geletti, & Civile, 2013; Lacombe, Malandain, Vilasi, Amrouch, & Roure, 2009). Over the last decade, and due to rapid urbanisation and the development of tourism and related infrastructure, particularly in Albania's coastal towns and capital, as well as agricultural practices (the use of heavy machinery, pesticides), deforestation, and other changes, this area has been facing severe anthropogenic hazards that have influenced various erosion processes (Hoxha et al., 2012; Nicandrou, Mofor, Delpak, & Robinson, 2004; Parise, Qiriazi, & Sala, 2004; Pranzini et al., 2015; Prifti et al., 2013; Sallaku, Kristo, Maçi, Peçuli, & Shallari, 2010, 2009). These hazards exist along with the changing Mediterranean climate, vegetation, rich river network, and seismicity, which together enhance the degree of erosion that is a hundred to a thousand times more extensive in this area compared to that seen in most other European countries (Buchroithner, 2000; Grazhdani & Shumka, 2007; Muço et al., 2012; Qiriazi & Sala, 2000). Almost 20% of the land here is subject to severe erosive processes, with an average intensity of over 50 tonnes per hectare per year (Lireza & Lireza, 2014), while areas around Tomorri Mountains release as much as 180 tonnes per hectare per year (Agroweb, 2016).

The population dynamics likewise reveal a high index of change, demonstrating massive out- and in-country migrations that have characterized this area throughout the centuries (Gregorič Bon, 2017). The scholarly literature in migration studies describes Albania as one of the most migratory countries in Europe (King, 2005; Mai, 2005; Vullnetari, 2012), and compares it with a “migration laboratory” (King, 2005) or discusses it as a nation “on the move” (Vullnetari, 2012). It is estimated that in this ex-communist country, isolated for more than four decades (1945–1990) due to the autocratic regime of Enver Hoxha, over 1.5 million people left in the period between 1990 and 2010. This equals more than a half the total current population of 2.8 million residents (INSTAT, 2017; World Bank, 2011).

This article contends that various modes of movement, such as the physical movements of people, geotectonic shifts and geomorphological movements of the landscape, are embodied in people's practices and spatiald in their environment. Whereas a large body of scholarly literature from different disciplines focuses on geomorphological movements and population migrations in various parts of the world (Abrar & Azad, 2004; Black et al., 2011; Gracia, Rangel-Buitrago, Oakley, & Williams, 2018; Pranzini, 2017; Pranzini et al., 2015; Seto, 2011; White & El Asmar, 1999; Zaman, 1989), hardly any of these works correlate the two processes (Chen, Lin, Zhang, & Lu, 2012; Green & King, 1996). To address this gap in the literature, this article sets out to explore the correlation between the geomorphological and demographic changes in the wider Vlora area for the period between 1979 and 2016. It develops a tripartite analytic-synthetic model consisting of (A) remote sensing analysis employing automated land/water detection from satellite data; (B) demographic analysis concentrating on population changes using methods of statistical analysis, with a special focus to ensure sufficient data quality through data imputations and validations, bivariate correlations, etc; and (C) extensive anthropological fieldwork comprising participant observation, open and semi-structured interviews and discussions, obtaining up previously inaccessible demographic data and other relevant data, along with archival work. The first objective is to analyse and establish the relationship between geomorphological and demographic movements, which are seen to be crucial for understanding the present-day Vlora and its landscape. The second objective is to develop new methodological approaches that have the potential to be applied to similar areas elsewhere.

1.1. Study area

The case study focusses on the wider area around the city of Vlora in the south-western part of Albania, which covers about 541 km^2 (Fig. 1). The study area is bounded by the line where the gently sloping piedmont merges into the nearly flat lowlands in the coastal area. The northern boundary in the coastal lowlands is defined by the Ujitja-Lumi water channel flowing into the Adriatic Sea. For computational reasons related to changes in the coastline position, the fixed maritime part of the coastal strip, stretching approximately 1.5 km into the sea, represents the western boundary of the study area. Thus the use of a defined polygon (with fixed outer coordinate bounds) enables the analysis of land cover changes within that area.

Administratively, the study area is part of Vlora Municipality and the seat of one of 12 counties/prefectures (Alb. *prefektura*) bearing the same name. The county is altogether constituted by 36 districts (Alb. *rrethi*) and 61 municipalities (Alb. *bashki*). Over the last decade this coastal area, which incorporates the second largest port in the country, has been affected by rapid urban construction of mostly touristic complexes (hotels, apartment houses, touristic villages, etc.) and other infrastructural building projects (TEC, pipelines, VIII Corridor, extension of the port, etc.).

1.2. Geomorphology, erosion and denudation

The physical-geographic position of Albania sets it between the Adriatic-Ionian depression on the one hand, and the Dinaric and Shara-Pindos orogenic systems on the other (Atlas svijeta, 1961; Furlani et al., 2014). Such a position has given rise to complex landscapes, stimulated by strong geotectonic movements, particularly in its southern portion. Its relief is the outcome of intensive Cainozoic contractional phases (Favretto et al., 2013), which have separated out the so-called Inner Albanides and Periadriatic depression from the Dinaric-Ionian continuum (Fig. 2).

Geomorphologically speaking, the Vlora–Elbasan transfer zone separates the Adriatic plain, as the major Albanian plain, from the so-called Ionian zone (Outer Albanides) in the south-eastern direction. The alluvial plain at the Adriatic coast is weakly stratified, with moors and lagoons stretching continuously from Orikum (south of Vlora) to Shkoder in the north. It has developed through the processes of sediment accumulation in the Periadriatic submarine tectonic depression. Generally, the majority of sediments, as well as those in the Vlora region itself, come from the Ionian zone, since the Inner Albanides are separated from it by the so-called Kruja zone (a tectonic thrust) between the Krasta-Cukali and Ionian zones (Fig. 2). Under intensive processes of erosion, the Periadriatic basin was filled with material from the surrounding mountains carried by the main Albanian rivers (Drin, Buna, Vjosa, Shkumbini, the Seman/Osum-Devoll catchment, and so on), all flowing into the Adriatic Sea.

In line with the geotectonic findings (Lacombe et al., 2009), Albania is one of the most seismically active areas in Europe, geo-tectonically lying adjacent to the recently extremely active neighbouring Apennines of Italy. The wider Vlora area thus finds itself in an interplay of so-called endogenous (geo-tectonics, seismic activity), exogenous (erosion, denudation, flooding, fluvial displacement and material transportation, lagoon-type water inundation etc.), and anthropo-geographical (urbanization, resettlement, industry, mode of production) factors.

According to Favretto et al. (2013) the recent evolution of the geomorphological features of this area, identified by satellite methods, mark the Albanides as considerably deformed. This supports the thesis of Lacombe et al. (2009) about the Saranda area, which is that contemporary geotectonic activity is the source of recent, rapid changes in the make-up of the landscape. Deriving from these two theses, the authors argue that the recent demographic changes in the wider Vlora area are significantly contributing to current changes in the landscape. In contrast to the idea that folding of the Sazani and Ionian zones contributes to the recent uplift, this research maintains that urbanization with the corresponding human activities has contributed significantly to the narrowing of the alluvial plain, and consequently to the soil/land loss and maritime transgression.

Recently, in the course of the last decade, the Albanian coastline has faced a number of abrupt changes. With over 400 km of coastline, and