



The 2014 volcanic eruption in Fogo and the reterritorialization process: from risk to geographic resilience

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The population of Fogo Island, in Cape Verde, shows a peculiar relationship with the living territory, given that the eminence of volcanic risk is a reality they face every day. The 1951 and 1995 eruptions were particularly scarring in this insular geography, leaving in several generations of Cape Verdeans, the mark of a creation-destruction-restart cycle, as well as an attitude of symbiosis with nature. This article is intended to present and discuss results from a scientific research paper based on a study conducted on Fogo Island, in Cape Verde, in February 2016, where researchers sought to understand the local population's response to the last volcanic eruption (from November 2014 to February 2015), in a logic of deterritorialization-reterritorialization, namely in terms of community and territorial resilience. The analysis method was based on direct observation, with record of the views in a field journal, as well as the biographic narratives of all those who were affected, through questionnaires and interviews.

Keywords: risks, volcanic eruption, reterritorialization, resilience, Cape Verde, Fogo Island

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Introduction

The 1951 eruption of the Fogo Island volcano presented to Orlando Ribeiro, a unique moment to witness, live, a natural phenomenon of great interest to geography. Thus, with state sponsorship from the Ministry of Overseas, he left Lisbon a week after the beginning of the eruption activity, which had begun on June 12th of that year, aiming to observe the phenomenon and record the collected information. He would then take on another mission, from December 1952 to January 1953, where he deepened his study of the geologic, cartographic and geophysical aspects of the eruption, established close contact with the local population and gained knowledge of their life conditions. This would result in a monographic work, with the first part dedicated to the geography of Fogo Island (relief, climate, vegetation, colonization, rural life, housing, commercial activities, relation with the sea, accesses) and the second part devoted to the circumstances surrounding its volcanic eruptions (history of previous eruptions, from 1785 to 1857; description of the 1951 eruption) (Ribeiro, 1998).

It is important to note that in his work, more specifically in the first part, he dedicates a chapter to the subject of 'crisis: misery and redemption', where, although not using explicitly the concept of resilience, he refers to the population's response to scenarios of agricultural crisis, in a logic of *ex loco* resilience, championed by the regime of that time, which promoted emigration. To address the issue of emigration, Orlando Ribeiro considers the human and physical characteristics of the territory and defends agriculture as a valid economic activity for the autochthone population, even providing suggestions about enhancements that could be made, and other guidelines to adopt,

which he refers to as 'rational economy', such as forestation, land shaping, planting of bushes, and cultivating respect for the traditional economy, culture, irrigation and sea use processes, among other aspects. (Ribeiro, 1998).

The following excerpt from Ribeiro's study is a record of major importance when read in the context of our present study. It is particularly useful in helping readers fathom how the local population react and respond to volcanic eruptions.

At night, they were home, felt an earthquake, followed by a large bang; they went outside, shouting that the volcano had burst. So, father and the oldest sons started putting wooden crosses around the house, so that the lava would pass by, according to the tradition. The lava flew for a whole week, only in the second day did it reach near the house ... Always slow, giving enough time for everyone to run away and so there were no victims.

It was known that the historic eruptions had always occurred far away from the most populated areas of the island, they had not last long and had not caused victims (Ribeiro, 1998: 246).

Following the footsteps of Orlando Ribeiro, other academics have published studies about the volcanic risks in Fogo Island, Cape Verde. More recently, another study on volcanic eruption in Fogo Island has come to influence the research work that we now present. Nascimento *et al.* (2016) published conclusions of a research project in the area of human mobility, where the authors considered the dislocation strategies of the population when faced with volcanic risk. The research was based on seven in-depth interviews conducted over four months after the last eruption (in June 2015), where there was a determination of the interviewees' will to return to the location of origin, even after having been affected by the eruption (Nascimento *et al.*, 2016).

Nascimento *et al.* and Ribeiro inspired our work, where we too have analysed and discussed results from field work focused on the last eruption (November 2014 to February 2015) albeit conducted a year after the phenomenon (i.e. February 2016).

There are two aspects that differentiates our work from previous works: firstly, the relatively distancing time character (the study by Orlando Ribeiro was conducted in the 1950's and Nascimento *et al.*'s research was carried out in the aftermath of the 2014–15 eruption) and secondly, our study is based on the assumption that the populations' return is a resilience strategy adopted by the affected community understood in the logic of a deterritorialization-reterritorialization process. In that sense, this article comes to complement and diversify the scientific research perspectives conducted around the subject-territory while concurrently contributing to an update of the Fogo Island case study.

Hence the central goals of this study are, (i) on one hand, realizing how the dynamics of natural risks in Fogo Island, more specifically volcanic risk, influences the autochthon community's everyday life within the affected territory; and (ii) on the other hand, discussing the return of the community as a reterritorialization process, which reveals a tophobic relationship between individuals and risky place(s), as a mechanism of resilience.

Methodology

The field work we conducted employed observation as a base method. Pocinho (2012) states that when adopting this approach, it is not only important to collect information that translate the concept, but also to obtain other data that may reveal unknown facts.

In his article, Ribeiro (2012: 68) emphasized this option, stating that '... the direct observation of the territory is at the base of any study. [For] Outdoor science

[Geography], its laboratory is Nature'. Belo (2012: 11) corroborates this idea, by mentioning the importance of observation in Orlando Ribeiro's research, and its prevalence in the study of Geography: 'This was his method: the permanence in places, an attentive and long gaze to an immensity of details that common people fail to notice. It was the understanding of the land as it were a dynamic and in permanent transformation document'.

In this vein, we modelled our method on Freixo (2009), who maintained that observation should be focused on stating facts, although in the case of this study, we chose to conduct 'experimental observation', in the sense that there were several variables to be analysed and data collection conditions were planned. However, even in the initial planning stages, and given it was our first field work attempt, we used an 'unsystematic observation' (or non-structured) method because the territory and the volcanic phenomenon was known to us only from a distance, with limited bibliography and statistical support. The individuals and places we observed stemmed from the first contact we made with the community-place.

We conducted 'non-participant observation' which required us to stay outside of the reality that we were studying with no interference or involvement in the situation whatsoever — this meant that we gathered information from the community who were experiencing the situation firsthand. The observation was also a 'team' or 'shared' observation as it was conducted by both authors of this article keeping open the possibility of recruiting more investigators to participate in the study. Location-wise, we did field observation i.e. our observations were recorded at the location of the phenomenon.

This method of classification is supported in the ideas of Lessard-Hébert *et al.* (2005) whereby the author explained 'participated observation', as facts presented based on information derived from observed subjects, although the latent phenomena could have been taken into account by us who observed the phenomenon. Therefore, there were live interviews performed, not during the eruption and escape, but in the subsequent reterritorialization stage. The quest to rebuild the inhabitants' everyday lives were relayed to us 'face-to-face'.

Summing up, this investigation was based on three pillars: (i) direct observation of the phenomenon (interview with the involved individuals); (ii) field survey; and (iii) our own perception based on the synthesis of collected information.

There were 'individual' and 'semi-directed' interviews—the latter involved pre-determined questions that were aimed to work as a starting point (Ketele & Roefiers, 1999).

In their paper, Rosa and Arnoldi (2006: 17) defended their hypothesis that 'analysing the interview as data collection technique, we can claim that it is not a mere dialogue but an orientated discussion to a defined goal which, through an interrogation, leads the informant to talk about specific subjects, resulting in data that will be used in the research.' Albarello *et al.* (2005) highlights the interview as a way for interviewees to report aspects of their biography that they deem important, their goal being to discover the concrete conditions of existence and the everyday territorial experiences.

Based on these ideas, we chose to document the interviews in writing (in the form of field notes and not voice recordings) at the location-moment of the observation, in order to enable the interviewees to feel at ease about conveying their opinions without fear of exposing themselves. A logbook was kept, containing written perceptions we had of events, according to a reference table planned ahead of the trip and of the field work—it also comprehended the description of the landscape and geographic sketches.

The interviews were conducted in different groups in order to obtain diversified perspectives. The various groups consisted of: (i) two inhabitants of Chã das Caldeiras, who experienced the eruption personally; (ii) two tourism agents, who observed the consequences of the eruption at a distance; (iii) a teacher of a private school in S. Filipe, the capital of Fogo Island, who had contact with children displaced due to the volcanic phenomenon; and (iv) a religious community (led by four sisters) with activity in S. Filipe who support the Fogo community in general, the affected being among them. We focused on studying experiences from these sample groups due to the fact that this research intends to analyse the reterritorialization/resilience process from the point of view of the population that were affected by the eruption.

Geographic aspects of Fogo Island

Physical geography

Located in the Atlantic Ocean (Figure 1), at latitudes between 17°12' and 14°48' North and 22°44' and 25°22' West of Greenwich, the archipelago of Cape Verde is part of the so-called Sahel climate zone, with a semi-arid climate that crosses Africa from the Atlantic until the Red sea, prolonging through Arabia, Syria and Iraq up to the deserts of the tempered area of Eurasia and to the regions affected by monsoon climates.

It is a climate zone that separates the warm from the temperate area. Rain is scarce and highly variable, stimulating the development of several studies about the causes and consequences of droughts in the archipelago. Such studies have attempted to analyse the distribution and evolution of rainfall in order to anticipate future occurrences and formulate prevention/mitigation actions. From the rainfall records it was possible to determine patterns that suggest severe crisis occurring within a 23-year interval period and moderate crisis occurring every 11 years (Fonseca, 1962). These cycles are associated with issues of astronomic nature related to solar activity (Fonseca, 1952, 1956).

In general, rain falls in the form of showers, sometimes with greater intensity, even reaching values higher or equal to the monthly average amounts. The rainy season takes place between the months of August and October, sometimes beginning in July, coinciding with the presence of the intertropical convergence zone, when it is further

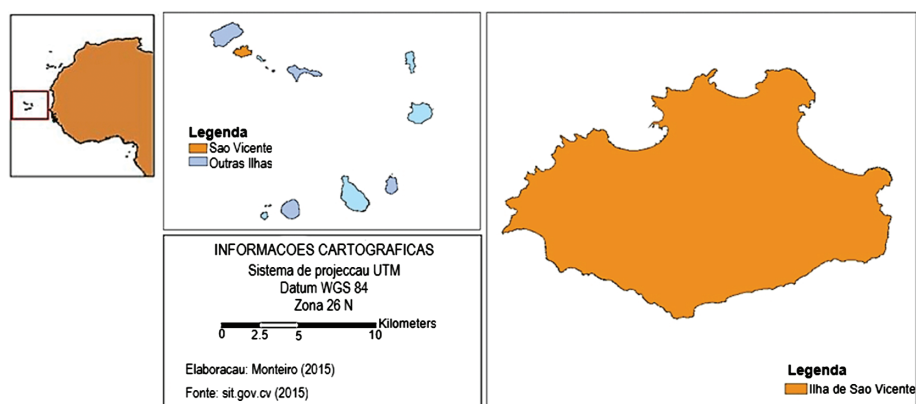


Figure 1. Location of the archipelago of Cape Verde and Fogo Island.

Source: Site of the Government (2016).

North (Amaral, 1964; Ferreira, 1983). The position of the archipelago of Cape Verde is, however, marginal to the great convective intensity, justifying the high variability of rainfall throughout the years. During the dry season, the archipelago is under anticyclonic influence, with trade winds blowing from the Northeast. They are constant winds, that represent a strong source of humidity, mainly in the slopes facing northeast and at a higher altitude.

Fogo Island, like all mountainous islands, is characterized by a diversity of local climates, mainly determined by exposure and relief. In the coastal areas, it is arid, except for a small portion to the North, between Mosteiro and Atalaia that is exposed to trade winds. Aridity is accentuated in the Southwest of the island as this area is sheltered by the volcano's edge.

São Filipe, located in the West part of the island at around 40 m of altitude, experiences an average of about 180 mm of annual precipitation. Whilst in some years, such precipitation does not even exceed 100 mm, in major rainfall years it sometimes exceeds 400 mm. Monte Velha, a village located in the north edge of Chã das Caldeiras at 1300 m of altitude, experiences annual precipitation that is higher than 1000 mm. There are years when total precipitation exceeds 2100 mm. In dry years, the levels of precipitation have been reported to be lower than 350 mm.

In coastal areas, during the warmer months (June), the average monthly temperature rises to 22.9° C and in the coolest season (December) the average monthly temperature dips to as low as 14°C. In Chã, the month of December may be considered to experience true winter, especially at night when even water freezes. Beyond the influence of altitude, these values result from thermal inversion produced through orographic action. During the night, the air that is heated by extremely strong insolation quickly cools in the very dry atmosphere, precipitating on the Chã platform, thus flooding it with cool air. It is very common for frost to accumulate on plant leaves in vineyards, such that farmers resort to protecting them with straws (see Figure 2).

Apart from the influence of trade winds, between December and June, Fogo Island frequently experiences three other types of winds: (i) the 'winter winds' (from December to March); (ii) the 'dry weather winds' and (iii) the 'east winds' (Amaral,



Figure 2. *Wine culture protected with straws.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

1964). The latter is characterized by the occurrence of continental winds with an ENE trajectory. Locally known as '*lestadas*' (East winds), they are winds with dry and warm characteristics, often times loaded with dust coming from the Sahara desert, formulating what is known as a 'dry mist' that corresponds to the Harmattan.

The instability of air masses is reinforced by the orographic effect. It is useful to be aware of the importance of relief as a factor that contributes to regional and local climatic diversity. Climatic and hydroclimatic classifications (Cunha, 1961b; Teixeira, 1968; Ferreira, 1989) as well as exposure and extension of the islands (Olivry, 1989; Alves, 1986) are also directly related within these parameters.

From a structural point of view, the archipelago is located in a situation of continental interpolate (Ernst & Buchan, 2003), whose genesis is attributed to a hotspot mechanism (mantle plumes), made visible via a ridged connection of the basement rocks between the archipelagos of Cape Verde and the Canary Islands (Patriat & Labails, 2006; Holm *et al.*, 2008). The islands of Cape Verde would have originated from the fragmentation of an ancient subcontinental mantle, when forming an oceanic mantle during the opening of the Atlantic Ocean (O'Reilly *et al.*, 2009). This type of hotspot activity would have begun around 19 to 22 million years ago, bringing about an uplifted crustal area in which the archipelago is implemented (Plesner *et al.*, 2002), resulting in volcanic activity that remains until today. The tectonic activity is highlighted by the presence of inter-atlantic transforming rift faults, important lift processes and main regional lineament with a NW-SE direction and NNE-SSW tectonic structures (Victória, 2012).

The igneous rocks that outcrop the Cape Verdean islands resulted fundamentally from the crystallization of alkaline primary magmas heavily sub-saturated in silica and more evolved rocks, such as phonolites and nepheline syenites originating from magmatic evolution and differentiation (Davies *et al.*, 1989). Another group of rocks present in the archipelago consists of the carbonatites, suggesting that the subcontinental lithospheric mantle may comprise mainly, or at least part of, these rocks (Hoernle *et al.*, 2002).

Fogo Island has a large and complex terrain, supporting a uniquely fresh volcanic structure that is still active. The huge cone bears a rounded contour shape that is simple and regular.

From a morphological point of view, the island comprises mainly of a large trunk of dissymmetric cone whose centre is pulled towards the Northeast direction, with flanks of softer pendants leaning towards the west, south and more abruptly towards the east. The island is flooded by a vastness of adventitious cones with altitudes seldom exceeding 100 m, some already very affected by erosion, with the rare exception of the island's oriental flank. Emissions exterior to the caldera after its formation seemed to have been rare, except as evidenced by the presence of a small volcano, the Morro de Trás-os-Montes, settling on the Mosteiros *fajã*, corresponding to a cinder cone formed during submarine eruptions (see Figure 3).

Chã das Caldeiras corresponds to a platform with around 2 km width, is horseshoe shaped with a flat bottom interrupted by the presence of a few secondary cones and lava streams. It is limited by the enormous semi-circular caldera, measuring around 9 km in diameter, facing east. It is formed by accumulations of *lapilli*, thick cinder, interspersed by brief effusive episodes, intercepted by veins and *sills*. It presents a continuous transversal step with a vertical interval of 50 m pending north, associated to a fault in a NW-SE orientation (Silveira *et al.*, 1997).



Figure 3. *Cinder cone near to Monte Grande.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

After the caldera was formed, eruptive activity resumed inside, with hard serialization of successive episodes (see Figure 4).

There is evidence of abundant forms of lava spillage, ranging from very fluid to corded, revealing torsion and contraction forms, occupying the majority of the flattest part of Chã today (Figure 5). The most recent is a mantle of fluid lava that has intercepted the road connecting the villages of Bagaeira and Povoação. It is still visible from the transversal drop of about 50 m dictated by the triangular Spike formed from the same accumulations of tuffs and aged lava.

What is referred to as ‘volcano’ corresponds to the eruptive cone formed inside the Chã, rising to about 1000 m from it, dictating the culminating point of the island to be 2829 m. It has a diameter of about 500 m. Its rim height is around 100 to 200 m



Figure 4. *Photo with mantle of lava corresponding to the eruptive episodes of 1995 and 2014, in Chã das Caldeiras.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.



Figure 5. *Photo with lava cords from the 2014 eruption.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

(according to the height of the rim dismantled). The east flank connects directly with the sea with an impressive slope interrupted by deep and narrow grooves, where, during the rainy season, rivers dig through with extraordinary competence (see Figure 6).

Therefore, the oldest cone has numerous secondary cones (Figure 7), of several years of age, both in the cone, at the bottom, and even inside the Chã, still marked by a set of lavas and cinder resulting from several eruptions that have spilled, sometimes reaching the sea.



Figure 6. *Photo of the river east of the island.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.



Figure 7. Photo with secondary cones and the most recent lava flow of 2014.

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

The more ancient eruptive materials appear at the base of the Island (Ribeiro, 1960), comprehending rather fluid basalt lavas, tuffs, cinder, *lapilli* and ashes. In Bordeira, the large wall is crossed by numerous veins that represent the first eruptive cycle.

Human geography

This study will take into account the most recent data on the population dimension made available by the Cape Verdean National Statistical Institute, namely the 2015 Statistical Yearbook.

The archipelago of Cape Verde had, in the previously mentioned year, 524 833 inhabitants, whilst the Fogo Island had 35 838 inhabitants, corresponding approximately to 7 per cent of the total population of Cape Verdeans. Demographically, Cape Verde has an annual growth rate of 1.23 per cent, contrary to the municipalities of Fogo Island, which record an average loss of 0.47 per cent per year. This tendency towards population decline contrasts with the case of the municipalities of Praia or Mindelo, as well as with the tourism islands of Sal and Boavista. The shift from high birth rates to low birth rates, as well as emigration may have contributed to this population decline. The demographic increase in Sal and Boavista islands could be attributed to the diversification of work opportunities in urban areas, especially in tourism, thus attracting individuals of less economically dynamic islands there.

In 2014, about 64 per cent of the population lived in urban areas, which is a lower percentage when compared to Fogo Island, whereby the percentage of people living in urban areas and rural areas is split down the middle at 50 per cent, respectively.

In 2014, the unemployment rate in Cape Verde was 15.8 per cent. As compared to Cape Verde, Fogo Island had lower unemployment rates (7.3 per cent) and this may be related to the need for workforce associated with agriculture, which absorbs, even on a seasonal basis, a high number of active population. This justification is corroborated when we analyse the disaggregated data: on Fogo Island the unemployment rate in rural areas is lower (6.4 per cent) than in urban areas (9.5 per cent).

It is worth noting that Fogo has a young population, whose age average is 28 years old—an average age lower than the age of the country itself (27 years old). It is a

country with strong emigration dynamics, expressed in the form of a negative migration balance in 2015 (1010 inhabitants less).

Grassi (2006) mentions the emigration trend of the Cape Verdean population, referring to the USA as the preferential destination for those coming from Fogo Island. This hypothesis is corroborated by Cardoso (2014) who points to the mid-19th century as the starting point for such exodus, occurring in the form of an influx of North American whale fishing ships, which would come to open an initial channel for this island's migration flow. The salary differences between the origin and destination countries, as well as the opportunities for economic and work improvement of families, expedited the exit of Fogo Cape Verdeans to USA.

The diaspora from Fogo Island in this country is very important for the economic balance of relatives who remain in the place of origin. In a recent study by this author, referring to the time period before the 2014-2015 eruption, it was concluded that 98 per cent of the families interviewed received remittances from family members who migrated to the USA, amongst which 59 per cent were already benefiting from that support for at least 10 years. That amount was channelled to meet basic needs (food), to invest (presumably in housing and purchase of real estate) or for savings.

The role of the emigrant has been very important, from a material and immaterial point of view in terms of providing support to the population affected by the last eruption. In a study about the effects of volcanic risk to Fogo's population, Nascimento (2016) presented the hypothesis of mobility as a response to the loss of housing assets and cultivation lands due to advancement of lava. In fact, when observing the strong diaspora of Fogo population into the USA, associated with the possibility of a migration culture, one might think that Fogo's population displacement to the American continent is a form of *ex loco* resilience. The predominance of a young population and relatively dynamic birth rate, could also be demographic factors indicating and justifying the influx of emigration in a post-volcanic crisis. The authors conclude that that is not the case, as the interviewees were already talking about returning to their homes or rebuilding their damaged house only four months into the aftermath of the eruption.

In the course of the investigation work and in particular, a year after the eruption's end, when the lavas cooled down, new data was presented indicating (i) the idea of a return that is associated with strong notions of topophilia, (ii) an understanding of how everyday life was organized and (iii) how the reterritorialization process of the individuals took place.

Reterritorialization: from risk to resilience

The construction of the analytical model of this study was based on the idea of Faugères (1990) about the concept of 'risk' that the author defines as being 'a complex system of processes whose modification in functioning is susceptible of causing direct or indirect losses (loss of resources) to a given population'. Also, Lourenço (2014) corroborates this idea by understanding risk as something that can potentially manifest (or not), such that, in case it occurs, there exists the possibility of having negative consequences in the physical and human geographical context in which it takes place. According to Cunha (2013) risk will therefore include potentially dangerous processes that are developed in a relatively defined time-space dimension, and that will affect people and their assets. Mendes (2015: 44) even draws attention to the fact that, by always involving consequences to people, it may be considered that all risks are social.

This emphasis on ‘where-when-who-why’ is defended by Lourenço (2015), who in a previous work (Lourenço *et al.*, 2013) justifies the study of risks in Geography by the fact that they occur all over the earth’s surface.

In this logic, Velez de Castro and Lourenço (2016) conducted a study on the type of phenomena able to generate risk situations, which in the context of this study seems to be a combination of (i) a natural risk (i.e. volcanic eruption) effected in the territory generating population displacement and (ii) an anthropic risk given that human displacement may generate situations of social exclusion and poverty, interfering negatively in the stability and living standards of the affected population. Therefore we justify the need to reflect on the proposed case study, based on the idea of Gonçalves (2012), which draws attention to the importance of the study of risks in the area of Social and Human Sciences, both in the perspective of prevention of such risks and at the level of understanding the psychosocial consequences of risks on individuals.

The United Nations Development Programme has dedicated the last Human Development Report (PNUD, 2014) to the issue of ‘Sustaining human progress: reducing vulnerabilities and building resilience’. It emphasizes the need for governments to adopt institutional reforms and policies in order to provide resilience mechanisms to the more risk-fragile territories and communities.

We take into consideration the definition of Santos (2009) who argues that the concept of ‘resilience’ is related to the ability of a society and/or territory to reabsorb disturbances and reorganize its key functions. Therefore, it is considered an integrative, cooperative and interdisciplinary process. The author defends that with the experience, individuals will tend to generate not only answers, but also thought structures to prevent potentially negative situations. Gonçalves (2012) therefore defends that there are intrinsic characteristics to individuals that are so fundamental to the ‘resilient reaction’ as, for example, self-esteem and self-control, considering them as differentiating factors for behavioural adaptation.

Hence, the concept of ‘resilience’ is, to our understanding, not only an adaptation of individuals’ transforming actions to territorial risks, but also a recreation of personal attitudes, positions and functionalities, in an individual and community perspective, which may occur before, during or after a potentially adverse action, when perceiving natural, anthropic or mixed risks.

To provide clarification of these ideas, we will synthesize the ideological lines of Folke (2006); Soria *et al.* (2007); Fernandes (2008); Freitas and Estevens (2012); and Scherer and Minello (2013), who provide important contributions to literature on types of resilience. As for the forms of resilience—resilience may be individual or communitarian, depending on the response levels, i.e., undivided or part of a strategy affected towards a group or set of people. The introduction of well-defined territorial facts, in the case of community resilience is within the socio-ecological scope, for this means the autochthon natural resources are being considered as an effective response to risk situations. Authors such as Armitage (2006) and Quandt (2016) emphasize this perspective, considering the concept of resilience as a boundary of power between natural and social systems, faced as being part of a whole, i.e., starting with holistic territories.

In terms of space, resilience may occur in the location of the phenomenon (*in loco*) or may even require a need for displacement (*ex loco*) in a permanent or temporary form. Concerning time, resilience may be reactive, in which case the response is subsequent to the phenomenon, or pre-emptive, where there is the possibility of foreseeing negative consequences of the risk and, therefore, choosing a mitigation strategy downstream of the process. The special manifestation of these replies, understood as cycles,

does not depend only on individuals per se or individuals organized in communities but on externalities such as, for example, the role of social networks, the economic system or of political capital involved.

Haesbaert (2005), and Fernandes (2007) understand resistance as resulting from the phenomenon of deterritorialization, which results from a loss of territory. In practice, it means there is a group of individuals who, for several reasons, are forced to leave their reference location and move towards a different geographic destination. Initially, that will imply a loss of spatial identity, which may require the management of negative situations, associated with the shock of assimilating into a new community and a new territoriality. In a case study of the Tungurahua volcano, Tobin and Witheford (2002) highlight negative factors associated with the evacuation of local populations who reterritorialized ex-loco, as being related to the degradation of health conditions that became the basis for the systematic return of some individuals to the volcanic risk location.

However, the survival instinct will indicate the need for integration at the new location, with a consequent reformulation of space and geographic identity references, in a logic of what Haesbaert (2004) names as 'reconstruction of territory' of the individual(s). Tuan (2008) and Oliveira (2011) corroborate this idea by suggesting that the territorialization of individuals, as a resilience strategy, is owed largely to a sense of topophilia, i.e., the affective bond established between individuals and territories. Thus we understand that this notion will determine not only the deterritorialization-reterritorialization process, but also the population's 'resilient return' to its 'locations of origin', even in situations of imminent risk or danger.

It is in this context of risk-eruption-resilience, that we will present, analyse and discuss the results of the field work conducted in Cape Verde, more specifically in Fogo Island, which was based on direct and indirect observation of the main village-population affected by the last eruption (2014-2015), more specifically in the village of Chã das Caldeiras.

Analysis of the field work results

On November 22nd of 2014, during the night, the inhabitants of Chã das Caldeiras felt a strong earthquake, having being warned by the authorities that were already monitoring the phenomenon. The oldest inhabitants who had witnessed the 1955 eruption and/or the one in 1951 used empirical evidence to predict when the next eruption would occur. This prediction came true on November 23rd 2014 around 10 a.m. Despite the fear felt by the population located at the edge of the eruptive crater, the resilience strategy involved initially, the *in loco* evacuation of elderly people and children.

The prevalence of youngsters and adults during the crisis period, was related to two main factors: firstly, as a means to protect assets from being stolen especially from inside houses; and secondly, due to topophilia, i.e., the connection established with the location of residence and work (agricultural fields around the village). This group within the local community stayed until they reached the limit of what they considered 'effective danger', which occurred with the advancement of lava through the land, culminating in obstruction of the only road connecting Chã das Caldeiras to the rest of the island. As it can be seen in Figure 8, most of the houses were totally covered by volcanic materials, such that in many cases, the exact location of the houses could only be identified through little signs or pieces of roof that were exposed.



Figure 8. Photo of the houses in Chã das Caldeiras covered in lava.

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

The total evacuation of the community took place and most of the displaced population have been installed in three main points: (i) in the school in Mosteiros; (ii) in foster centres and houses in Achada da Furna and Monte Grande; (iii) and in rented houses in the capital of S. Filipe¹ (see Figure 9).

In terms of reterritorialization, the process manifested itself negatively in the form of social instability within the dislodged community in Mosteiros. This was mainly caused by the large distance between the new location and the affected area, worsened by limited road access which meant that the displaced community could not return regularly to their home to assess the impact of the advancement of lava on the houses and land.

In the case of Achada da Furna and Monte Grande, the phenomenon of reterritorialization was more positive, due to easy access from sheltered locations to the affected location. This empowered many inhabitants to travel regularly to the affected locations to assess damages and then return to their sheltered locations. Furthermore, after the 1995 eruption, the Cape Verdean government had built, 'secondary residences' in sheltered locations for the inhabitants living in the volcanic eruption's area of influence to relocate to.

The starting point in all the interviews was the recognition that the population affected by the volcanic eruption wanted to return to their locations of origin, thus giving reterritorialization a character of 'resilience *in loco*'. The reasons for return are mainly:

1. The importance of home and land in the location of origin—There is a strong sentimental connection between the inhabitants and the village of Chã das Caldeiras, which is strengthened not only through the systematic experience of generations of family members at this location, but also through the dynamics of communitarian endogamy. The house and the land are territorial reference points decisive to the individual and group identity balance of these inhabitants. Although the plantation farms belong to the State, they are cultivated by the population and transmitted from generation to generation without clear regulation of its use and ownership. Therefore, the inhabitants speak about 'their lands', which they consider their own, not only due to the fact that such lands have become a source of income for the

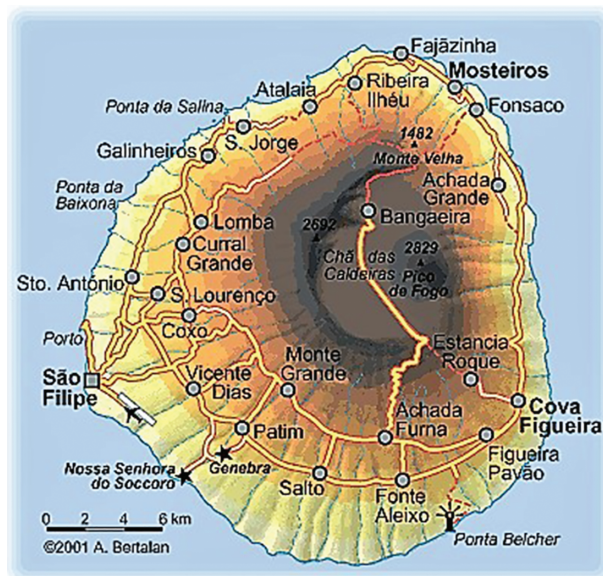


Figure 9. Map of Fogo Island.

Source: <http://www.simonecaputogomes.com/new/mapa.asp>.

population but also because they have maintained and cared for the local landscape for generations.

2. Absence of usual social relations in the sheltered locations — Following the previous point, the existence of neighbouring relations is very important for the community. With the dispersion of the community to sheltered areas, the daily bonds between neighbours are broken, ‘dehumanizing’ and making the process of *ex loco* reterritorialization more difficult.

When we conducted direct observation on the field, we confirmed that in Chã das Caldeiras, the inhabitants affected by the eruption were building new houses on volcanic materials. These were located precisely over their previous houses, i.e., in high risk areas. This phenomenon is partly an attempt by the inhabitants to resume the everyday life, work and social interaction that existed before the crisis.

3. Improper nutrition—It was reported to us that the content of ‘basic baskets’ (provided by the local government) with food meant to supply the needs of those who were displaced were insufficient and were not palatable (as some portions were processed foods). Used to eating organic produce from their own farmlands, they could not adapt to this new gastronomic reality.
4. Shortage of work at the shelters (villages) in the secondary residence and in the capital—Inactivity, associated with a break in the rhythm of agricultural work, as well as the unavailability of jobs associated with the sudden demand in the work market resulted in many active youngsters and adults being forced to stop work. This translated into ill-feelings amongst this section of the population who are used to working. That situation has stimulated the quick return of many to agriculture, a sector in which they have a lot of experience in. It must be mentioned that the area of Chã das Caldeiras is one of the most important suppliers of agricultural products for the entire Fogo Island and even other islands in Cape Verde.

5. Spiritual relationship with the volcano —The inhabitants of Chã das Caldeiras manifest a peculiar relationship with the volcano, whether it be animist in character (often mentioning that what ‘the volcano gives [its fertile land, the food], the volcano takes away [destruction through eruptions]’), or religious in character (i.e. eruptions are understood as the manifestation of the power of God). There is trust in Nature and in God, as two entities that protect the population. It must be remembered that, in both eruptions (occurring in the 20th century and in 2014—2015), there were no deadly victims. The interviewees mentioned that the people thank divine entities for ‘giving them time’ to save themselves and some of their belongings from their houses.

For the above reasons, most of the population choose to return to Chã das Caldeiras. On the possibility of emigration, the interviewees mentioned that there did not seem to be significant increase in population exit flows, as one might predict despite the dynamics of the phenomenon (loss of assets and of work), and the existence of social networks of compatriots living in the USA who can help with emigration and settling into the new country. Conversely, family members who emigrated to the USA were the ones that strengthened the shipping of remittances, in order to monetarily support their displaced family members when they were living outside Chã das Caldeiras and, subsequently, aid in the reconstruction of houses at the location of origin.

However, given the notion of volcanic risk enhanced by the actual dangers they have experienced, it can be seen that the younger population especially, have discovered new ways of living within this territory, namely through:

1. Planning of territory and construction — Although they still complain about the lack of leisure locations, mostly bars and coffee houses, the inhabitants of Chã das Caldeiras have a positive perception about the village’s reconstruction. On the one hand, planning is being made more adequately (i.e. streets with better layouts, construction of basic sanitation, etc.). On the other hand, new houses are being erected with cheaper materials, i.e., the owners do not wish to invest in expensive construction materials (Figure 10), so that in case of future volcanic eruption and property damage, there would be ‘less losses’ experienced. In some cases, the inhabitants have changed the location of their houses to areas they consider to be of lesser volcanic risk.
2. Progressive return to social life — The reunion with neighbours, the slow reunification of the population and the normal experience of everyday life reinforces within the community, bonds of friendship and mutual cooperation, transmitting into a great deal of emotional satisfaction in the inhabitants of Chã das Caldeiras.
3. Return to the agricultural activity — The possibility of replanting land for agriculture provides family aggregates their primary source of income which is very beneficial to the domestic economy. Besides, it is also a win-win situation for the natural landscape, as farmers take care of agricultural land (plantation of vines, coffee, fruit trees, beans, etc.) (see Figure 11).
4. New work dynamics — The eruption has accentuated Fogo Island’s character as a natural tourism destination. Therefore, many youngsters are not only dedicated to agriculture, but to the tourism industry, working as tourist guides who lead foreign tourists on pedestrian or car routes around the island. Their goal is to show the main volcanic interest locations on Fogo Island.



Figure 10. *Photo of a reconstructed house.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

As part of this study, the case of the displaced children and youngsters of school going age must be highlighted. Schools in S. Filipe received displaced students who, in the middle of the crisis, were very agitated and concerned, even to the point of failing examinations and being withheld from progressing to the next grade. The anxiety seemed to have been caused by the disruption of school during and after the eruption period as well as the associated psychological trauma on these young people who were witnessing the phenomenon of a volcanic eruption *in loco* for the first time. Also the transfer from Chã das Caldeiras (an agricultural area in the island's interior) to S. Filipe (an urban area on the island's coast), triggered the deterritorialization process and accentuated feelings of loss of the territory of origin.

However, from an academic point of view, the reterritorialization of these children and youngsters in this urban area will have a positive effect on their lives, because they will have more academic opportunities, especially in terms of continuing their studies. Perhaps it is this generation, being more literate, that may be



Figure 11. *Photo of a plantation of beans.*

Source: Photograph taken by Fátima Velez de Castro and Bruno Martins.

reluctant to return to Chã das Caldeiras, taking into consideration the lengths at which they can progress in school in S. Filipe. In this case, the territorial references will be the city and its schools, providing the reterritorialization process a more flexible dynamics concerning the possibility of choices, both professionally and mobility-wise.

Conclusion

It is apparent from the discussion of bibliographic and statistical readings in this study, as well as from the field work conducted, that the 2014-2015 volcanic eruption in Fogo Island continues to scar the everyday lives of all those who were affected, more specifically the inhabitants of Chã das Caldeiras.

The return strategy was adopted by the affected community, in a logic of *in loco* resilience (concerning space), reactive within the community (concerning time) and bore socio-ecological and systemic traces (concerning type).

The initial deterritorialization process was forced, i.e., it was the result of a loss in the territory of origin by an escape, due to fear of mortal danger in the form of by being hit by lava. The first attempt of reterritorialization happened by the 'temporary' welcoming of the displaced population in several villages i.e. Mosteiros, Achada das Furnas, Monte Grande and S. Filipe. However, this displaced population decided to return to the affected village, influenced by the topophilia dimension, but also due to more pragmatic considerations, i.e., resuming work (agriculture) and reconstruction of houses.

We have observed how the autochthon community, more specifically in Chã das Caldeiras, relate to the dynamics of natural risks in Fogo Island, more concretely the volcanic risk, accepting, in a 'peaceful' interaction, the presence of this natural phenomenon and its spiritual significance (i.e. '[what] the volcano takes, the volcano gives back').

The interviewees thought the inhabitants should have access to specific training in the area of volcanic risks, namely in terms of how to act during an imminent risk situation. Schools could have been the location of such training facilities, and the subject of 'risks', particularly 'volcanic risks' should be expressly contemplated both in official subjects such as Geography or Natural Sciences, and in other curricular or extracurricular activities, for example, conducting field trips to the locations affected, as well as lectures with specialists in the field.

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Endnote

1 It was mentioned by the interviewee that the number of dislodged people was around 1300 inhabitants, this being a number obtained through empirical observation. Nascimento *et al.* (2016) claim that at least 234 houses were destroyed.

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