



Post-Disaster Needs Assessment (PDNA)

FOGO VOLCANIC ERUPTION

2014-2015






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A report prepared by the Government of Cabo Verde, with technical and financial support from the United Nations (UN): namely, United Nations Development Programme (UNDP), Food and Agriculture Organisation of the United Nations (FAO), United Nations Human Settlement Programme (UNHABITAT), United Nations Children Fund (UNICEF), International Labour Organisation (ILO), the European Union (EU), the World Bank (WB), the Global Facility for Disaster Risk Reduction (GFDRR), and the Government of Luxembourg.



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ACP-EU Natural Disaster Risk Reduction Program

An initiative of the African, Caribbean and Pacific Group, funded by the European Union and managed by GFDRR



GRAND-DUCHÉ DE LUXEMBOURG
Ministère des Affaires étrangères

Direction de la coopération au développement

FOREWORD

In the early hours of the morning of November 23, 2014, preceded by a series of geophysical and geochemical precursor signs continuously monitored by the National Institute of Meteorology and Geophysics and the University of Cabo Verde, our country was registering yet another eruptive episode along a SSW-NNE fissure on the east flank of the Pico Novo - Chã das Caldeiras with the formation of four eruptive vents and the emission of gases, tephra and lava.

The 88 days of intense and effusive eruption culminated in the total destruction of all houses and community infrastructures of the localities of Portela and Bangaeira - Chã das Caldeiras, forcing the evacuation and displacement of 964 people. The lava flow also buried an extensive agricultural area of wine, fruit, beans, and vegetables production, as well as the endemic biodiversity of the National Park of Fogo and the social and economic infrastructures of those communities.

Fortunately, despite the vast trail of material damage and heavy economic losses, there was no loss of human life due to the timely and efficient early response of local and central authorities as well as the enormous solidarity of Capeverdians, friends and partners. The affected population was relocated to care centers in Monte Grande, Achada Furna and Mosteiros.

Upon passing the most critical period of emergency, the greatest challenges are the “Reconstruction” and the restoring of the socio-economic conditions of the affected locations. Consequently, an integrated response to the emergency and to the rapid recovery of the affected populations was of paramount importance. To this effect, the Government of Cabo Verde created the Cabinet of Reconstruction of Fogo, in charge of the management, monitoring and execution of the different reconstruction works, as well as the efficient and transparent use of mobilized funds for the socio-economic recovery of the island of Fogo.

This Post-Disaster Needs Assessment (PDNA) report now published, is the result of the efforts of the Government of Cabo Verde and its international partners aiming at providing the country with an assessment based on an internationally accepted methodology for resource and partnerships mobilization for a recovery and post-disaster reconstruction. This PDNA also aim to strengthen the institutional capacity at sectoral and municipal levels. Therefore, we would like to express our appreciation for the multi-sectoral team of national experts from different government departments and municipalities of Fogo. Our special thanks to technical and financial assistance of UN agencies (UNDP, FAO and UNICEF), the European Union, the World Bank, the GFDRR (Global Facility for Disaster Risk Reduction), the Government of Luxemburg and Japan.

As a technical and resource mobilization document, the PDNA defines the areas of intervention, the strategy and the medium and long term objectives, for all the economic and social sectors as well as cross-cutting issues such as gender and environment. With this document the Cabinet of Reconstruction of Fogo will be able to fulfill its objective of producing an action plan for the recovery, and the empowerment of families through specific programs of development of the productive sector (agriculture, livestock, agribusiness, tourism etc.) and the infrastructure of the new settlement (sectors: Health, Education / Sports, Social and Cultural) aiming at reducing risk of disasters of the population.

Praia, 25 August 2015

António Nascimento

A handwritten signature in blue ink, appearing to read 'António Nascimento', written in a cursive style.

Chairman of the GR

ACKNOWLEDGMENTS

The Post-Disaster Needs Assessment (PDNA) is an extensive and labor-intensive exercise that could not have been made possible without the dedication and support of the various ministries and departments of the Government of Cabo Verde in providing the time of their staff with their accompanying expertise.

This PDNA report was prepared by a joint team working under the lead of the Cabinet of Fogo Reconstruction and consisting of representatives of the government of Cabo Verde and members of the international community, namely, the Joint United Nations Office of Cabo Verde, the European Union (European Union Service for Foreign Policy Instruments, Unit 2, and Delegation of the European Union in Cabo Verde), and the World Bank.

Special acknowledgment is extended to the government of Cabo Verde for its leadership, support, and cooperation throughout the assessment. A full list of the governmental institutions and staff who participated in the PDNA assessment and writing of the report is included in appendix 2. To all of these contributors the team would like to express their deepest gratitude and appreciation.

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ACRONYMS

ADEI	Agency of Entrepreneurial Development and Innovation
ASA	Airport and Safety Agency
BPPS	Bureau of Policy and Program Support / UNDP
DCGEM	dynamic computable general equilibrium model
DNA	National Directorate of Environment
GRD	Gestão de Riscos de Desastre
RRD	Redução de Riscos de Desastre
ZEE	Zona Económica Exclusiva
UE	União Europeia
SAP	Sistema de Alerta Precoce
FAO	Organização das Nações Unidas para a Alimentação e Agricultura
IDEFI	Investimento Directo Estrangeiro
GAO	Budget Support Group
GDP	gross domestic product
GIZ	German Agency for International Cooperation
DECRP III	Documento de Estratégia de Crescimento e Redução da Pobreza
ha	hectare
IE	Road Institute
IEFP	Vocational Training and Employment Institute
INE	National Statistics Institute
INMG	National Institute of Meteorology and Geophysics
INGT	National Institute of Land Management
INE	Instituto Nacional de Estatísticas
ITER	Institute of Technology of Renewable Energies (Canary Islands)
LEC	Laboratory of Civil Engineering
MAHOT	Ministry of Environment, Housing, and Land Use
MDR	Ministry of Rural Development
MFP	Ministry of Finance and Planning
MIEM	Ministry of Infrastructures and Maritime Economy
MIREX	Ministry of External Relations
MJEDRH	Ministério da Juventude, Emprego e Desenvolvimento dos Recursos Humanos
MTFF	Medium-Term Fiscal Framework
SINR	Sistema de Informação Nacional de Riscos
AP	Área Protegida
UGAP	Unidade de Gestão de Áreas Protegidas
PDNA	Post-Disaster Needs Assessment
PEM	Municipal Emergency Plan
PNF	Natural Park of Fogo
SNPCB	National Civil Protection and Fire Fighters' Service
TACV	Cabo Verde National Airline
UNDG	United Nations Development Group
UNDP	United Nations Development Group
UNICEF	United Nations Children's Fund
Uni-CV	University of Cabo Verde
UN-HABITAT	United Nations Human Settlements Programme
USB	basic health unit
IVA	Imposto sobre o valor acrescentado
OMS	Organização Mundial da Saúde

EXECUTIVE SUMMARY

On November 23, 2014, people on the island of Fogo, and in particular the community of Chá das Caldeiras, were awakened by the onset of a volcanic eruption on the ridges of the tectonic fault of Pico de Fogo. During the early hours of the eruption, critical infrastructure such as roads and telecommunications were immediately destroyed by a massive torrent of lava that also covered a substantial area of arable land. However, because of the type of volcanism associated with the Pico do Fogo, which is a slow movement of magma, the population had sufficient time to be evacuated from the affected area. During the eruption large quantities of ash and gases were expelled into the atmosphere, with severe impact on the air quality, which in turn prevented normal flight operations. The eruption gained local, national, and international attention when the lava flow completely destroyed the two communities that had been living on the foot slope of this volcano since 1927. The eruption terminated on February 7, 2015, after 88 days of continuous emission of magma.

Emergency operations required the engagement of national authorities to ensure that all needs were fully met, and equipment and goods were sent from the capital Praia and neighboring islands. The population was fully evacuated and temporarily relocated in shelters, public schools, rental facilities paid for by the government, or the homes of families and friends. However, most of the affected population was resettled in the houses in Achada Furna and Monte Grande built by the government in the aftermath of 1995's Pico de Fogo volcanic eruption.

Overall, the eruption left a trail of devastation as it completely destroyed the two settlements in the caldera and displaced the 994 people living there. Agricultural land was destroyed as well as the wine cooperative, with sizeable consequences for the local economy, which is mostly agriculture based. The eruption also affected social infrastructure (schools, the health center, and a church) and the recently completed Fogo Natural Park's management headquarters and education center.

DISASTER EFFECTS

The total value of the eruption effects (physical damages and production losses) has been estimated at Cabo Verde escudos (CVEsc) 2,832.30 million, equivalent to US\$28 million (see table ES.1). Of this amount, CVEsc 2,138.0 million refer to the value of destroyed assets (75.5 percent of the total) and CVEsc 694.3 million are changes in the flows of production of goods and services (24.5 percent of the total). This distribution is typical of disasters caused by natural hazards of geophysical origin (i.e., the value of damages is higher than the value of losses).

Table ES.1: Estimated Value of Disaster Effects from the 2014 Fogo Volcano Eruption (CVE millions).

Source: PDNA.

Sectors	Damage Value	Ownership		Flow losses	Ownership		Total Effects	Ownership	
		Public	Private		Public	Private		Public	Private
Social sectors	817.4	46.0	771.4	12.4	12.4	-	829.8	58.4	771.4
Housing	755.2	-	755.2	1.5	1.5	-	756.7	1.5	755.2
Education	40.2	40.2	-	2.1	2.1	-	42.3	42.3	-
Health	5.8	5.8	-	8.8	8.8	-	14.6	14.6	-
Culture	16.2	-	16.2	-	-	-	16.2	0.2	16.1
Productive	970.7	17.4	953.3	426.5	4.6	421.9	1,397.2	22.0	1,375.2
Agriculture	578.3	16.4	561.9	272.8	4.6	268.2	851.0	20.9	830.1
Livestock	5.1	-	5.1	0.9	-	0.9	6.0	-	6.0
Agroprocessing	240.0	-	240.0	95.0	-	95.0	335.0	-	335.0
Tourism	147.3	-	147.3	57.8	-	57.8	205.1	-	205.1

Infrastructure	186.5	182.7	3.9	44.1	9.2	34.9	230.6	191.9	38.8
Electricity	-	-	-	3.7	-	3.7	3.7	-	3.7
Water and sanitation	0.5	0.5	-	9.2	9.2	-	9.7	9.7	-
Transport	182.2	182.2	-	22.2	-	22.2	204.4	182.2	22.2
Communication	3.8	-	3.8	9.0	-	9.0	12.8	-	12.8
Cross-cutting	163.3	163.3	-	211.3	204.8	6.5	374.6	368.2	6.5
Environment	156.0	156.0	-	164.0	164.0	-	320.0	320.0	-
Governance	6.5	6.5	-	2.5	2.5	-	9.0	9.0	-
Disaster risk reduction	0.8	0.8	-	38.0	38.0	-	39.2	39.2	-
Employment	-	-	-	6.5	-	6.5	6.5	-	6.5
TOTAL	2,138.0	409.4	1,728.5	694.3	231.0	463.4	2,832.3	640.4	2,191.9

The estimated value of damage of assets and disruption of production flows is equivalent to about 2 percent of the country's gross domestic product (GDP), which indicates that the impact of the disaster on the national economy would be of limited relevance, as discussed later. Had information on the value of gross domestic production for the island been available, the estimated regional disaster impact would have been higher and relevant. The disaster impact is of significant relevance at the personal or household level.

Disaster effects are not evenly distributed when considering the ownership of damage and production losses: the public sector sustained total effects of CVEsc 640.4 million (or 22.6 percent of the total), while the private sector—including individuals and businesses—sustained total effects estimated at CVEsc 2,191.9 million (or 77.4 percent of the total), as shown in figure ES.1. This is a reflection of the relative burden to be faced by each sector during recovery and reconstruction, although the government is expected to absorb a higher share of the implicit contingent liabilities to assist in the resilient recovery of the affected populations, particularly the poor and other vulnerable groups.

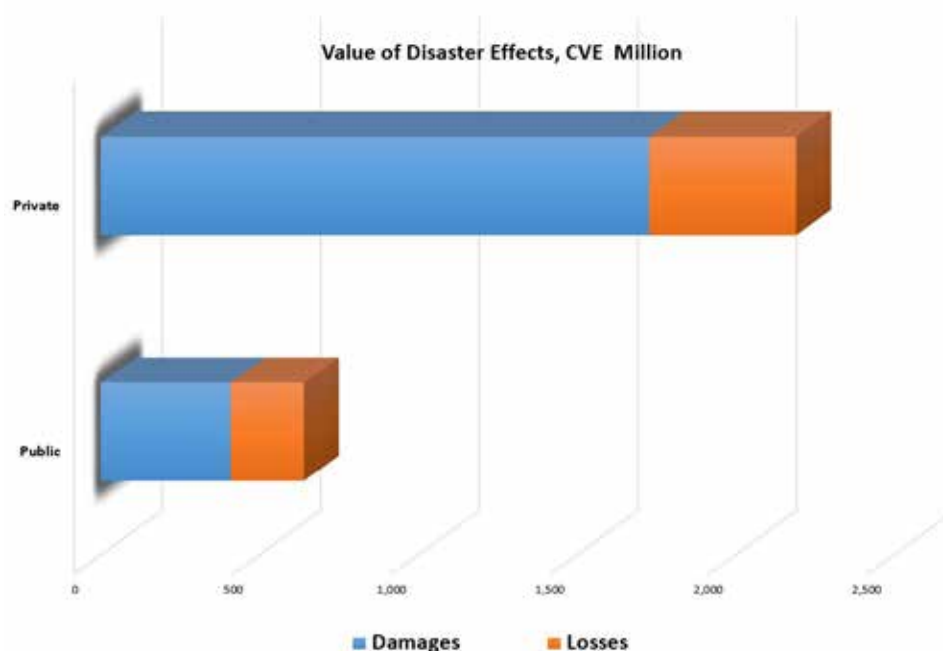


Figure ES.1: Distribution of the 2014 Eruption Disaster Effects between Public and Private Sectors (CVEsc millions)
Source: PDNA.

An observed pattern is related to the manner in which disaster effects are spread over time and across geographical areas. In this particular case, while the destruction of assets occurred at the end of 2014, during the eruption of the volcano, production losses are predicted to continue for the next few years, as shown in

figure ES.2). This is due in part to the destruction of mature fruit trees and vineyards that would need to be replaced and nurtured for three to five years before they reach maturity and can be harvested. Even though agricultural lands were covered by lava and volcanic ashes, rendering the land unsuitable for agricultural activities, there are certain areas where the land was not affected by the lava front or the accumulation of ashes that may be prepared for the production of seasonal or annual crops, facilitating farmers' ability to resume some activities that can help them earn income before permanent plantations of fruit trees could be harvested again.

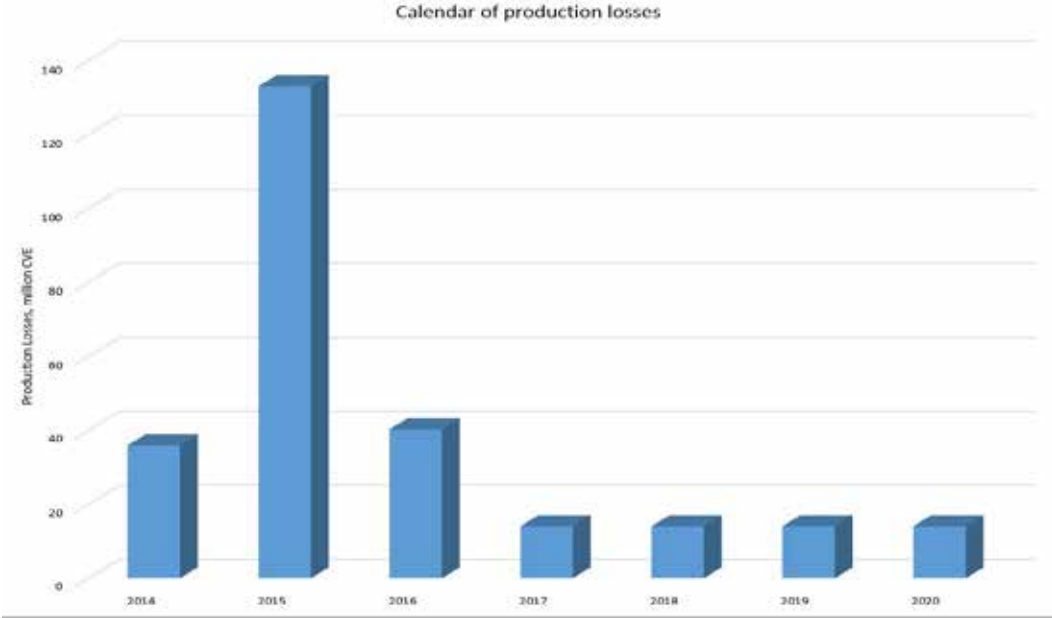


Figure ES.2: Time Variation of Production Losses Caused by the Volcanic Eruption.
 Source: PDNA.

The analysis of the disaster effects distribution across sectors reveals that the productive sectors experienced most of them, with a total of CVEsc 1,397 million, accounting for approximately 50 percent of the total effects. Social sectors followed with CVEsc 830 million, corresponding to the 29 percent of the total (see figure ES.3).

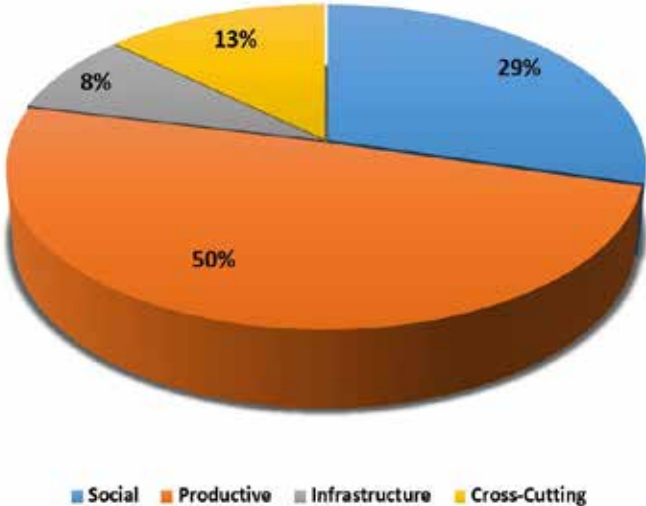


Figure ES.3: Main Sectors Affected by the 2014 Fogo Disaster
 Source: PDNA.

The most affected sectors were agriculture (CVEsc 851 million, in terms of damage and production losses); housing (CVEsc 757 million, mostly as damages); agroprocessing (CVEsc 335 million); wa-

ter and sanitation (CVEsc 540 million); Agro-industry (CVEsc 330 million); environment (CVEsc 320 million); tourism (CVEsc 205 million); and transport (CVEsc 204 million), as shown in figure ES.4.

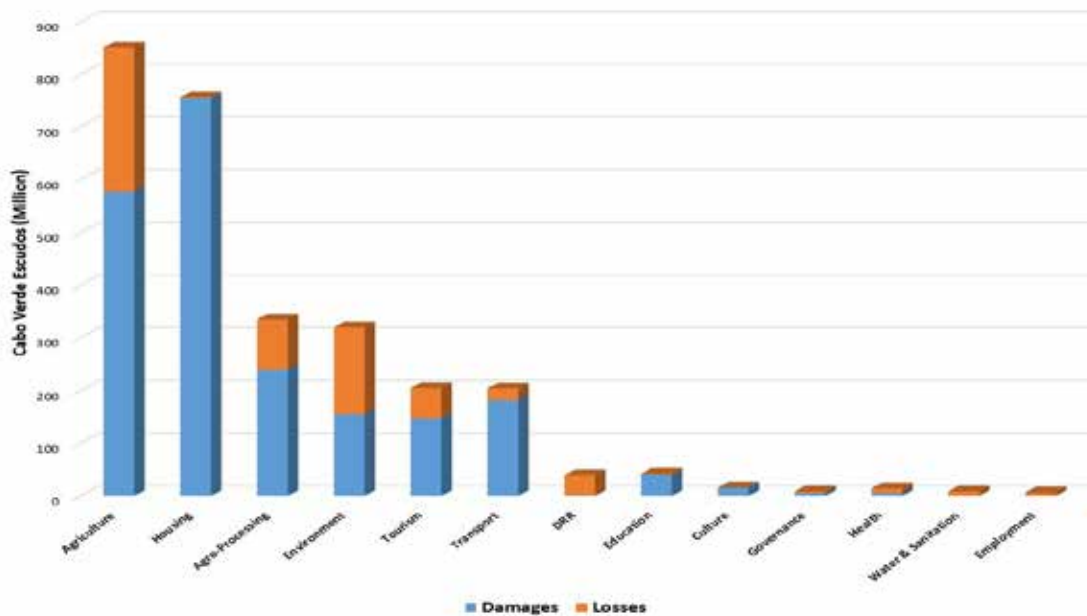


Figure ES.4: Sector Breakdown of Damage and Production Losses from the Eruption

Source: PDNA.

The estimated value of destroyed physical assets represents slightly less than 5 percent of the annual rate of gross fixed capital formation, which is a reflection of the capacity of the national economy to replace those assets.

MACROECONOMIC IMPACT

The impact of the volcano eruption has been substantial on the local economic activity of Fogo Island but small in terms of Cabo Verde's economy as a whole. The damage caused by the eruption translates into a loss of capital stock at the end of 2014 equivalent to 0.42 percent of the total capital stock, with the highest losses occurring in the primary sector. In terms of GDP, there is a small loss in 2014 attributable to the 1.5 months of foregone economic output since the volcano eruption started. The highest loss to GDP occurs in 2015 and is equivalent to 0.44 percent of the expected GDP of that year.

IMPACT ON HUMAN DEVELOPMENT

While there are no official data on poverty levels for Chã das Caldeiras, the ones for the municipality of Santa Caterina to which Chã belongs are higher than the national average. The effects of the eruption on agriculture and on tourism will certainly be substantial on people's livelihoods since agriculture and to a lesser extent tourism were the main sectors of economic activities for the people in Chã. Should activities in these two sectors not be rapidly resumed and sustained, it is likely that people's income levels might decline in the coming months. It is also possible to assume that decreasing income levels might bear further negative consequences on such other aspects of the population's well-being as nutrition, health, and education. It should be noted, however, that the relocation of the population of Chã to other settlements with better facilities might actually bear positive consequences by improving access to health and education services. These services were inadequate to meet the demand in Chã. Similarly for housing, the provision of improved homes will certainly benefit the affected population. It remains difficult to estimate the psychological consequences of the disaster on the affected population and particularly the social and cultural aspects of relocating the community of Chã. It can be expected that psychosocial support would be needed to address the potential negative emotional impacts on some members of the affected communities, particularly taking into consideration the unique cultural and social dynamics that prevailed in the community of Chã.

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RECOVERY NEEDS AND STRATEGY

The eruption of the Pico do Fogo volcano destroyed homes and transport and social infrastructure and had an impact on the livelihoods of the entire community of Chã das Caldeiras. The needs that must be urgently addressed are related to housing and improved access to social services and utilities in the new settlement as well as the revamping of agricultural activities in the caldera to avoid further deterioration of livelihoods. Infrastructure works, particularly reestablishing safe road access to Chã, are critical to facilitate the resumption of key economic activities: agricultural and tourism. Facilitating the natural park management operations as well as rebuilding tourism-related infrastructures and the park's management headquarters are important parts of the latter. Replacing damaged equipment used for monitoring volcanic activity is also essential.

While the volcanic eruption unveiled some existing vulnerabilities, the recovery strategy offers an opportunity to address those vulnerabilities through the adoption of a build back better approach as the guiding principle. This will help increase the overall resilience of the affected population and promote sustainable development. The recovery strategy should address emerging needs related to accessing public services such as health and education and the improvement of the livelihoods of the affected communities, not only by resuming existing agricultural activities, but also by diversifying households' income-generating capacity, offering sustainable alternatives, the expansion of tourism-related opportunities. The strategy should also protect their livelihoods by strengthening the national and local capacities for disaster risk management and environmental management. Postdisaster recovery needs and related costs have been identified for each sector included in the analysis. The total amount for the recovery process is estimated at CVEsc 287.9 million, equivalent to US\$30.2 million (total amounts for each sector are indicated in table ES.2).

Table ES.2: Summary of Cape Verde Recovery Needs

Sector	CVE (milhões)			Total (CVE milhões)	US\$ (milhões)			Total (US\$ milhões)
	Short	Medium	Long		Short	Medium	Long	
Productive sectors	355.4	94.9	45.8	496.0	3.5	0.9	0.5	4.9
Agriculture	91.5	30.3	35.4	157.2	0.9	0.3	0.4	1.6
Livestock	41.0	30.3	-	71.3	0.4	0.3	-	0.7
Agroprocessing	32.4	8.1	-	40.4	0.3	0.1	-	0.4
Tourism	190.5	26.1	10.4	227.0	1.9	0.3	0.1	2.2
Social sector	377.6	443.7	-	821.3	3.7	4.4	-	8.1
Housing and land use	373.6	358.0	-	731.6	3.7	3.5	-	7.2
Health	3.7	31.6	-	35.3	0.0	0.3	-	0.3
Education	0.2	37.3	-	37.5	0.0	0.4	-	0.4
Culture	-	16.9	-	16.9	-	0.2	-	0.2
Cross-cutting issues	189.0	447.0	232.1	840.9	1.9	4.4	2.3	8.6
Environment	40.9	218.1	25.1	284.1	0.4	2.2	0.2	2.8
Employment	5.8	99.2	28.5	133.5	0.1	1.0	0.3	1.3
Gender	-	-	-	-	-	-	-	-
Disaster risk reduction	137.1	110.0	173.2	420.3	1.4	1.1	1.7	4.2
Governance	5.2	19.7	5.3	3.0	0.1	0.2	0.1	0.3
Infrastructure	329.6	524.0	10.0	863.6	3.3	5.2	0.1	8.5
Transport	329.0	504.0	-	833.0	3.3	5.0	-	8.2
Communication	0.2	-	-	0.2	0.0	-	-	0.0
Energy	-	-	10.0	10.0	-	-	0.1	0.1
Water	-	20.0	-	20.0	-	0.2	-	0.2
Sanitation	0.5	-	-	0.5	0.0	-	-	0.0
TOTAL	1,251.5	1,509.6	287.9	3,021.8	12.4	14.9	2.8	30.2

INTRODUCTION

On November 23, 2014, the people of the island of Fogo, and in particular the community of Chã das Caldeira, were awakened by the onset of a volcanic eruption on the ridges of the tectonic fault of Pico de Fogo. The eruption was preceded for several days by a series of strong explosions and small earthquakes normally associated with brittle rock failure due to magma redistribution in or near a central magma reservoir or more likely a dyke intrusion. During the early hours of the eruption, critical infrastructure such as roads and telecommunications were immediately destroyed by a massive torrent of lava that also covered a substantial area of arable land.

Because of the type of volcanism associated with the Pico de Fogo, consisting of slow magma movement, the population had sufficient time to be evacuated from the affected area. During the eruption, large quantities of ash and gases were expelled into the atmosphere, with severe impacts on the air quality, which in turn prevented normal flight operations. The eruption gained local, national, and international attention when the lava flow completely destroyed the two parts of Chã das Caldeira—Portela and Bangaeira—where people had been living at the foot of the volcano's slope since 1927. The eruption terminated on February 7, 2015, after 88 days of emitting large quantities of magma.

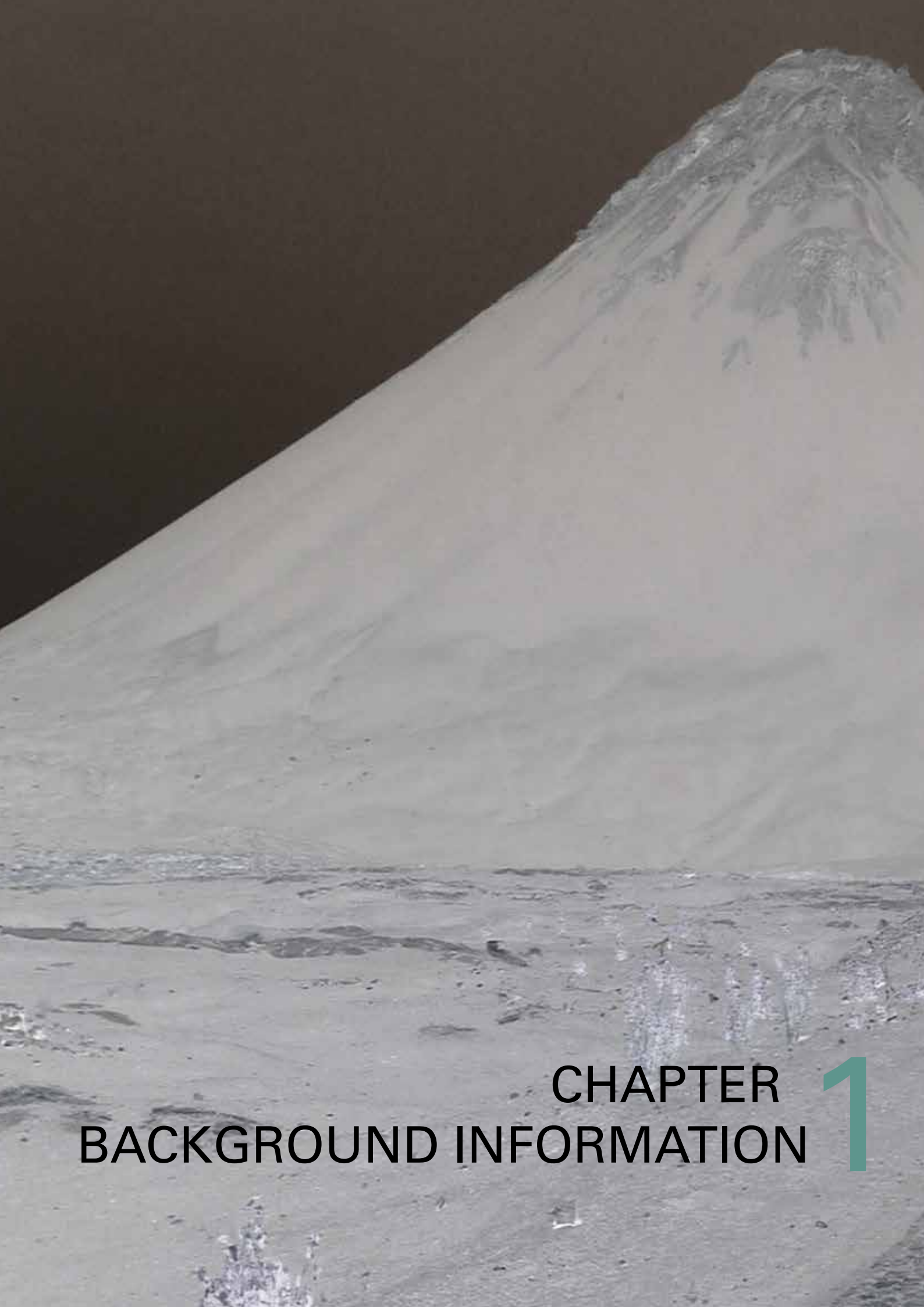
The 2014–15 eruption left a trail of devastation, displacing 994 people whose houses were covered by the lava and destroying agricultural land and inputs as well as the winery facility. The adverse effects on the livelihoods of the population of Chã and the local economy were significant. The eruption also destroyed social infrastructure (schools, a health center, and churches), the main access road to Chã, and the headquarters of the Natural Park of Fogo, which was based in the caldera. Following the eruption and as emergency operations ended, the government of Cabo Verde decided to undertake a comprehensive assessment to identify the recovery needs and guide the recovery strategy for Chã das Caldeiras. The support of the international community was requested, and a Post-Disaster Needs Assessment (PDNA) was conducted by the government and the United Nations, European Union, and World Bank in April 2015. This report is the result of that assessment.

Chapter 1 provides background information on the island of Fogo and particularly on the two communities of Chã das Caldeiras (Portela and Bangaeira), an overview of the disaster event, and the immediate response operations. The chapter also describes the methodology used for the assessment and the PDNA process in Cabo Verde.

Chapter 2 analyses the disaster effects (i.e., physical damages and production losses) in the economic and social sectors affected by the eruption as per the following: productive (agriculture and tourism); infrastructure; social (housing, education, health, and culture); and cross-cutting themes (environment, disaster risk reduction, governance, gender, employment, livelihoods, and social protection).

Chapter 3 focuses on the overall impact of the disaster on the macroeconomic situation of the country and highlights the long-term impact of the eruption on the human development of the affected population. Finally, chapter 4 analyses the recovery needs and propose a recovery vision, principles and strategy.

Note on currency and equivalents: The currency conversion rate used is US\$1.00 = CVEsc 98.9.



CHAPTER 1
BACKGROUND INFORMATION



COUNTRY BACKGROUND: CABO VERDE

Cabo Verde is a small nation located in the Atlantic Ocean, approximately 550 to 800 kilometers off the West African coast. The archipelago nation is a horseshoe-shaped cluster of 10 islands, 9 of which are inhabited, and 13 islets constituting an area of 4,033 square kilometers and an exclusive economic zone that extends for approximately 734,000 square kilometers (figure 1.1).

The islands rise from the deep abyssal plain beyond the African continental shelf and are divided into two groups according to dominant winds: windward and leeward. The windward islands are Santo Antão, São Vicente, Santa Luzia, São Nicolau, Sal, and Boa Vista. The leeward group comprises Maio, Santiago, Fogo, and Brava. The morphology and geology features vary greatly among the islands. The relief is generally very steep on the islands that are mountainous, culminating in high elevations such as 2,829 meters on Fogo Island and 1,979 meters on Santo Antão Island.



Figure 1.1: The Archipelago of Cabo Verde

Source: mapsoft.net

Many of the islands show overlapping periods of active volcanism, although Sal and Maio, in the east, have the oldest dated volcanic rocks (12 and 16 Ma, respectively) and only Fogo and Santo Antão, at the western ends of the northern and southern arms of the “horseshoe,” respectively, have experienced significant volcanism in the last 500 ka (Holm et al. 2006; Plesner et al. 2002).

The economy of Cabo Verde is service oriented, with commerce, transport, and public services accounting for more than 70 percent of the gross domestic (GDP), while agriculture and fishing contribute only to 9 percent of the GDP. Cabo Verde was the second country, after Botswana, to graduate from the category of least developed countries. The country economy registered a real GDP growth rate of around 4 percent in 2011, 1 percent in 2012 and it is estimated to have dropped to 0.5 percent in 2013.

Cabo Verde has also made great strides in improving its health and education standards and other aspects related to human development. In 2013, the country’s score on the United Nations’ Human Development Index was 0.636, an increase from 0.573 in 2000. This improvement reflects achievements mainly in education and health over two decades. In fact, Cabo Verde more than doubled its per capita total health expenditure from US\$70 in 2002 to US\$144.2 in 2012. Increased resource allocation has led to improvements in

basic health indicators. Available World Bank data for 2013 shows that infant and child mortality rates fell from 21.9 and 26.0, respectively, per 1,000 live births in 2010 to 23.3 and 27.8. Similarly, maternal mortality declined from 58 per 100,000 live births in 2010 to 53. Accordingly, the share of the health sector in government operating expenses is expected to increase from 9.1 percent in 2015 to 9.7 percent.

steady improvements in education have also been recorded, with Cabo Verde recording near universal primary education and achieving the Millennium Development Goal target in 2005. Literacy rates for those ages 15 years and older stood at 85.3 percent in 2012 compared to 80.0 percent in 2004. Similarly, the secondary education completion rate stood at 90.0 percent in 2012, up from 57.0 percent in 2005.

CABO VERDE'S DISASTER PROFILE

Historical data show that Cabo Verde have always suffered from recurrent severe droughts, which resulted in high mortality rate and took a high toll on the livelihoods of the people. Prior to its independence in 1975, this cycle of droughts caused widespread famine and forced migration. At the same time, Cabo Verde also suffers from heavy rainfall pattern that—in association with the geomorphology of the islands (high elevation and steep slopes)—frequently causes flash floods and leaves a trail of destruction on valley floors, coastal zones, and low-lying urban settlements.

The country is also exposed to other hazards such as landslides, coastal erosion, and forest fires. Landslides, especially those triggered by flash floods, are a recurrent disaster, affecting especially mountainous areas and having negative consequences for infrastructure (roads and check dams), agricultural land, and housing. In urban areas, especially in slum zones, landslides associated with floods also exacerbate the socioeconomic vulnerability of poor urban dwellers and further degrade informal settlement habitats.

Twenty-eight volcanic eruptions have been registered since the “discovery” and settlement of Fogo Island in 1460, with an average frequency of one eruption every 19.2 years. These events have adverse effects on the island’s landscape and the people’s livelihoods. The volcano Pico do Fogo erupted in 1951, 1995 (for 35 continuous days), and, of course, 2014–15, for 88 days. Associated with the vulcanism, seismic risk is also a reason of concern on the islands of Fogo, Brava, and Santo Antão island, despite the generally low magnitude of events (less than 3.9 on the Richter scale and with deep epicenters, around 13 kilometers deep). This hazard remains a risk especially for critical infrastructure and housing

With regard to coastal erosion, urban growth has resulted in occupation of coastal zones susceptible to storm surges and seawater intrusion. Coastal erosion associated with climate change and sea-level rise has been further exacerbated by anthropogenic action in coastal zones—sand extraction for construction purposes remains one of the main environmental issues of the country and has negative impacts on saltwater intrusion in soil and aquifers.

THE ISLAND OF FOGO AND SOCIOECONOMIC ASPECTS OF CHÃ DAS CALDEIRAS

Fogo is the fourth largest island of the archipelago (443 square kilometers). It was the second, after Santiago, to be populated around 1493, mainly for the production of cotton and rearing of horses. Like the rest of the islands of Cabo Verde, Fogo is located in arid and semiarid climate zones. The climate of the island is characterized by two distinct seasons: rainy (August–October) and dry (November–July).

Initially named San Filipe, the island's name later changed probably due to the presence of the active volcano that shapes the whole island in a nearly round-based, cone-like structure of about 25 kilometers (16 miles) in diameter that reaches a maximum height at the Pico do Fogo (Peak of Fire), 2,829 meters above sea level (figure 1.1). The large summit caldera (about 10 kilometers in the north-south direction and 7 kilometers in the east-west direction) is not located in the center of the island, but rather towards its northeastern corner. The caldera is bounded by steep near-vertical fault scarps on the north, west, and south sides (bordeira) but is breached to the east where lava can flow to the coast. The current topography of Fogo, with the caldera open to the sea on the east side, results from the sliding of the east flank of the volcano towards the ocean (Day et al. 1999).

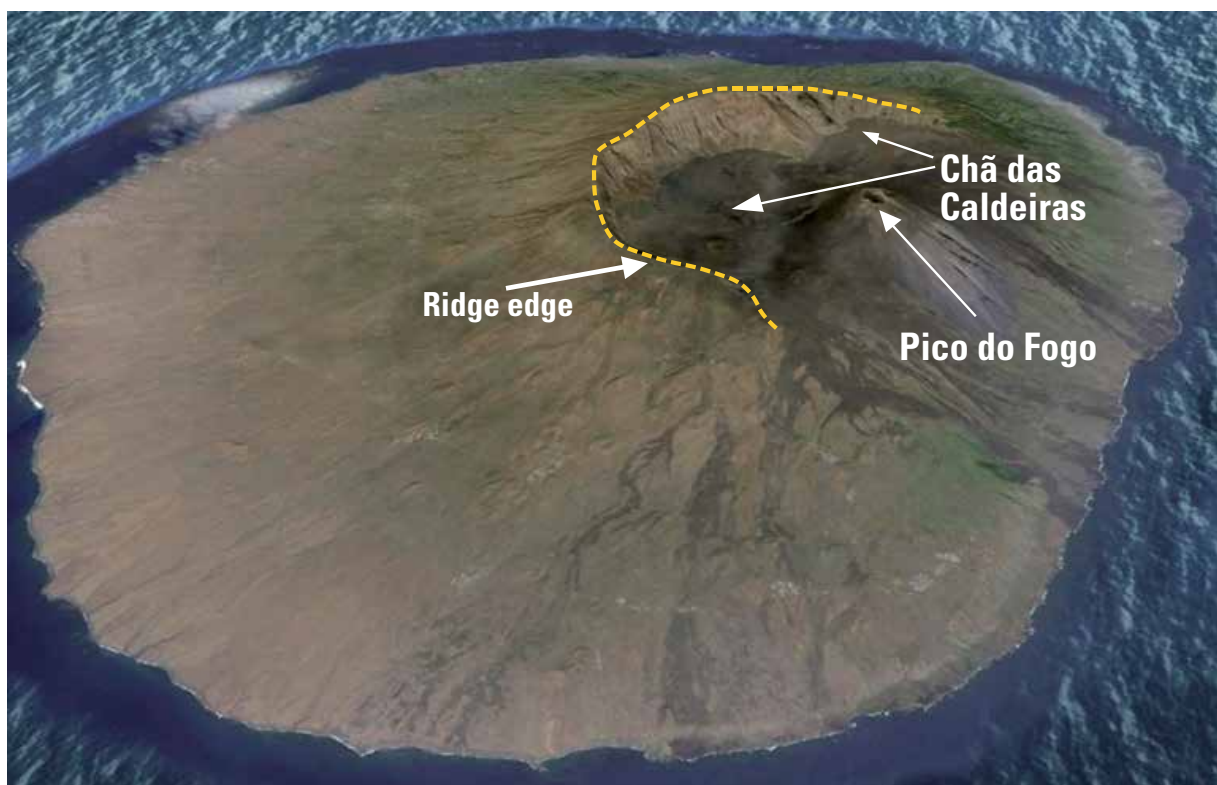


Figure 1.2: Island of Fogo, with Chã das Caldeiras on the Slopes of the Pico do Fogo and Enclosed by the Headwall of Bordeira

Source: Adapted from Google Earth.

SOCIAL AND ECONOMIC ASPECTS OF CHÃ DAS CALDEIRAS

The settlement in Chã das Caldeiras started in the late nineteenth century or early twentieth century, when a few families decided to establish their residency there to take advantage of the agriculture potential of this area. The two most representative and populated localities of Chã das Caldeiras (Portela and Bangaieira) were located within the boundaries of the Bordeira. Administratively part of the municipality of Santa Catarina do Fogo, these communities were quite distant from the municipal center and presented distinct social and economic characteristics compared to other rural settlements in the island. The limited size of the community and the maintenance of close family ties have resulted in strong social cohesion and a rich social capital.

The latest census, conducted in 2010 by the National Statistics Institute (INE), counted the population of

Chã das Caldeiras at 697 people: 357 women and 340 men. The total population has grown to 964 people, of which 486 are women and 478 are men (See table 1.1). While census data demonstrated a declining population trend in Fogo Island, in the case of Chã das Caldeiras, the population has practically doubled since the 1995 eruption. More up to date information was made available by the National Civil Protection Service, based on a post-eruption displaced population survey. According to this data, approximately 249 families were residing in the Chã das Caldeiras right before the eruption.

Table 1.1: Chã das Caldeiras Population (December 2014)

Population	Female	Male	Total
Elderly	16	9	25
Adults	230	235	465
Youth	70	70	140
Children	134	135	269
Infants	36	29	65
TOTAL	486	478	964

Source: National Civil Protection Service.

The communities of Portela and Bangaieira in Chã das Caldeiras were not provided with water and electricity services for years. The shortage in provision of basic public services (water, sanitation, education, health, and administrative services) derives from an initial governmental decision, after the 1995 eruption, to prohibit the resettlement in Chã das Caldeiras in order to discourage the return of displaced population and to avoid urban expansion. However, the nonreturn policy was unsuccessful due to limited economic opportunities in resettlement areas, inadequate housing conditions, and the distance of the resettlement areas of Achada Furna and Monte Grande from Chã, which did not allow a daily commute in absence of public transport. Once the return to Chã das Caldeiras became factual there was an increasing social and political pressure to provide basic services. The combination of a power alternation at the central level in 2000 and the creation of a new municipality in 2005 resulted in the reopening of the school and progressive provision of services such as installation of a governmental delegation, opening of a police unit, and construction of a basic health and sport facilities.

The population lives mainly from agriculture and livestock, taking advantage of the unique microclimate of the caldera. In fact, Chã das Caldeiras is the only area in Cabo Verde that grows significant quantities of grapes and produces export-quality wines. Agriculture and animal husbandry engage most of the population, as it provides basic family economic subsistence. Agroprocessing, especially the making of wine, cheese, jams, and so forth, was part of the community livelihood and has played a major income-generating role. Tourism services (guiding, hostels, and restaurants) and handicrafts have been complementary livelihood activities. Despite the enormous touristic potential of the locality, economic activities around tourism were still incipient but progressively engaged the youngest population and attracted entrepreneurs.

THE 2014–15 ERUPTION

The eruption was preceded by a series of seismic activities, recorded by the National Institute of Meteorology and Geophysics (INMG) and geochemical data collected by the University of Cabo Verde. These precursor signals indicated the imminent threat of the eruption in Fogo. According to the INMG, on November 22 and 23 the earthquakes continued and increased in intensity. These series of seismic events indicated that the magma pressure was increasing and rising toward the surface. At 10:00 a.m. on November 23, the subsidiary vents located on the base of the Pico Novo began expelling large quantities of pyroclastic materials and volcanic ashes and large quantities of volcanic gases.

Three vents on the north-south direction were opened, with distinct viscosity (“A” and pahoehoe lava) and flow directions. The lava slowly engulfed approximately 520 hectares inside the caldera, with an average lava wall height of four to eight meters. Two hundred and eight hectares of agricultural land were destroyed, corresponding to 24.61 percent of agricultural lands. The lava front also covered the main road in the

caldera that was providing access to the communities of Bangaeira and Portela e Djeu de Lorna, halting all evacuation efforts by motorized vehicles.

Based on the scientific measurements from the University of Cabo Verde, during the early stage of this natural phenomenon the eruptive column reached the height of 6,000 meters. Intense volcanic ash depositions were reported in Cova Tina and Monte Beco, Portela, Bangaeira, Sao Filipe, Cova Figueira, Patim, Monte Grande, and on the islands of Brava and São Vicente. The first lava front was characterized mainly by pahoehoe type lava, and at a later stage of the eruption aa lava travelled between Mount Cova Tina and Mount Beco. As the eruption proceeded, three fronts of lava were clearly established: toward Monte Lorna, Cova Tina, and northward, destroying the communities of Portela and Bangaeira (see figure 1.2).

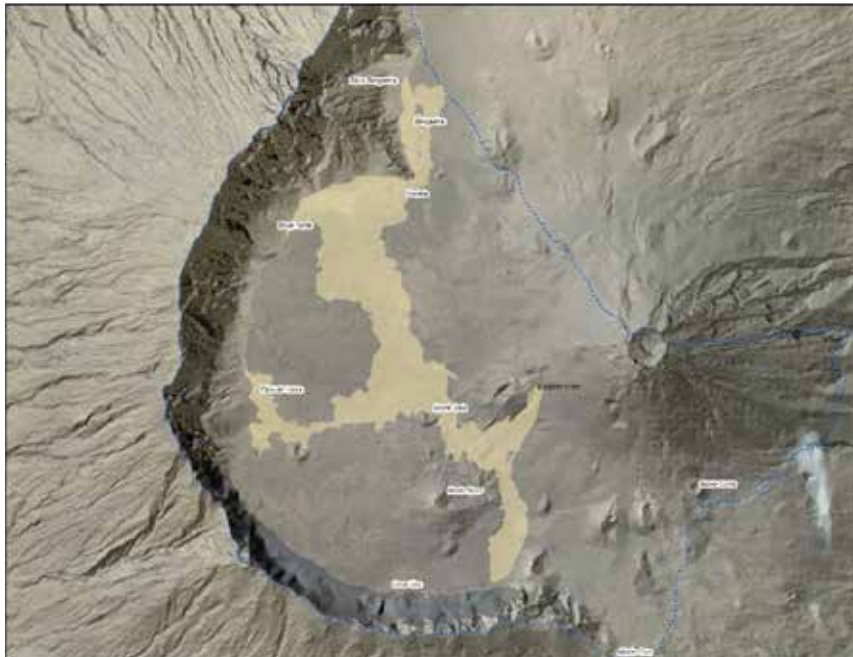


Figure 1.3: The Lava Field (yellow) of the 2014–15 Eruption

Source: Image courtesy of INGT.

The population of Chã das Caldeiras immediately began self-evacuating, the people taking as much of their goods and removable physical assets as they could. Fortunately, no deaths were reported.

With support of a rover unit deployed by INMG in São Filipe city, the quality of air was monitored starting on November 28, 2014. Reporting, from sample monitoring, was done on a daily basis. The reporting pointed out the concentration of SO₂, NO₂, O₃, CO₂, PM₁₀, and PM 2.5 and compared those values to the limits of safe human exposure established by the World Health Organization (WHO) in 2005. While the reported concentration exceeded the safe public health limits for only a few days, a full picture of the health impact of volcanic gases emissions cannot be drawn because the monitoring unit was stationed in a single location in São Filipe and sampling in Chã das Caldeiras and Mosteiros was not conducted.

The eruption continued over a period of almost three months and ended on February 7, 2015. The end of the eruption was scientifically confirmed by measurements on a series of parameters: decreased temperature of the fumaroles, almost undetectable sulphur dioxide emissions, stagnant pahoehoe flows, and minor fumarolic activity at the edge of the new emission points. More in-depth characterization of the eruption, in terms of volume and composition of lava, and tomography need to be completed in order to gain further understanding of the hazard dynamics.

By the end, the eruption had impacted mainly the productive, social, and infrastructure sectors, with significant effects mostly on private property (figure 1.3). A total of 260 houses in Portela and Bangaeira; all critical public infrastructure such as schools, hotels, a health center, sports facilities, and roads (about 5,700 meters); arable land (208 hectares); and rural infrastructure, including churches, were totally destroyed. The

newly built (May 2014) and emblematic headquarters and visitor center of the Natural Park of Fogo was also completely buried by the lava.



Figure 1.4: Damage to Private Properties in Portela (left) and Bangaeira (right)

RESPONSE OPERATIONS

In the early hours of eruption, the National Civil Protection Services at the national level as well as the municipal emergency centers in Fogo were activated, and they were the first emergency responders. A state of emergency was declared, and the Crise Gabinete was created by the Council of the Ministers. An initial meeting of the Crise Gabinete, chaired by the prime minister, was held on December 3 to identify priority areas of assistance to the displaced—including improvement of living conditions and identification of re-settlement options. In Fogo, assistance was coordinated by Civil Protection authorities and three Mayors.

Standard assistance packages with basic one-week duration baskets, including food and other items, were distributed to households in Achada Furna, Achada Grande, and Mosteiros. The 964 displaced persons were resettled in temporary shelters, a public school, rental facilities paid for by the government, or the homes of families and friends in localities such as Mosteiros, Achada Furna, Monte Grande, and São Filipe. However, most of the affected population was evacuated to the houses in Achada Furna (40 houses) and Monte Grande (70 houses) built by the government following the 1995 eruption, as these remained their property even after their return to Chã das Caldeiras.

The following national entities engaged in emergency response operations:

- *National Civil Protection and Firefighters Service (SNPCB)*. The President of Civil Protection and a national level coordinator for the emergency response were deployed to Fogo to assist the entire operations.
- *Cabo Verde Red Cross Society*. Seventy-six volunteers were deployed from Fogo, Praia, and other islands in rotating shifts during the eruption duration. The Red Cross assisted in the registration and distribution of relief items at all three displacement sites.
- *Local authorities*. The mayors of Santa Catarina, São Filipe, and Mosteiros (affected municipalities) supported the emergency response and evacuation of people and goods from the start.
- *The army*. Fifty Cabo Verde personnel of the armed forces were deployed to Fogo to support the evacuation of affected people and assist with securing the affected areas as well as temporary accommodation centers.
- *Local communities*. These provided various volunteers working in the temporary accommodation centers
- *Other governmental entities*. All the relevant ministries were engaged in the response: Health; Education; Interior; Environment, Housing, and Land Management (MAHOT); INMG; National Institute of Management of the Territory (INGT); and the Laboratory of Civil Engineering (LEC) participated in the emergency management and assessments.

- *Academia.* The University of Cabo Verde provided the scientific day-to-date monitoring of the volcanic activities.

Although the government played a substantial role in the emergency response, it was felt that additional support was required, and international assistance was requested. Support to initiate humanitarian relief and early recovery needs was provided by several development partners. The Ministry of Foreign Affairs played a major role in coordinating international assistance, while the national emergency task force (i.e. Crise Gabinete) was designated the main coordination body, supporting early recovery efforts and information and communication. A UN Disaster Assistance and Coordination team¹ was deployed in early December 2014 to support the overall coordination, early needs assessment, and information management at the request of the government of Cabo Verde and a preliminary Early Recovery Plan identifying main areas of support was prepared in January 2015 with support from the UN. However, since the eruption was still continuing, it was decided to wait to complete a comprehensive assessment of the consequences of the eruption.

POST-DISASTER NEEDS ASSESSMENT (PDNA) METHODOLOGY

The PDNA is a methodology for joint assessment and recovery planning that seeks to assess the impact of the disaster and define a strategy for recovery, including the estimation of financial resources required². The assessment evaluates the disaster effects pulling together information on the physical damages of the disaster and on its socio-economic aspects (economic losses, changes in service delivery and governance caused by the disasters, and increased risks and vulnerabilities) and, on such basis, evaluates the overall impact the disaster has on the macro-economic and human development context of a country. On the basis of this information, the PDNA determines the needs and recovery priorities generated by the disaster and produces a consolidated report that lends to a resilient recovery strategy.

The PDNA process is government led and government owned. Technical support and facilitation may be provided by the European Union (EU), World Bank, and the United Nations Development Group (UNDG), as well as other stakeholders as determined and requested by the government. The PDNA process involves the participation of the affected population, local authorities, NGOs, donors, civil society, and the private sector. Given the broad range of organizations, individuals, and communities that need to be involved, cooperation and coordination are essential for achieving a participatory and comprehensive PDNA.

The PDNA produces four core deliverables:

1. *A consolidated assessment report* based on sector reports that present a cross-cutting, comprehensive assessment of the impact of the disaster
2. *A recovery strategy* that defines the vision for national recovery and outlines recovery actions for each sector and affected region (The strategy clarifies objectives and interventions, expected results, the timeframe, and the expected cost for the recovery process.)
3. *A basis for resource mobilization* in support of the country's recovery
4. *An outline for a country-led recovery process through the formulation of a recovery strategy*

The sectors generally assessed in a PDNA are as follows:

- *Social.* Housing, education, health, and culture
- *Infrastructure.* Water and sanitation, community infrastructure, energy and electricity, and transport and telecommunications
- *Productive.* Agriculture, livestock and fisheries, commerce and industry, and tourism

¹ The team comprised experts from the Office for the Coordination of Humanitarian Affairs, United Nations Development Programme, WHO, Food and Agriculture Organization, United Nations Children's Fund, and associated experts from the European Commission's Humanitarian aid and Civil Protection Department (ECHO).

² The PDNA is the result of a commitment articulated in the joint agreement on postcrisis cooperation, signed between the European Union, the World Bank, and the United Nations Development Group in 2008. Through the agreement, PDNA partners commit to supporting government ownership and leadership of the postdisaster needs assessment process.

- *Macroeconomy.* GDP, fiscal deficit, and balance of trade (import-export, revenue-expenditure)
- *Finance.* Banks and nonbanking financial institutions
- *Cross-cutting themes.* Governance, disaster risk reduction, employment and livelihoods, environment, and gender.

The PDNA does not duplicate national and international rapid humanitarian assessments but complements them with the objective of ensuring one consolidated process. If humanitarian assessments have been carried out by the government, UN, civil society or other group, the information and analysis contained is used to reinforce the PDNA exercise.

PDNA PROCESS IN CABO VERDE

The government of Cabo Verde requested the undertaking of a PDNA and the technical assistance of the United Nations, EU, and the World Bank on 1 March 10, 2015 through an official letter sent by the Office of the Prime Minister, through the Ministry of External Affairs (MIREX/DNAPEC). The PDNA and sectors terms of reference were drafted in consultation with the government

The main objective of the PDNA was the assessment of the consequences of the 2014–15 volcanic eruption on the affected community of Chá das Caldeiras, and including considerations for any secondary consequences for the Island of Fogo and for the whole country. On the basis of the assessment, the recovery needs and related financial implications were identified and a recovery strategy defined.

The preparation and coordination of the PDNA assessment was led by UN Joint Office in Cabo Verde, in close coordination with the UNDP Climate Change and Disaster Cluster based in the UNDP Headquarters in New York, and it was undertaken in close collaboration with the World Bank and EU delegation in Cabo Verde.

The assessment was preceded by a four day training (April 13–16, 2015) for technical level staff from all relevant ministries and their delegations at the island-wide or municipal level on the Island of Fogo who then took part in the assessment itself. Representatives of the affected municipalities and some elements from civil society organizations (including the Red Cross) also participated in the training.

The data collection was conducted from different sources and applied different methods at different times and began April 6–15 when experts from UN-Habitat, UNDP, and UNICEF organized several technical working sessions with the INGT and LEC. This initial stage was followed by the assessment by sector conducted in Fogo between April 16 and 18. The assessment built on both primary data, collected through field visits to the affected area, technical group meetings, and interviews with relevant stakeholders (mostly government at both national and local levels) and secondary data, available from national and local governmental sources (statistical sector reports, official records and legally approved documents from the Official Gazette, and diagnostics and programmatic documents). Existing humanitarian and sector-specific assessments, and recommendations from the Forum of Reconstruction have been used as well to complement information.

During the process, several consultations were held with the government and other relevant stakeholders for the purpose of data collection and validation. Multiple consultations were undertaken with government sector leads both during the training and three meetings with the Reconstruction Cabinet. Private sector stakeholders in Fogo were also consulted through informal surveys. During those consultations, the preliminary findings of the assessment were jointly reviewed and the guiding principles and priorities for the definition of the related recovery strategy were discussed.

Civil society participated in this consultative process through the integration of the results of two household surveys conducted by the INGT among the affected population. A Budget Support Group meeting also provided a forum in which to share information among the partners on the PDNA.

This report has been finalized with the government of Cabo Verde, in particular the Cabinet of Reconstruction and the Prime Minister's Office, among other key stakeholders.

CHAPTER 2

DISASTER EFFECTS

Disaster effects refer to the results of the disaster event that are to be assessed, and they manifest in damages and losses. Damages refer to the destruction (partial or complete) of infrastructure and physical assets (including final goods, goods in process, raw material, and equipment and spare parts). Losses refer to economic flows that will be affected by the disasters, such as production declines, reduced incomes, and increased expenditures over time until the economy and assets are recovered.



PRODUCTIVE SECTORS

AGRICULTURE

Predisaster Situation

The agricultural sector represents one of the main sources of livelihood for a large proportion of the households in Chã das Caldeiras. Out of a population of 964 individuals living in the area, comprising children, youth, adults and elderly people, about 88 adult heads-of-household directly engage in crop production and/or livestock rearing. Considering that there are approximately 200 families residing in Chã das Caldeiras, it is clear that this sector contributes significantly to the generation of income for nearly half of the population. Of the total number of people involved in agriculture, 78 percent are male and 22 percent female (MEYHD 2014). Males engage mainly in agricultural activities such as cultivating annual and perennial crops, mostly pigeon peas, orchards, and vineyards, as well as animal husbandry. Women are involved primarily in harvesting the crops, along with their processing, to obtain wine, jam, and other agroproducts. The total cultivable land in the Chã das Caldeiras is approximately 848 hectares (ha) (MRD, 2015). The average plot size is 1.5 ha, however, there are a few people owning more than 25 ha. Land is passed on from a generation to another. Despite that, land ownership is still considered an issue. In this regard, in 2014, the government initiated a registration process to legalize land tenure. Among different employment opportunities in the agriculture sector, casual labor is a common practice, especially during the various harvesting seasons.

Thanks to favorable climate conditions, milder temperatures and greater precipitation compared to the rest of the island, as well as rich soil fertility, the agricultural activities in the Chã das Caldeiras are highly profitable. The main products include fruits such as grapes, apples, pomegranates, figs, and peaches, as well as vegetables and pulses comprising pigeon peas, potatoes, manioc, and peppers, among others. Grape production is the most important and profitable income-generating activity. Nevertheless, all cultivations are used both for household consumption and for income generation. Regrettably, consistent official data do not exist to identify the real coverage of each crop on the total arable land. Therefore estimations of total production in the area are challenging. Despite this, secondary information such as fieldwork reports and research studies indicate that the percentage of agricultural plots cultivated by different crops varies considerably in the area (MRD 2015; Matos 2010). Numerous intercropping systems are practiced in the Chã das Caldeiras whereby different seasonal and perennial crops are grown together on the same plot and with different densities, depending on the household's preference. Besides farming, a small portion of the population is engaged in livestock rearing. Goats, chickens, rabbits and donkey, the latter used mainly for transport of goods, represent the livestock subsector. No information is available regarding the number of animals reared for each class. However goats and chickens are the most common livestock. Goat milk is used to produce the well-known queijo de cabra, a homemade type of cheese consumed and sold on the local and national markets. Other homemade productions include the manufacturing of local wine called manecom, produced for both commercial and household consumption.

The main organizing productive body in the Caldeiras is the Associação dos Agricultores de Chã (an agricultural cooperative), which holds considerable sway over the local economy. The cooperative, with 102 members, is the main body responsible for the production of the Chã-labelled wine (white, red, and rosé) along with different types of spirits, sold mainly on the national market with a small quantity exported abroad. In addition to this, the cooperative buys fruit surplus from the local farmers and transforms it into processed products, especially jam. Two production facilities, one for wine making and another for fruit processing, were constructed in 1998 with support funds from the EU and the Italian nongovernmental organization COSPE (Cooperation for the Development of Emerging Countries) as well as private funds invested by the cooperative members themselves. These centers are furnished with highly advanced machinery and equipment imported from abroad. In the wine center there is a wine tasting area which was considered a very pleasant destination for many tourists visiting the Fogo volcano before the eruption.

Eruption Effects

The key parameters for the estimates of disaster effects on the agriculture sector include the assessed level of the damage on the land (by percent), the estimated average number of plants cultivated per ha for each crop, the expected income or yield, and farm gate prices.

In order to have a better picture of the impact of the eruption in regard to damages and losses for each subsector, a summary table was developed (table 2.3). It follows the presentation of the subsector narrative assessment.

Land

The effect of the eruption had a major impact on the available agricultural land (figure 2.1). Out of the 848 ha of cultivable land in the Caldeiras, approximately 208 ha have been entirely covered by the lava, representing 24 percent of this land (INGT, 2015 xxxx). The total value of the damage to this land is estimated at US\$5 million (494.5 million CVEsc). This cost was calculated by multiplying the current cost of one ha of land by the total affected areas. At present, one ha of agricultural land is valued at approximately 250,000 CVEsc (~US\$2,500)¹.

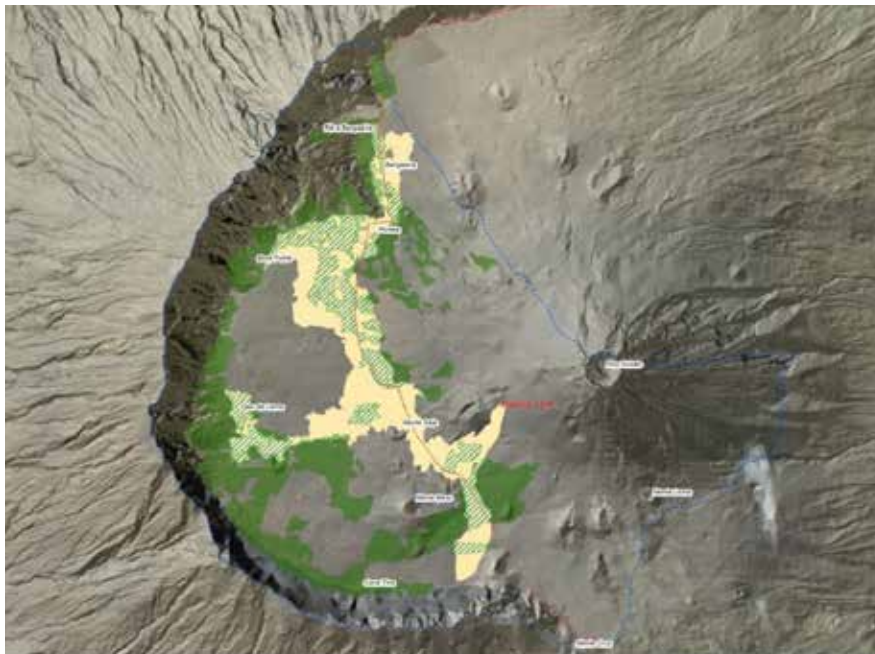


Figure 2.1: Impact of Lava Flow on Available Agricultural Land

Source: Image courtesy of Cabo Verde National Institute of Land Management (INGT).

Crops

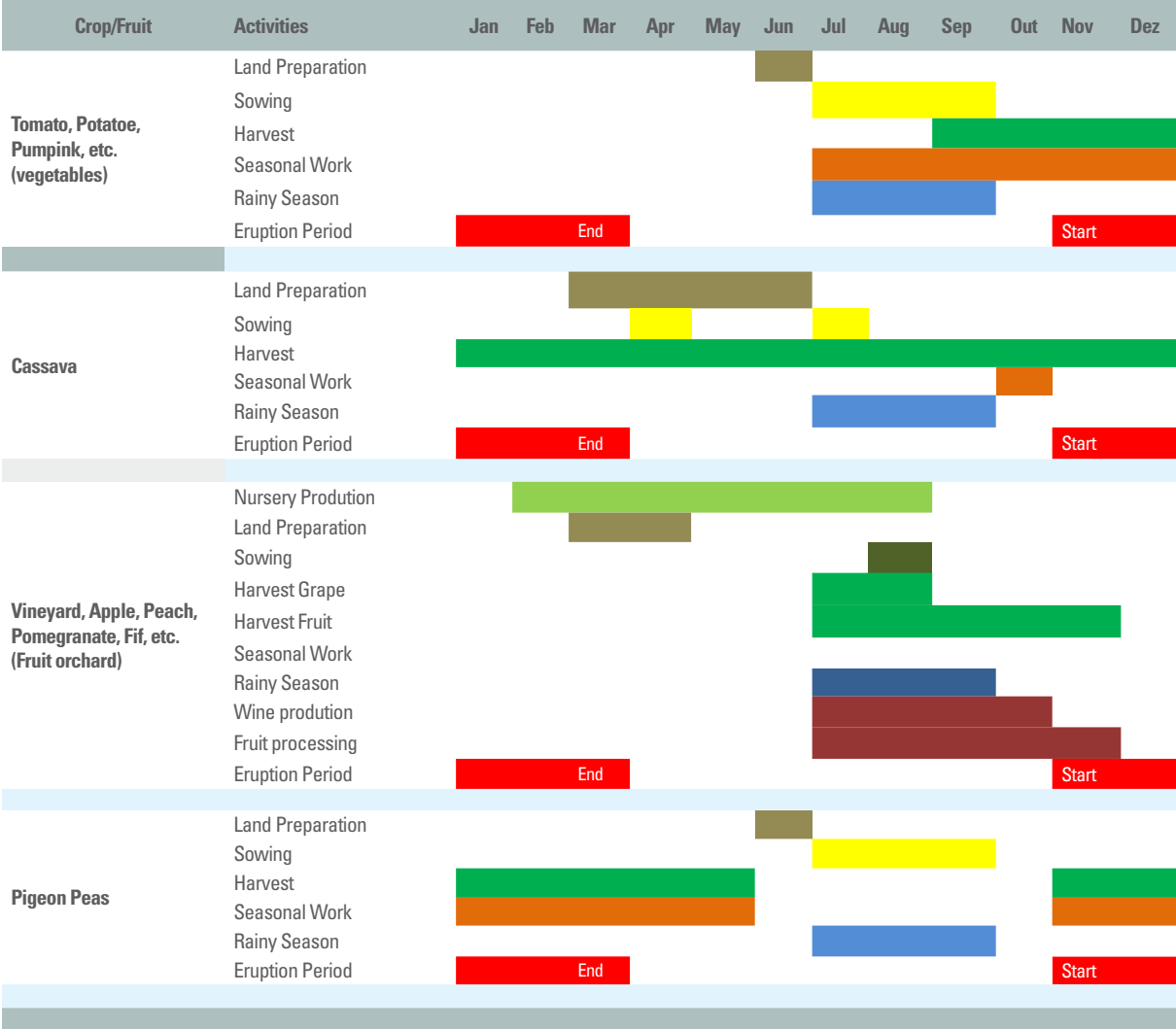
Crops such as pigeon peas and other seasonal vegetables were the most affected, because they were largely cultivated in the area where the lava has flown. According to informal talks with farmers and the cooperative representatives, the vineyards and fruit tree plantations were less affected, at 3 percent and 5 percent, respectively, because they were located mainly at the marginal edge of the Caldeiras due to its favorable climate conditions. As already mentioned in the baseline section, no data was available to identify the existent coverage of the crops, disallowing clear estimation of damage and losses for each crop. However, primary observation and consultation of secondary information, in addition to informal talks with farmers, allowed for reliable and acceptable estimations.

Additionally, a seasonal crop calendar was also developed to cross-reference accuracy of the findings and understand which cultivations were most affected and at which stage of their development (table 2.1).

There were no damages in terms of destroyed or lost agricultural machinery or tools (e.g., hoes, axes, ploughs). In fact, almost all farmers managed to save these productive assets. The total damages to crops are valued at CVEsc 7.1 million (US\$72,661).

¹ Gathered from informal talks with local farmers and cooperative representatives.

Table 2.1: Seasonal Calendar of Crops Cultivated in Chã das Caldeiras



The total amount of crops-related losses is estimated at CVEsc 266.5 million (US\$2.6 million). These losses mainly include the loss of income generated by the impossibility of harvesting different crops during the volcanic eruption due to lava destruction and ashes expelled and deposited over agriculture land. Furthermore, the calculation includes the loss of income that will occur until the new cultivations will produce again after being replanted elsewhere. This applies especially for the permanent plantations, such as vineyards and orchards. In order to go back to satisfactory production, these plantations will need at least five years of growth. This time frame was used as temporal indicator to determine part of the losses.

In addition to those losses the assessment considered the maintenance costs (e.g., sawing, pruning) as well as the cost of the labor, which are required until the replanted perennial crops will become productive again. The estimated losses include the costs needed to purchase new agricultural inputs (e.g., seeds, seedlings, fertilizers) necessary for the production of new crops.

Livestock

Animal husbandry has experienced the smallest effects compared to all other subsector and amount to CVEsc 5.9 million (US\$60,665). The estimation of income loss from livestock was based on income that would have been generated from the animals in terms of production of milk, eggs, meat, and cheese as well as their offspring. Those losses amount to CVEsc 0.9 million (US\$9,124).

Damages are estimated at CVEsc 5.1 million (US\$51,541) and were determined by counting the incidence of animal deaths (table 2.2) and calculating their unit-alive price at farm gate. No major damages were caused to infrastructure such as stables, considering that most of the animals were safeguarded in simple enclosures made of rocks and wood stakes and attached or close to the houses. However, the damages to those simple or improved stables have been considered in the assessment. (Families were supported in the construction or upgrading of these facilities by development partners and the Ministry of Rural Development.

Table 2.2: Disaggregated Data on the Livestock Lost During the Eruption

Livestock	
Animals	Mortes
Goat	21
Sheep	2
Poultry	161
Rabbit	5
Pork	1
TOTAL	190

Water

In 2013, the Ministry of Rural Development conducted several boreholes before finding groundwater at 300 meters of depth. This single well was providing water to all of Chã das Caldeiras’s population both for household consumption and livestock production. The lava flow covered this important water source and all water systems were destroyed together with tanks and other equipment. The damages are estimated at CVEsc 62.3 million (US\$629,727). In addition, the annual losses of water that cannot be drawn up from the borehole anymore equals CVEsc 6.3 million (US\$63,322).

Agroprocessing: Wine, Jam, and Cheese Production

In addition to the negative impact on the agricultural subsector, the volcanic eruptions also had a major impact on the local processing of agriculture products, and especially the wine cooperative. The total amount of losses is estimated at CVEsc 95 million (US\$960,566). These losses equal the net income value generated by the cooperative after all production of wine, spirits, and jam is sold on the market, using a reference period of one year. The net income was calculated by deducting all operational running cost (e.g., salaries, electricity bill, maintenance, raw material) necessary for the production. On the other hand, damages amount at CVEsc 240 million (US\$2.43 million). These damages include the cost to replace the two processing facilities (one for wine production and another for fruit processing) including their equipment, tools, and machinery in addition to the equivalent cost of all stock of wine, spirits, and empty bottles lost during the eruption (figure 2.2). All stocks of jam produced by the cooperative were saved in time.

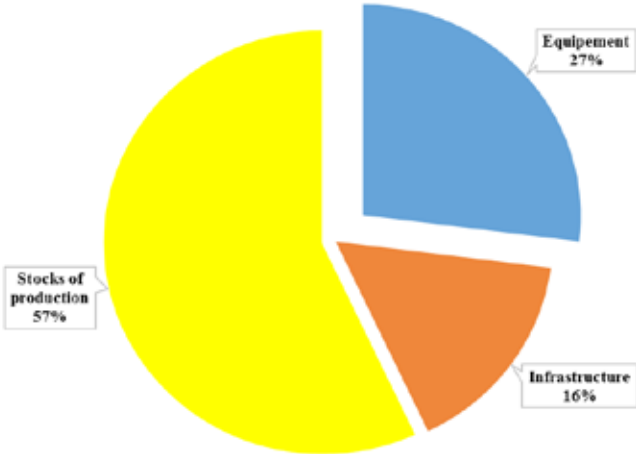


Figure 2.2: Proportion of Damage in the Agro-processing subsector (wine and fruit production)
 Source: Figures courtesy of Chã Cooperative.

Table 2.3: Total Damage and Loss in the Agriculture Sector of Cha das Caldeiras

Sector	Damage (CVEsc)	Damage (US\$)	Losses (CVEsc)	Losses (US\$)	Total (CVE)	TOTAL (US\$)
Culturas: anual e perene						
Component losses			266,506,984	2,694,712		
Component damages	7,186,218	72,661				
Total crops					273,693,202	2,767,373
Livestock						
Component losses			902,386	9,124		
Component damages	5,097,400	51,541				
Total Livestock					5,999,786	60,665
Agroprocessing: wine and jam production						
Component losses			95,000,000	960,566		
Component damages	240,020,757	2,426,904				
Total Cooperative					335,020,757	3,387,470
Water for agriculture						
Component losses			6,262,500	63,322		
Component damages	62,280,000	629,727				
Total water					68,542,500	693,049
Land						
Component losses						
Component damages	508,800,000	5,144,590				
Total land					508,800,000	5,031,646
GRAND TOTAL	823,384,375	8,142,646	393,342,370	3,889,857	1,216,726,745	12,032,503

The highest share of cost is represented by agricultural land, 43 percent, followed by the agroprocessing (jam and wine production) and crops subsector, at 28 percent and 23 percent, respectively. The livestock sector represents almost a negligible cost equal to 0.2 percent of the total cost in regard to damages and losses. (See figure 2.3.)

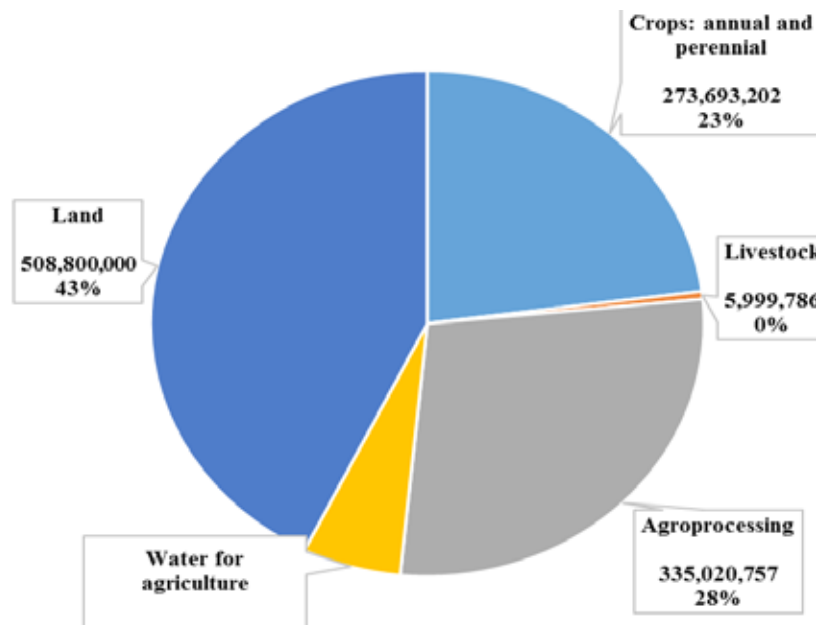


Figure 2.3: Disaster Effects per Subsector, Including Chã Cooperative (in CVE)

Additional Risks and Vulnerabilities

There are several risks and vulnerabilities that might arise due the volcano eruptions and that need to be taken into account to avoid further deterioration in the livelihood of the people depending on agriculture in the Chã das Caldeiras. The first risk is food insecurity. Most of the affected families began receiving food assistance from the government to avoid malnutrition. Many families had resorted to negative coping mechanisms (e.g., selling assets, reducing consumption of meals per day, borrowing money at high return rate), which could affect food security and other aspects of well-being. However, there is the risk that government aid might create dependency. To avoid this, it is necessary to quickly restore the livelihood of the population by guaranteeing access to agricultural land for the upcoming cropping season.

Wine-making activity is extremely important to the livelihood of the population of Chã das Caldeiras, and the restoration of the cooperative production capacity is of paramount importance. In fact, most of the surplus production from the local farmers was purchased and processed by the cooperative. In addition, the cooperative provided employment opportunities for a number of heads of households. Several informal talks with the local farmers have confirmed that the transformation of the grape into wine for the coming season will be done at home if the cooperative will not have the temporary facility in place in time. The wine makers claimed that producing wine outside Chã das Caldeiras will compromise the quality of the well-known Chã-labelled wine, as apparently changes in climatic conditions during the processing of the grape affect the fermentation processes. Almost certainly, homemade wine manufacturing might lead to higher production losses and lower marketability of the final product, followed by the risk of compromising the marketability of Chã-labelled wine. Finally, availability of higher production of wine at home might lead to the potential increase of alcohol consumption resulting in increased incidence of health-related problems.

Recovery Needs and Strategy

In order to implement the recovery strategy, key relevant actors were considered, namely, the Ministry of Rural Development and its sectorial departments (e.g., agriculture, livestock, rural development, soil and water conservation); National Institute of Land Management (INGT); academia and national universities; UN agencies such as Food and Agricultural Organization of the United Nations; national and international NGOs; and the private sector.

Interventions should integrate the build back better approach, and they were divided into the short (within the first 6 months), medium (6–12 months), and long term (between 12 and 36 months). The implementation of all interventions requires an overall investment of US\$6.51 million (table 2.4).

Short-Term Actions (within 6 months)

- *Finalization of land registration.* This exercise initiated by the government in 2014 should be completed to validate land ownership.
- *Access to new arable land.* The Ministry of Rural Development has already identified suitable arable land in other areas of the island. This land should be allocated with priority given to those families who have lost their agricultural land during the eruption.
- *Ensuring water availability.* Construction of water harvesting systems to capture rain water as well as drilling of a new borehole are important measures to address the issue of water scarcity and guarantee availability of water for the productive sectors, including livestock husbandry
- *Restocking of livestock, service support, and shelter delivery.* Provision of new animals, especially goats and poultry, together with animal feed, shelters, and supplementary veterinary services will be indispensable to the recovery of the livestock sector. The replacement of lost cattle, by introducing improved cattle breeds, is considered part of the strategy to enhance the resilience of the livestock farming subsector (by reinforcing productivity). The improvement of stabling conditions for animals, especially goats, is also considered an enhancement that will contribute to conservation goals of the Natural Park, limiting preexisting threats to endemic species and biodiversity conservation.
- *Construction of a new facility for wine production.* This is considered a very central need to avoid losing the production of the coming harvesting season (July 2015), as well as to guarantee the continuation of wine making during the future years to come.
- *Establishment of an efficient public-private transport system.* Provision of adequate transportation services to and from the neighboring residential areas to Chã das Caldeiras is very crucial to avoid the resettlement in Chã das Caldeiras, especially for the large majority of the population engaging in agriculture. Reestablishment and improvement of road access to agriculture areas is also considered important to allow access to markets for local products. However the cost of these access improvement measures is not considered within the agriculture subsector but accounted for under the infrastructure recovery needs section.

Medium-Term Actions (6 to 12 months)

- *Enhancement of crop varieties and yields.* Provision of good quality agro-inputs such as seeds, fertilizers, and fruit tree and grape seedlings will help increase the productivity as well as the quality of the agricultural productions.
- *Construction of a fruit processing facility.* There is need to reconstruct this facility in order to guarantee a continuation of production (e.g., jam), which is a further incentive to boost the local economy
- *Provision of technical support.* To be conducted in the fruit processing sector with the aim of reducing production losses and enhancing the quality and marketability of the final products (wine and jam).

Long-Term Actions (12 to 24 months)

- *Delivery of technical assistance and training.* Farmers, women, and youth should be the main targets. Training should focus on the promotion of good agricultural practices, value chain analysis, water management, marketing, and creation of business opportunities, so as to increase the general knowledge and awareness of the population of the Chã das Caldeiras about sustainable agricultural development.
- *Construction of a cheese factory.* This would provide new employment opportunities and enhance the quality and marketability of the well-known queijo de cabra (goat cheese).

Table 2.4: Summary of Recovery Needs and Proposed Activities

	Short term (up to 6 months)			Medium term (6 to 12 months)			Long term (12 to 24 months)		
	Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)	Necessid.	Costs (CVE)	Costs (US\$)
Agriculture production	Finalization of land registration exercise (cadaster)	5,056,000	50,000				Technical assistance and farmer training	25,280,000	250,000
	Construction of well surface water harvesting system and water reservoir	50,560,000	500,000				Construction of cheese factory	10,112,000	100,000
	Provision of private and public transport (motorbikes, minivan, and small trucks)	35,897,600	355,000						
Livestock/husbandry	Provision of animal feed and vaccine	32,864,000	325,000	Construction of stables	11,123,200	110,000			
	Water provision	8,089,600	80,000	Veterinary support	4,044,800	40,000			
				Livestock replacement	15,168,000	150,000			
Agro-processing (wine and fruit processing)				Construction of permanent wine processing facility	404,480,000	4,000,000			
				Construction of permanent facility for fruit processing	15,168,000	150,000			
	Construction of new wine	30,336,000	300,000	Enhancement of crop varieties (fruits and grape)	2,022,400	20,000			
	Purchase of production materials and equipment	2,022,400	20,000	Production of fruit plants (approximately 40,000)	1,011,200	10,000			
				Technical support for grape and fruit processing	5,056,000	50,000			
Total costs by time frame		164,825,600	1,630,000		458,073,600	4,530,000		35,392,000	350,000
TOTAL	CVE 658,291,200 or US 6,510,000								

a. The high total value of needs in the livestock and animal husbandry subsector is due to the fact that the eruption caused major losses of pasture land. Consistent investment to procure animal feed is needed to avoid depleting the remaining livestock for lack of food. Additionally, further investments are required to mobilize and supply additional water, increasing resilience to recurrent droughts, and to intensify the veterinarian service, considered at present insufficient. Longer-term required needs (e.g., construction of cheese factory) are suggested to enable higher labor opportunity for the people depending on the livestock activities performed in calderas. These details explain why the value of needs is much higher compared to the share of damages and losses caused by the eruption in this subsector.

TOURISM

Predisaster Situation

Tourism Sector Background in Cabo Verde

Tourism is one of the top economic drivers for Cabo Verde, contributing an estimated 20 percent of GDP and 14 percent of employment directly in 2013. Visitor exports generated 76.7 percent of total exports in 2013, and this is expected to grow 6.6 percent annually in the next decade. Moreover, foreign exchange earnings by trade in tourism services are considerable. Cabo Verde welcomed 503,000 international tourists in 2013 and, as figure 2.4 illustrates, the average annual growth rate of international tourist arrivals is almost 14 percent. The majority of Cabo Verde’s international tourists come from Western Europe, particularly the United Kingdom, France, Germany, and Portugal.

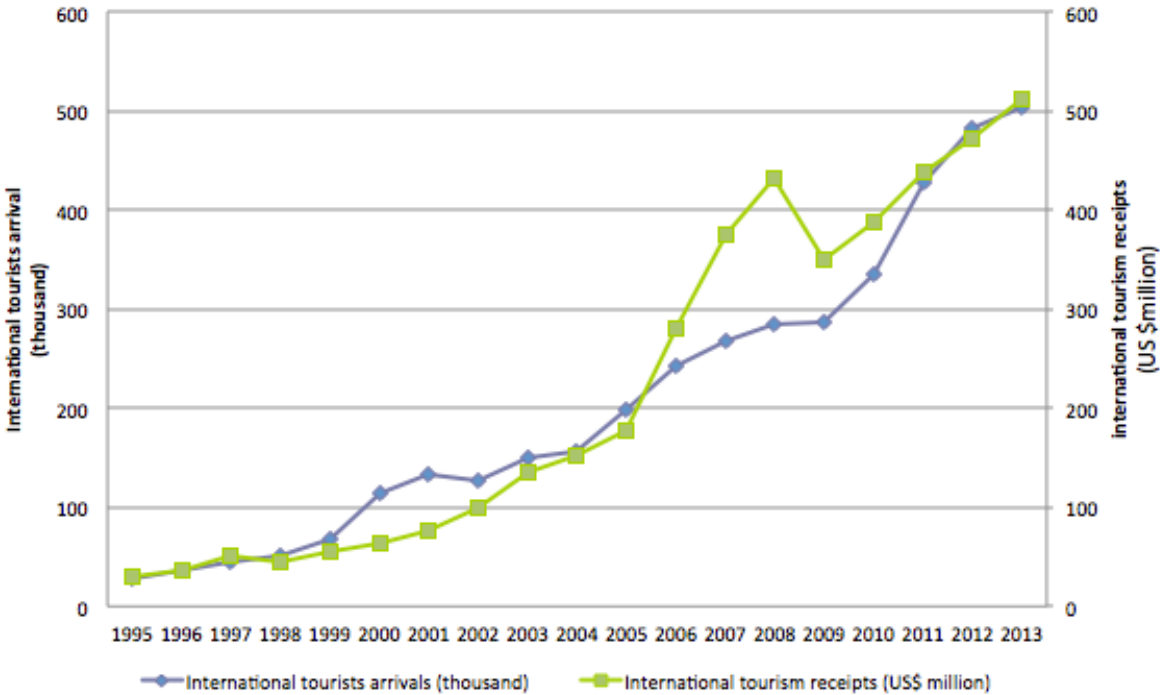


Figure 2.4: Cabo Verde’s International Tourist Arrivals and Receipts, 1995–2013
 Source: World Bank, 1995-2013.

Notably, many of the tourism development achievements in Cabo Verde, facilitated by government incentives, have been attributed to foreign direct investment (FDI) by large international operators, which built large all-inclusive accommodations on the islands with high “sun, sea, and sand” potential.

In the past 10 years the government has mobilized resources to finance an ambitious public investment program on infrastructure and building airports, roads and port facilities which combined with an attractive policy to attract direct investment, has contributed to create a good environment for tourism development.

Recent data collected by the National Institute of Statistics (INE) indicates that the islands of Sal and Boa Vista had about 75 percent of all the hotel rooms in the country and recorded a 90 percent market share in terms of tourist-bed nights spent in the country. Table 2.5 shows the 2013 distribution of lodging capacity by island, Fogo captures only 2.6 % of the tourist beds in the country

Table 2.5: Distribution of Tourist Beds and Occupancy Rates and Incidence of Poverty by Island

Island	Distribution of tourists beds (percent), 2013	Occupancy rate (percent), 2013	Incidence of poverty (percent), 2010
Sal	46.8	58	10
Boa Vista	28.3	81	11
Santiago	10.3	25	28
São Vicente	6.2	25	17
S. Antão	3.9	31	41
Fogo	2.6	20	40
São Nicolau	0.7	24	21
Brava	0.6	18	38
Maio	0.6	11	21
TOTAL	100	56	27

Source: Figures courtesy of the National Institute of Statistics.

The data in table 2.5 also show that islands with the most tourism FDI have the lowest poverty incidence, although Sal and Boa Vista almost totally depend on all-inclusive hotels. This suggests that the tourism sector has the potential to lift people out of poverty. However, based on a recent World Bank study, in addition to the positive impact of the all-inclusive development model, it is important to take into account the effects of leakage within the sector. Leakage mainly occurs through large imports of food and beverage and low levels of local spending.

Moving forward, in order to fulfill tourism's potential of contributing to poverty alleviation, Cabo Verde's tourism growth must be more inclusive and resilient. The country has adopted a vision to develop a competitive and sustainable tourism sector with high value added, focusing on the medium and high end of the market while linking with local enterprises and service providers that expand the benefits of this growth to the lower levels of the economic pyramid.

To achieve this objective, Cabo Verde's tourism sector needs to diversify its tourism offerings in terms of products, operators, and locations. In addition, many efforts are needed to improve the business environment and build the capacity and resilience of local small and medium enterprises (SMEs) to enter the tourism supply chains, access credit, and be economically productive.

Tourism Sector Background in Fogo

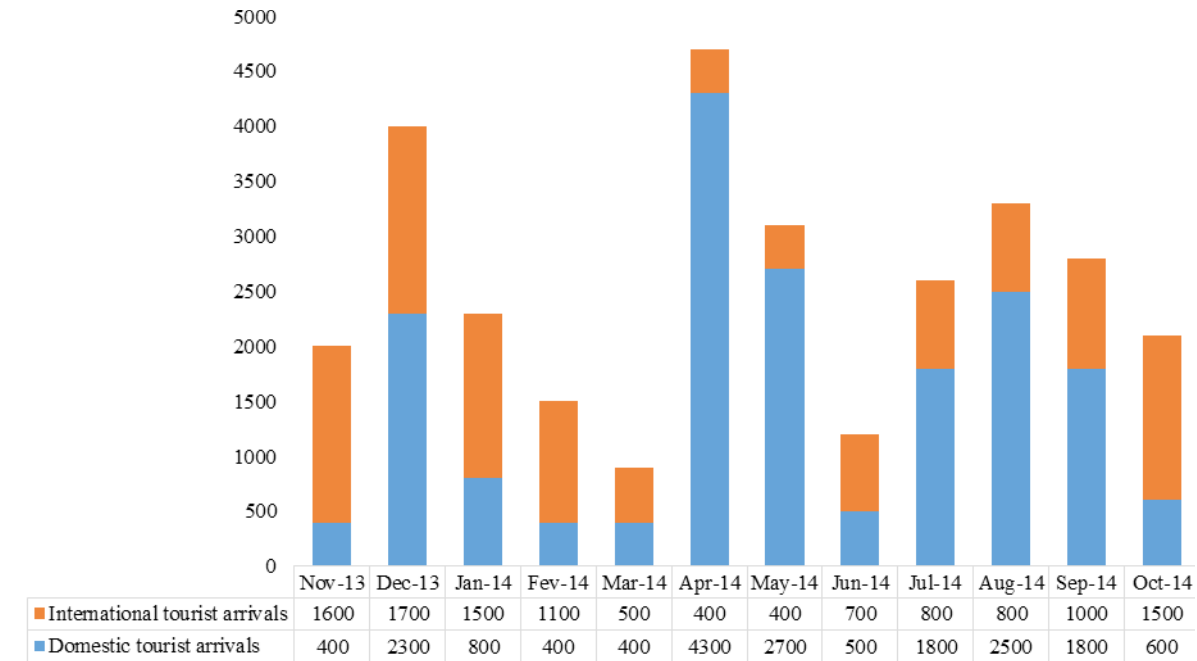
While Fogo island is the second poorest island in Cabo Verde and its economy is based primarily on agriculture and fishing, tourism in Fogo is steadily becoming popular with a focus on adventure (especially hiking) and nature observation and research (bird watching and volcano observation). The volcano is the major attraction on the island. The crater was declared a protected area (a Natural Park) in 2003, and there are five villages—Djeu de Losna, Cova Tina, Pico do Vulcão, Bordeira, Portela and Bangaeira—located inside the crater in the area of Chã das Caldeiras. In addition to the geological value, the area's exotic flora, endemic bird species, and wineries are also interesting to tourists. There are two wineries that received visitors before the eruption. Based on discussion with the Fogo Natural Park authorities, 20 percent of international tourists to the island spend two nights in Chã das Caldeiras, while 80 percent visit for a day trip from Sal, Santiago, or Boa Vista. A one-day excursion usually includes a trip to the crater with a guide, a winery visit and tasting, and a walk between two villages. The top three source markets for Fogo are Germany, Switzerland, and France.

In 2013, Fogo island received 12,000 international tourists according to a recent survey conducted by the Fogo Natural Park (PNF, 2014). Based on the estimation that 20 percent of international tourists stay two nights in Chã das Caldeiras, the average expenditure per international tourist in Chã das Caldeiras is about US\$28 during their visit. As there is no real data capturing the domestic arrivals, the number of domestic arrivals in 2013 was estimated at 18,500 and their average expenditure per person in Chã das Caldeiras is about US\$10. The above average expenditure includes only the costs associated with accommodation and

meals and excludes the costs of excursions.

October to January is the peak season for international tourists, accounting for 53 percent of total international tourist arrivals in one year. For domestic travelers, April is the busiest month due to the celebration of *Bandeira de Sao Filipe* (May 1), which is the biggest festivity on the island. Figure 2.5 shows the distribution of tourist arrivals during the 12 months before the eruption.

Figure 2.5: Tourist Arrivals, November 2013 to October 2014



Source: Figures courtesy of the National Institute of Statistics

The island of Fogo can be accessed by air or by fast ferry. Cabo Verde National Airline (TACV) offers daily flights from Praia, and Cabo Verde Express also offers chartered flights from Sal. There are four well-established tour operators in Fogo. Tourism facilities in Fogo are mostly small, family-run hotels, bed and breakfast accommodation, and homestay (“chez-l habitant”) offerings, which have experienced increasing popularity among tourists and the local population. In the eruption-affected area of Chá das Caldeiras, there were 14 accommodation establishments in total with 135 beds; 6 restaurants, including 5 that were part of accommodation facilities; 2 bars; and 1 tourist information office.

In total, these tourism facilities provided direct employment to 32 people and 40 registered tour guides (freelancers associated under a guide association). Notably, 75 percent of people employed by the accommodation establishments and restaurants are female; in addition, 15 percent of tour guides are female. Since two communities received visitors, there were more people involved in the tourism sector indirectly. Given that most of these facilities were small family-run businesses, there are not accurate data capturing the salaries. Detailed information is available on neither employment nor social protection status. Table 2.6 shows the estimated average personal income generated by the tourism sector directly.

Table 2.6: Estimated Average Personal Income Generated by Tourism in Chã das Caldeiras

Jobs	Number of people employed	Estimated monthly salaries (CVEsc)	Estimated monthly salaries (US\$)	Total monthly salaries	Total monthly salaries (US\$)
Accommodation managers (hotels including restaurants)	14	40,000	\$396	(CVEsc)	\$5,544
Accommodation (hotels including restaurants)	15	11,000	\$109	165,000	\$1,635
Independent restaurant	2	11,000	\$109	22,000	\$218
Tour guides	40	25,000	\$247	1,000,000	\$9,880
Tourist information office	1	15,000	\$148	\$15,000	\$148
TOTAL	72	-		\$1,762,000	\$17,425

Source: Interviews with Fogo Natural Park authorities and stakeholders in the private sector.

Note: All numbers are rounded.

The World Bank study (2003) shows that hotel rooms in Fogo and Santo Antão islands tend to be slightly more linked to the local economy, as a result of their tapping the larger agricultural production present in these two islands. This indicates that tourism in Fogo has the potential to promote the local economic development and the opportunities to enhance the linkage.

ERUPTION EFFECTS

Fogo island was at the peak of the touristic season when the volcano erupted. All tourism facilities in the affected area of Chã das Caldeiras have reported 100 percent damage. These include 14 accommodation establishments, 6 restaurants, 2 bars, and 1 tourist information office (publically owned and operated by the Ministry of Rural Development). In addition, there are also some other tourism-related damages captured in the other sectors. For example, the headquarters facilities of Fogo Natural Park were completely destroyed. This facility included a souvenir shop, visitor center, auditorium for events, and interpretation facilities. The HQ destruction-related damage is captured in the environment sector effects assessment of this PDNA. The infrastructure sector captures the damages of the roads accessing the park. The largest damages and losses are borne by the private sector. It is estimated that the total damage to facilities and equipment is around CVEsc \$147 million or US\$1.5 million. Table 2.7 presents the detailed damages to the tourism sector.

Table 2.7: Damages to the Tourism Sector of Chã das Caldeiras

Damages	Amount (CVEsc)	Amount (US\$)	Private (percent)	Public (percent)
Infrastructure (accommodation, restaurants, and bars)	123,920,000	1,225,569	100	
Tourism support Infrastructure (tourist information office)	1,000,000	9,890		100
Furniture of accommodation	8,728,000	86,320	100	
Equipment of restaurants	2,617,890	25,891	100	
Furniture of bars	586,204	5,798	100	
Furniture of tourist information office	26,000	\$257		100
Other (generators, etc.)	10,400,000	102,856	100	
TOTAL	147,278,094	1,456,581	99	1

A more significant and ongoing impact is the loss of revenue from the downturn in tourist arrivals. At the national level, according to the data captured by the INE, the number of international tourist arrivals in the last quarter of 2014 did not drop compared to the same time of 2013. Instead it increased by 5.64 percent and the number of tourist bed nights remained at almost the same level. However, as the number of arrivals (table 2.8) does not distinguish leisure tourists from other visitors that came to Cabo Verde for the emergency relief operations, scientific research, and monitoring and early recovery related work, it is difficult to estimate the real decline in the demand for leisure tourism at the local level and national levels. Also, at

the island level we need to consider that emergency-relief-related workers and researchers came en masse in weeks following the eruption. Technical staff from different government institutions were continuously sent from the ministerial headquarters at Praia to monitor, report, visit, command operations, distribute relief items, and so forth. Not only researchers, technicians, and managers but also politicians from the different parties were several times on the island and participated as well on a large forum on the Fogo reconstruction, hosted in São Filipe. All those visitors, which normally stayover in São Filipe or Mosteiros's touristic accommodation facilities are not accurately capture by the above-mentioned statistics since their departure point is Praia airport and they did not pass through any border-control facilities. Notably, in contrast, the occupancy rate at the national level dropped by 4 percent.

Table 2.8: Change in International Tourist Activity, Fourth Quarters 2013 and 2014

	4th Quarter of 2013	4th Quarter of 2014	Change
Number of international tourist arrivals	144,837	153,016	5.64%
Tourist bed nights	924,008	924,226	0.02%
Occupancy rate	57 %	53 %	-4%

Source: Figures courtesy of National Institute of Statistics.

At the local level in Fogo island, there has been a significant drop in the tourist arrivals, as many flights were cancelled and all of the organized tourist activities (guided tours and hiking excursions) were closed during the eruption and in many cases did not resume after the end of the eruption. The Fogo Natural Park remained open for research and conversation activities, but it was not open for any tourism activities until mid-April 2015. The Ministry of Tourism, Investment and Business Development (MTIBD) collected data from the tour operators and estimated that the number of tourist arrivals would drop approximately 90 percent in the year following the eruption. As all the tourism facilities in Chã das Caldeiras were destroyed and could not receive any tourists, this resulted in CVEsc 52.1 million or US\$0.5 million in losses totally in local accommodation and restaurant revenue as figure 2.6 illustrates. The calculation was based on the forecasted revenue if these facilities received the same number of tourists as the pre-eruption level.

Tour operators have continued to receive cancelations on their advanced bookings, and new reservations are not picking up due to the absence of a positive official governmental travel advisory. One of the established tour operators in Fogo mentioned that they lost 90 percent of their revenue in the four months after the eruption. Due to the lack of sufficient information on security, tour operators expressed concerns regarding to the liability issues of bringing tourists to the affected areas.

Considering the limitations the national and local authorities face in assessing the residual volcanic activity (fault activity, landslides—especially rack fall—temperature of lavas and gases potentially expelled) and public safety and health implications of those volcanic hazards, the government has not been able to provide clear and specific guidance on what is allowed in Chã das Caldeiras to tour operators and tourists since the eruption took place. Under these conditions it is difficult to project when the business will be back to the preruption level. Absence of detailed official statements in regard to the safety of visiting the Natural Park could create a sense of insecurity in potential tourists that might reflect a declining travel intention

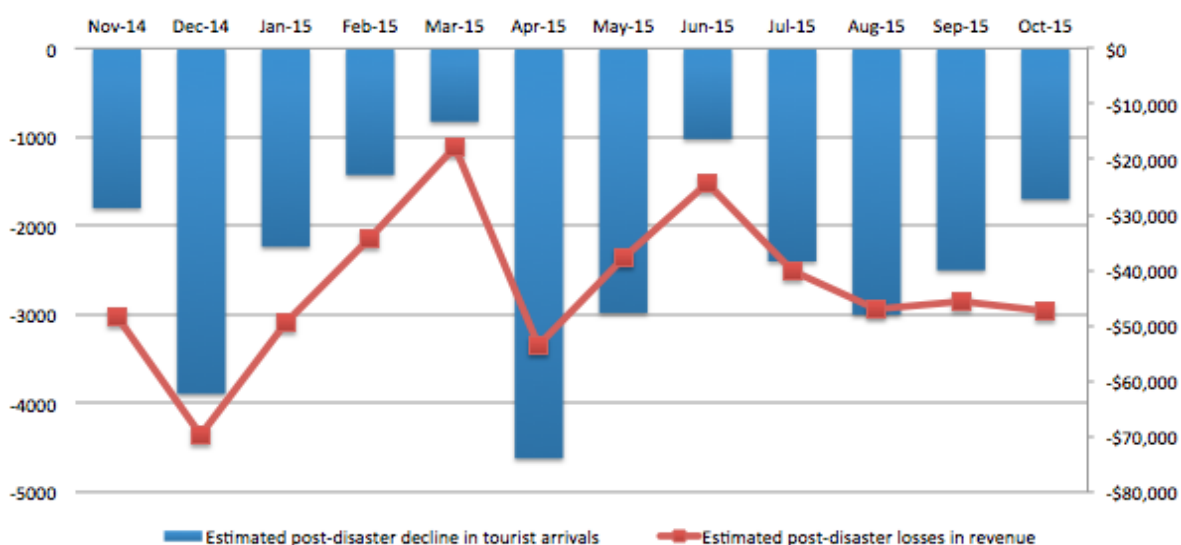


Figure 2.6: Decline in Tourist Arrivals and Revenue to Local Accommodation Facilities and Restaurants, November 2014–October 2015

Source: Estimations from the Ministry of Tourism, Investment and Business Development and tour operators based in Fogo.

Note: Tourist arrivals include both domestic and international tourists.

The full extent of negative impacts on the economy from the downturn in tourism will depend on how quickly visitor numbers rebound. Recent experience indicates that the travel industry is fairly resilient, with most crises prompting an initial and dramatic setback in arrivals but fairly quick rebounds once business and attraction operations can commence with a regular schedule. In the general case of a tsunami or an oil spill disaster, the pattern has been an initial sharp drop in arrivals with visitor numbers rebounding within one to two years on average once there is certainty of safety, security, and operation of basic services. In the case of the volcanic eruption of Fogo those rebounding times might be different by the different nature of the disaster (no fatalities and leaving quite impressive landscape marks) and also considering the policy of no resettlement of local populations.

For Fogo island, it is unclear at this point how large the impact on employment will be. Much depends on how quickly key attractions and facilities are open and how easily the industry recovers. As all the tourism facilities in Chá das Caldeiras have been damaged, all facilities workers lost their jobs in the area. (See table 2.9.) However, some managed to find temporary jobs elsewhere. Even if jobs for tour guides are maintained, the financial impact of fewer visitors and limited tourism activities is significant. Besides the losses in tourism revenue in accommodation and restaurants, the total estimated losses in the tourism sector is around CVEsc \$58 million or US\$0.57million.

Table 2.9: Losses in Personal Incomes in the Six Months after the Eruption

Jobs	Unemployment	Losses in personal income (US\$)
Accommodation (hotels including restaurants)	29	18,929
Independent restaurant	2	1,305
Tour guides	0	35,604
Tourists information office	1	890
TOTAL	32	56,728

Taking both damages and losses into consideration, the total estimated effects caused by the eruption to the tourism sector is about CVEsc 205 million (US\$2 million) as shown in Table 2.10.

Table 2.10 Total Effects of the Eruption in the Tourism Sector

Sector	Damages		Losses		Total Efeitos	
Tourism	US\$ \$1,456,581	CVE \$147,278,094	US\$ \$571,998	CVE \$57,836,000	US\$ \$ 2,028,579	CVE \$205,114,094

In this case, it has not been decided yet where to rebuild the destroyed facilities, and the rebuilding of severely damaged buildings, reconstruction in safer locations, and replacement of equipment will take considerable time. It is clear that this will cause prolonged disruption to the tourism sector and related loss of revenues. In addition, although the private sector has indicated a willingness to invest in lodging facilities in Chã das Caldeiras, the government of Cabo Verde has yet to communicate guidance and policies for land use and construction that might lead to robust and resilient investment.

In a press communiqué of the May 29, 2015, the Council of Ministers formally banned all civil construction for housing purposes but exempted buildings for economic activities, indicating that only small dimension touristic infrastructures will be authorized in Chã das Caldeiras. However, clear guidance on what is meant by “small dimension” and what kind of requirements and standards for reconstruction needs to be provided. It is expected once a formal decree will be passed and published

RECOVERY NEEDS AND STRATEGY

As shown in table 2.11, the initial estimates indicate that CVEsc \$227 million or US\$2.2 million is needed to address reconstruction for the next 18 months (starting on May 2015).

Table 2.11: Tourism Recovery Needs and Estimated Costs

	Short term (up to 6 months)			Medium term (6 to 12 months)			Long term (12 to 24 months)		
	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)
Tourism sector recovery activities and associated costs	Conduct feasibility study to analysis whether the tourism facilities should be reconstructed inside or outside Chã das Caldeiras.	1,500,000	(US\$)	Develop new tourism development strategy for Fogo	1,000,000	\$9,890	Solar system for tourism facilities	10,000,000	\$98,900
	Organize mediation dialogue with people affected	500,000	\$4,945	Develop land use plan and purchase lands for the reconstruction of tourism facilities outside affected area	4,150,000	\$41,044	Power generators for tourism facilities	400,000	\$3,956
	Reconstruct tourism facilities (accommodation, restaurants, bars, tourist information office)	124,920,000	\$1,235,459	Construct new tourism facilities in Chã das Caldeiras (e.g., campsite for tourists if feasible)	20,000,000	\$197,800			
	Purchase equipment and furniture (accommodation, restaurants, bars, tourist information office)	11,958,094	\$118,266	Develop risk evacuation plan	550,000	\$5,440			
	Develop programs to provide temporary jobs for employees lost their jobs in the tourism sector	1,650,000	\$16,319	Provide capacity building for local communities	412,500	\$4,080			
	Develop and implement marketing and information campaign	50,000,000	\$494,500						
Total costs by time frame		190,528,094	\$1,884,323		26,112,500	\$258,253		10,400,000	\$102,856

TOTAL

CVE 227,040,594 or US\$2,245,431

Recovery efforts that are based on globally accepted best practices, such as the incorporation of the build back better approach in all relevant productive and social infrastructure investments, require the commitment of both public and private sector leaders. The government can improve building practices through the establishment of risk-sensitive land-use planning and sustainable zoning regulations while discouraging unsustainable investments and settlements in high-risk areas.

The revision of building codes and safety standards for infrastructure, commercial and official buildings, and productive facilities and the strengthening of enforcement mechanisms should discourage unsustainable investment and settlements in high-risk areas, preventing potential future damages and losses. Measures that contribute to risk-informed sector planning and development would reinforce tourism sector resilience and social and environmental sustainability while contributing further to local economic development.

In addition, government and the private sector working in partnership can leverage the great potential that the tourism industry has toward contributing to poverty alleviation, through the creation of alternative sources of income and livelihoods. The communities on Fogo island, and particularly the former communities in Chá das Caldeiras, could be integrated in a comprehensive tourism development initiative that provides an array of tourist packages. These would include, for example, guided visits to Pico de Fogo Natural Park and cultural integrations with wine- and cheese-producing communities. Such a strategy would support efforts to improve the business environment by building the capacity of local SMEs to enter the tourism supply chains, access credit, and become economically viable.

While tourism in Fogo island only shares only a small amount of national tourism receipts, the island has the potential to grow to be a unique and valued tourism destination. As demonstrated by similar efforts in other countries also exposed to volcanic eruption hazard, it is possible to transform the challenges posed by a risky environment into a successful business opportunity through well-designed and targeted campaigns and public and private investments, all of which contribute to increasing the overall social and economic resilience of vulnerable communities and the country as a whole. (See box 2.1 for more.)

Box 2.1: Global Experience in Postdisaster Recovery in the Tourism Sector

Global experience shows that recovery calls for implementation by both the public and private sectors of rapid, cohesive, and ongoing marketing and rebuild strategies. These efforts target consumers, suppliers, and operators. In the case of the 2004 Sri Lanka Tsunami, 90 percent of the affected large hotels and smaller operators reconstructed and refurbished lodging facilities through the Susahana loan scheme initiated two years after the Tsunami. Tourism is the sector that utilized the highest percentage of its allocated funds compared to the others. After the outbreak of flu in Mexico in 2011, the increasing domestic tourism receipts help tremendously to offset the financial losses from the decline in international tourist arrivals. In the case of Japan, after the earthquake and tsunami in 2011, the Japanese government and the private sector have worked together in a cooperative manner to change the world's view and utilized some creative strategies that reflect the fundamentals of effective crisis recovery for tourism. The Japan Tourism Authority allocated US\$414.3 million or 10 percent of its annual budget for this effort, not only to encourage travellers to Japan, but to do so in a manner that creates an immediate critical mass to achieve momentum vital to overcoming such a crisis. Fogo can learn from and adopt these approaches.

Besides the recovery needs, some additional recommended recovery interventions that follow will enable the crucial return of traveler confidence, improved resilience for the future disasters, and collaboration to improve the structure and competitiveness of Cabo Verde's tourism sector.

Short-Term Recommendations (within 6 months)

- *Feasibility study.* Conduct a study to determine whether the tourism infrastructure and physical assets, such as hotels, guesthouses, and the information center, should be reconstructed and where. Detailed assessment and in-depth analysis need to be carried out on related risks, tourism planning, capacity, and so forth. A feasibility study on possible environmentally friendly and resilient tourism facilities would enable both viable and sustainable development. Currently, Fogo has a total of only 2.6 percent share of the tourist beds in the country.
- *Rebuilding the tourism infrastructure.* Based on the feasibility study, the destroyed tourism infras-

structure needs to be rebuilt, integrating the build back better principle and selecting risk-minimizing locations and design. In addition, basic infrastructure such as the supply of water and energy services needs to be improved to support tourism operations.

- *Marketing and information campaign.* The key to minimizing the negative financial impact is to bring tourists back as quickly as possible. This marketing campaign is intrinsically linked to the improvements and needs identified in the Disaster Risk Reduction subsection. The improvement of disaster preparedness (in terms of early warning systems but also contingency planning) and emergency response capabilities will definitely benefit the tourism industry. The trust in tourism marketing will depend on the effectiveness of disaster risk management improvement measures. The marketing campaign will require a focused effort to get the message out to the travel trade and to tourists that the tourism sector is open and operating, that it is safe to visit Fogo (and there are plenty of potential adventure and ecotourism activities despite some restriction that might be temporarily established on volcano hiking), and that visitors are welcome. The transparency, efficiency, and up-to-date content of current communications needs to be improved. This recommendation is closely tied to the needs identified under the environmental sector to enable larger development of ecotourism activities. Under the environmental sector, needs related with park signage, trailing safety and upgrade, interpretation facilities, and so forth have been considered.
- *Programs to provide temporary jobs.* Engage employees who lost their jobs in the tourism sector by providing them with temporary work. Opportunities for such temporary jobs can arise in tourism-related rehabilitation and reconstruction work, to accelerate the tourism sector's recovery and provide needed income until permanent employment and livelihoods are restored with the reopening of the tourism facilities.
- *Encouraging domestic tourism.* While the decline in the international tourist arrivals to Fogo island is unavoidable in the short term, it is a good practice to encourage domestic tourism through building awareness in the population of Cabo Verde and promoting locally offered tourism package. Following the floods in Thailand in 2011, there was a strong push by the government to promote domestic tourism, encouraging Thais to travel and spend in their own country.

Medium-Term Recommendations (6 to 12 months)

- *A new tourism development plan for Fogo.* The plan should outline the detailed targets, needed resources, time frame, and coordination between multiple sectors involved in the tourism industry. The government of Cabo Verde has announced that the new settlement area will be outside the Chá das Caldeiras and in the locality of Achada Furna. The new tourism development needs to integrate the new development plan of Achada Furna and coordinate private sector investments strategically in the tourism sector while minimizing any negative environmental impacts.
- *Capacity building for local communities in sector opportunities.* Capacity building and technical assistance will enable improvement of communities' readiness to enter the supply chain. It is advisable to support disaster preparedness and business continuity planning for the sector stakeholders and to expand capacity for client-oriented business management.
- *Access to finance for SMEs.* Given that private sector, small business losses are relatively high, government assistance should be carefully targeted to the affected small businesses. Facilitating access to finance would provide players with the required resources to rehabilitate their business. For small-scale tourism-related business, intervention programs should concentrate on microfinance where the demand and need is stronger.
- *A tourism-related contingency plan.* The tourism industry is vulnerable to numerous risk factors and Fogo still faces the possibilities of future volcano eruption or other disasters. Develop a sector-specific contingency plan to better understand and manage risks and ensure better preparation for handling the future crisis. The sector-specific measures should be aligned with general risk communication strategies, preparedness policies, and emergency plans further described in the disaster risk reduction section of this chapter. Tourists and stakeholders need to be informed about the potential risks in the park to limit the misperceptions and negative impact on the destination

brand. It is also crucial to consider tourist (and their specific needs) within the emergency plans and especially evacuation measures.

- *Diversified source markets.* As most tourists are from Western Europe, expand source markets that have increasing interest in adventure tourism and streamline visa requirements accordingly.

Long-Term Recommendations (12 to 24 months)

- *Institutional framework and business environment.* Cabo Verde lacks a long-term policy framework to support the development of diversified tourism products. The current development progress of tourism sector is heavily dependent on the all-inclusive model. According to the World Bank's Doing Business 2014 report, Cabo Verde was ranked 122 out of 189 countries globally. As the FDI in recent years has been slowing, the weak business environment discourages private investment and poses additional limitations on the competitiveness of SMEs. The tour operators and hotel owners in Fogo also expressed concerns related to the difficult business environment, which discourages their interest of investing in Chá das Caldeiras
- *Air connectivity and access.* Improve connectivity between the other islands and Fogo to mobilize tourists out of the all-inclusive resorts. The feedback received from tour operators in Fogo and a large tour operator based in Sal all indicated that the air connectivity to Fogo is the biggest challenge for tour operators looking to bring more tourists to the island. Improvements in air and boat connectivity (especially in terms of frequency, price, and reliability) is also essential to mobilize further domestic tourist.
- *Tourism infrastructure and products.* The current tourism products that Cabo Verde offers mainly focus on a few islands. The potential of tourism is still underdeveloped and needs to be diversified. Collaboration with the private sector is critical, especially with large tour operators who are integral to tapping the full tourism potential of underdeveloped sites. In addition, basic tourism infrastructure such as transportation infrastructure (to improve interisland connectivity by air or ferry), electricity, and water connections need to be upgraded in order to support the development and promotion of new tourism products.
- *Data collection and analysis to improve sector planning.* Greater efforts are needed to improve local level data collection. Current data collected at entry points do not separate leisure travel and business travel. Therefore it is difficult to understand and forecast the demand accurately. Without better and consistent collection of tourism statistics, it is challenging to quantify the economic impact of the sector, facilitate policy formulation, project future support infrastructure investments, and attract private investments.

INFRASTRUCTURE SECTORS

Predisaster Situation

Cabo Verde has a relatively well-developed stock of basic infrastructure. The government of Cabo Verde has implemented policies designed to alleviate infrastructure bottlenecks affecting the completion of its public investment program in energy and multimodal transportation (seaports, airports, and road transportation), among others, as reflected in its Third Growth and Poverty Reduction Strategy Paper (GPRSP-III / DECRP III). In the past decade the government has invested over US\$147 million per annum in infrastructure, which amounts to 15 percent of GDP, among the highest ratios in Africa. National coverage increased substantially for all infrastructure, from water, electricity, telecommunications, and transport.

Transportation

Nearly all of the nine inhabited islands have both marine and air access, and more than 72 percent of the

national road network is paved. However maintenance is lagging. The country has four international airports (on the islands of Sal, Praia, Boa Vista, and São Vicente) and three national airports (Fogo, São Nicolau, and Maio), as well as nine seaports, seven of which have been modernized and expanded in the past few years. Whereas much of the transport infrastructure is in good condition, interisland connectivity is a major bottleneck for economic integration (World Bank in press).

Road Network

Cabo Verde's road network consists of 1,350 kilometers (about 44 percent asphalted and the rest is paved with cobblestones) spread among the nine inhabited islands (334 kilometers per 1,000 square kilometers compared to 81.5 kilometers per 1,000 square kilometers for Africa as a whole). The comparatively dense road network is characterized by (i) major roads (often a "ring road" around an island) that extend from each island's principal seaport and airport to municipalities and serves small towns and rural communities; (ii) secondary roads that serve smaller ports and fishing and agricultural communities farther off the main axes; and (iii) municipal town roads and tracks.

The estimated value of the country's road infrastructure asset base is about US\$535 million (31 percent of GDP, a relatively high value compared to other African countries at 25 percent average, 14 percent for Senegal). However, the road network is vulnerable and expensive to maintain because of the geography (steep slopes); geology (unstable and crumbly terrain conducive to landslides, subsidence and rock falls); and climate (extreme events with heavy rains and flash floods likely to become more frequent). Steady progress has been achieved in advancing the institutional reforms in the road sector as seen in (i) a functioning road maintenance fund (Fundo Autónomo de Manutenção Rodoviária) funded by the Service Tax on Road Maintenance (Decree Law 16/2008), which established the amount on the Decree Law 7/2014; (ii) establishment of a dedicated road agency (Instituto de Estradas, IE); and (iii) improved capacity in the Ministry of Infrastructures and Maritime Economy (MIEM) to support planning and decision making. Notwithstanding the progress achieved in road maintenance, there are considerable challenges that hamper sustainability of the road asset capital stock, including: (a) limited but growing road fund sources, (b) unmet rehabilitation demand for aging roads to bring them to maintainable standards, and (c) a significant emergency works backlog caused by flash floods and landslides.

Fogo island's road infrastructure has been designed to fit the mountainous topography and conical shape of the island. The island's road network consists mainly of ring roads, dominated by two major rings: (i) the main ring of about 81 kilometers and (ii) the top ring of about 42 kilometers. According to the Cabo Verde Roads Institute, Fogo island's national roads cover a total length of about 165 kilometers: 132 kilometers being paved, 29 kilometers in cobblestone, and 8 kilometers of dirt roads. At the time of the volcanic eruption in Fogo island, only 8 percent of roads were in good condition, 28 percent in acceptable condition, and 63 percent in bad condition (Instituto de Estradas 2013).

Before the eruption, road access to Pico de Fogo Natural Park was ensured through a paved road in good condition, connected to an internal network of mixed-type (rock and dirt) and dirt roads, which provided safe access to the natural park, park management headquarters, including the Visitors Center, and the communities within the caldera.

Airport and Port

Due to the geographic characteristics of the Cabo Verde archipelago and the unreliability of maritime transportation between islands, air transportation has become the dominant transport mode to connect the islands and for the development of tourism beyond the three islands with international airports. It is the only practical option for reaching certain destinations.

In 2011, 1.9 million commercial passenger movements in the airports of Cabo Verde were reported, representing an increase of approximately 11 percent and 27 percent, compared to 2010 and 2008, respectively. Of these reported passenger movements, around 903,909 were international passengers and 877,363 were domestic. There are 19 international and 3 national operators in Cabo Verde, with 9 registered airplanes (IDA and IMF 2014).

In 2013, the government undertook a series of reforms aimed at increasing private sector participation in

the operation and delivery of port services. These included review and amendment of the Law of Ports of 2010; a new regulatory framework for the sector; changes in the statutes of the Maritime Port Institute, which became the Port and Maritime Agency, charged with economic and technical regulation of the sector; and changes in National Port Enterprise, a state-owned company, which became in charge of managing the entire port system of Cabo Verde, as the general concessionaire for the port system (“landlord port” regime) (IDA and IMF 2014).

Fogo airport is a small facility to operate domestic flights. Since 2012 it has received improvements including a runway extension to accommodate the TACV fleet reinforced by bigger capacity planes. The airport receives TACV flights and charter flights from Cabo Verde Express, which transports tourists from big hotels in Sal and Boavista. The airport is managed by the national Airport and Safety Authority (ASA) and has the capacity to operate only during the day. When the country is affected by dust storms from the desert (January, February, and March) operations in the airport are restricted due to limited visibility for approach and landing.

Telecommunications

Cabo Verde has made good progress in expanding access to telephone services, landline phone, mobile phones, and Internet (3G and optical fiber). Costs have been reduced significantly in recent years but rates are still among the highest in the world.

According to information provided by the Telecommunications Regulatory Agency, Internet services provided by CVTelecom and UNITEL/Tmais have increased 77 percent at national level. However, in terms of access the INE (2010) census indicates that only 6.3 percent of the population has access to the Internet. On the other hand, the mobile services have 499,458 subscribers, which is more than the actual population of Cabo Verde.

Regarding disaggregated coverage by the two existing companies (CV Telecom and UNITEL/Tmais), they both provide services to the island of Fogo, with fixed and mobile communications and Internet services, reaching almost 100 percent of the communities and villages. The biggest provider is CVTelecom, which has been on the ground since 1996, with 97 percent coverage and around 30,000 subscribers on the mobile services. UNITEL, launched in 2007, provides national coverage and has 3,882 mobile subscribers in Fogo. Regarding the internet services, both 2G and 3G, there are 3071 subscribers. These clients are supported by a network of 11 sites, distributed on the island. Chá das Caldeiras has its own site to cover 18 subscribers.

Chá das Caldeiras had landline coverage by CV Telecom and mobile and Internet (3G) coverage by both companies. Associated infrastructure, both for landline (posts and cables) and mobile (antennas) were generally available on the eruption-affected zone.

Energy

It is estimated that the demand for power generation will increase from 95 megawatts (MW) in 2008 to 300 MW in 2020 (MECC 2008). In 2014, energy generation capacity reached 156 MW, of which almost 25 percent is renewable, with more than 98 percent of the population having access to electricity. While the national electrification rate is high the quality of the electrical service supplied is considered very poor, with frequent and lengthy power outages. The increase in energy consumption poses strategic and infrastructure planning challenges to Cabo Verde, as electricity production in the country is mainly from the burning of petroleum products, which creates a strong dependence on imported fuel, as the country has no known fossil fuel deposits. This factor, coupled with the cost of insularity, the high oscillation prices and inefficiencies in the sector, results in a high cost of electricity in Cabo Verde, about 70 percent higher than in the EU. The country has started a process of diversifying energy production, tapping into alternative sources of energy, namely wind and solar, with wind energy production reaching up to 20 percent of total consumption on the islands of Santiago, São Vicente, Sal, and Boavista, and solar energy production parks in the islands of Santiago and Sal. The government has engaged on an ambitious sustainable energy policy, covering increased penetration of renewable energies, improved access to modern energy services for cooking, and improved energy efficiency. To achieve this policy, a policy target of 100 percent renewable energy by 2050 for electricity generation has been established. Large investments in terms of production and storage capacity are

expected to achieve those policy targets. The modernization of the grid to allow integration of renewable energy generation and to minimize losses is also expected to require large investments. In addition, several studies on the potential of geothermal energy production have been conducted in several islands, including Fogo.

Water is scarce in Cabo Verde and the main supply source of the population is the desalination of sea water (93 percent). The production of desalinated water consumes about 10 percent of the electricity produced in Cabo Verde (MECC 2008), further increasing the demand and cost of energy production. Public Company for Electricity and Water internal consumption of electricity for water desalination is very high. While about 4.5 million cubic meters of desalinated water were produced in 2009 only 2.9 million cubic meters were sold, with nonrevenue water representing 35.3 percent of the total production (World Bank 2011).

According to the INE (2010) census data, before the recent volcanic eruption, Fogo island municipalities' had percentages of households with access to electricity below the national and urban averages, as shown in table 2.12.

Table 2.12: Cabo Verde and Fogo Island Homes with Access to Electricity

	Access			Total
	Yes	No	NA	
Cabo Verde	80.8	18.9	0.3	100
Urban	89.6	10.0	0.3	100
Rural	63.8	36.0	0.2	100
Fogo island municipalities				
Mosteiros	68.0	31.8	0.1	100
S. Filipe	69.0	30.8	0.1	100
S. Catarina	46.5	53.1	0.4	100

Source: INE 2010.

In Fogo island electricity production is still mostly generated from the burning of fossil fuels and distributed through the electrical grid.

Chã das Caldeiras was not connected to the island grid, nor did it have its own mini grid. In some public infrastructures (park HQ and school and health facilities), as well in some hotels and households, power generators, solar thermal water heater systems, and/or photovoltaic panels were used for self-consumption purposes.

Water and Sanitation

According to the government of Cabo Verde and partner organizations concerned with water and sanitation issues, including the *Millennium Challenge Corporation - Cabo Verde*, about 57.2 percent of Cabo Verdeans do not have access to clean public water in their homes, with only about 9 percent of poor households having access to the public water network. Throughout Cabo Verde, more than half of poor households who do not have access to the public water network receive their drinking water from community fountains, while the rest rely on private tankers, which translates into higher costs for the same amount of drinking water, and the poorest segments of the population, who oftentimes live in the areas less serviced by public utilities, are forced to pay a higher portion of their incomes for water.

Furthermore, getting water for household needs has been an activity traditionally assigned to poor women, who, when not connected to the water distribution network, may spend a large part of their time gathering and transporting water, exacerbating their fragile income and food security situation, particularly considering that women-headed households represent a large proportion of the total, and these are commonly the poorest households in a country. In addition, on Fogo island, 45.6 percent of all farms are headed by women.

INE (2010) census data indicate that the percentage of households with access to water through connection to a public water network in Fogo island municipalities before the volcanic eruption was above the rural average but below the national average. The percentage of homes without access to the public grid was higher than the rural average in two of the three municipalities, as shown in table 2.13.

Table 2.13: Connections to the Public Water Distribution Network

	Connection				Total
	Yes, within the home	Yes, outside the home	Without water from the public grid	NA	
Cabo Verde	42.5	11.8	45.4	0.3	100
Urban	53.4	7.0	39.3	0.3	100
Rural	21.5	21.1	57.2	0.3	100
Fogo island municipalities					
Mosteiros	27.3	15.9	56.7	0.1	100
S. Filipe	40.6	19.4	39.8	0.2	100
S. Catarina	27.9	8.1	63.6	0.4	100

Source: INE 2010.

Sanitation in urban and peri-urban areas is also a major development challenge for Cabo Verde's population, especially considering urbanization rates. Thirty-three percent of the country's households are without access to improved sewerage systems in their homes, and 35.2 percent of homes are without toilet or latrine. The situation is even worse in rural areas, where the percentage of households without access to improved sewerage is 55 percent and without toilets or latrines 56 percent.

According to INE (2010) census data, Fogo island municipalities had, before the volcanic eruption, no access to public sewer systems. However, households in the three municipalities had access to septic tanks at rates well above the national average. In regard to access to sanitary installations (access to either a toilet or latrine), the three Fogo's municipalities had averages above the national, as shown in table 2.14.

Table 2.14: Homes with Sanitary Facilities and Wastewater Evacuation Systems

	Sanitary installations					Wastewater evacuation system				
	Toilet	Latrine	No toilet or latrine	na	Total	Public sewer system	Septic tank	Without access	na	Total
Cabo Verde	63.6	0.8	35.2	0.3	100.0	19.4	47.4	32.9	0.3	100
Urban	74.7	0.4	24.6	0.3	100.0	28.8	49.2	21.6	0.3	100
Rural	42.2	1.7	55.9	0.2	100.0	1.1	44.0	54.6	0.2	100
Fogo island municipalities										
Mosteiros	75.8	0.5	23.5	0.2	100.0	0.0	77.5	22.4	0.1	100
S. Filipe	68.2	0.1	31.6	0.1	100.0	0.0	71.9	28.0	0.1	100
S. Catarina	67.2	2.6	29.8	0.4	100.0	0.0	69.1	30.4	0.4	100

Source: INE 2010.

In the communities impacted by the volcanic eruption, disposal of solid waste was done via trucks operated by the municipalities. Garbage was collected in dumpsters owned by the households.

Sanitation is also a major development challenge for Cabo Verde's population. Only 40 percent of the country's urban areas have access to improved sewerage systems such as sewer networks or septic tanks; while less than 16 percent of rural households have access to improved sewerage. Solid waste management is another issue affecting the country. In Fogo island, waste management is done via trucks operated by the municipalities.

ERUPTION EFFECTS

Even though the direct effect of the volcanic eruption on the infrastructure sector was confined to a relatively small geographical area within the Pico de Fogo volcano's caldera, its impact was felt beyond the area directly affected, as the event caused not only physical damages and losses within the Natural Park and the communities living inside, but also impacted economic activities across the island of Fogo and the country as a whole.

Disaster effects in the infrastructure sector have direct implications on the other sectors assessed within this report, especially productive ones. Tourism as well as access to local markets of agriculture production depends, among other factors, on the operating conditions of the road infrastructure.

Road Network Subsector

The volcanic eruption caused substantial localized damage to the road network within the Pico de Fogo Natural Park. Particularly critical was the interruption of road access to the park and the caldera area, as the advancing lava front cut the road access to the communities of Bangaeira, Cova Tina, Portela, and Djeu of Lorna, preventing any further evacuation efforts by motor vehicles, as well as curtailing access to the park headquarters and agricultural lands within the caldera.

The advancing lava front, which in some points reached a height of four to eight meters above the ground, caused the destruction of 13 kilometers of roads within the Caldera that became submerged under the lava. Of the affected road network, 6.8 kilometers of paved roads were completely destroyed, with an estimated cost of CVEsc 136 million (~US\$1,357,126). In addition, approximately 5.2 kilometers of mixed dirt and stone roads, which were part of the internal network that connected the communities within the caldera, were also completely covered by the lava wall, amounting to an estimated cost of CVEsc 31.2 million (~US\$315,470 USD). Furthermore, 2.5 kilometers of dirt-base roads that provide access to the agricultural lands within the caldera, including the vineyards, also disappeared under the advancing lava flow, adding CVEsc 15 million (~US\$151,668) in damages. See photo 2.1.



a. Before the eruption



b. After the eruption

Figure 2.7: Fogo Island Roads Destroyed by the Volcanic Eruption

Airport Facilities

According to ASA, the airport facilities did not suffer any physical damage from the volcanic eruption. However, airport operators incurred losses estimated at CVEsc 3,157,863 (~US\$31,929) resulting from increased operational costs related to the disruption of air traffic during the period that the volcano was erupting.

Telecommunications Subsector

The area encompassing Pico de Fogo Natural Park, including the communities located in the caldera, was serviced by the two wireless phone companies that operate in Fogo island. According to the companies' senior managers in Fogo island, damages to telecommunication infrastructure were limited to the destruction of a single communications tower belonging to CVTelecom, amounting to CVEsc 3,800,000 (~US\$38,422). In addition, the two wireless telecommunication companies reported combined losses amounting at CVEsc 9,040,000 (~US\$91,405) due to service interruption as well as to provision of services at no cost to the affected populations to facilitate their contact with friends and family members during the emergency. Both companies reported that they were able to reestablish full services without delay precluding further losses.

Energy Subsector

Before the eruption of Pico de Fogo, electricity within the Natural Park was generated by portable or semi-portable power generators operated on gasoline or diesel fuels. At the time of the volcanic eruption, the residents of the communities within the caldera were, during the evacuation, able to salvage and take with them their power generators.

According to the information provided by senior representatives of Electra, the energy company operating in Fogo, no damages to the energy infrastructure were reported as a result of the volcanic eruption. The company, however, reported losses due to service interruption in the amount of CVEsc 3,720,000 (~US\$37,614).

Water and Sanitation Subsector

For the assessment of the impact of the volcanic eruption on the water and sanitation subsector it was agreed by the evaluation team that whenever the purposes of water infrastructure were mainly for agricultural production, damage and losses would be incorporated in the effects assessment on agriculture production. Domestic cisterns, as equipment attached to the housing units, were incorporated in the housing assessment, despite being, in nature, a part of water infrastructure.

In this section, in terms of damage the destruction by the lava flow of 36 solid waste containers or dumpsters, representing an amount of CVEsc 540,000 (~US\$,460), was considered. In terms of losses, the additional expenses to ensure water and sanitation access to displaced communities at the shelters or relocation areas (houses of 1995) were also taken into consideration. Total losses amounted to CVEsc 9,175,652 (~US\$92,777). Total effects (damages and losses) in the infrastructure subsectors amounted to CVEsc 230,633,515 (~ 2, 331,987USD) as shown in table 2.15.

Table 2.15: Damages and Losses in the Infrastructure Sector

	Total effects (CVEsc)	Total effects (US\$)	Damage				Losses			
			Value (CVEsc)	Value (US\$)	Ownership		Value (CVEsc)	Value (US\$)	Ownership	
					Public	Private			Public	Private
Electricity	3,720,000	37,614	-	-			3,720,000	37,614		3,720,000
Water and sanitation	9,715,652	98,237	540,000	5,460	480,000	60,000	9,175,652	92,777	9,175,652	
Transport	204,357,863	2,066,308	182,200,000	1,842,265	182,200,000		22,157,863	224,043		22,157,863
Comunicações	12,840,000	129,828	3,800,000	38,423		3,800,000	9,040,000	91,405		9,040,000
TOTAL	230,633,515	2,331,987	186,540,000	1,886,148	182,680,000	3,860,000	44,093,515	445,839	9,175,652	34,917,863

RECOVERY NEEDS AND STRATEGY

In the road transport subsector, rehabilitation requirements included the immediate restoration of road access to the Natural Park to facilitate management activities as well as access to the agricultural lands within the caldera to allow members of the affected communities to resume work related to wine production, livestock raising, and tourism-related activities.

Given the complete submersion of the roads under several meters of molten lava, causing a radical change in the surrounding landscape, it was necessary to realign the temporary road on a new path away from the lava front. Such realignment increased the costs of reopening temporary access to the park and the caldera.

The proposed costs include reasonable increases with respect to the estimated value of damage, which must be considered along with safe construction standards and materials compatible with environmentally sensitive and risk-prone areas.

It is understood that the whole area within the Pico de Fogo's caldera is at risk of future volcanic eruptions that can be as powerful as or even more violent than the one experienced during the 2014–15 event. However, to ensure safe access to the Natural Park and to allow for the continuation of agricultural activities that are compatible with the levels of risk within the caldera, it is suggested that targeted vulnerability studies be undertaken to map the areas of increased risk, taking into consideration past events to help develop a probability model of future eruption events and the projected trajectory of future lava flows, grading the levels of risk to inform public infrastructure investments and regulate private investments.

Based on such studies, new design standards can be developed that should make the new or rehabilitated infrastructures more resilient to future adverse events as well as contribute to enhanced resilience of the populations benefiting from the economic activities within the Natural Park and particularly in the caldera.

In order to address the most urgent needs of the infrastructure sector, the needs for recovery in the subsectors are presented in table 2.16, prioritized in three tiers. Implementation of priority one needs should begin immediately, as these needs affect the implementation of parallel recovery activities in other sectors, particularly those related to agriculture and tourism as well as for the proper management of the Natural Park.

Transport

To address efficiently the adverse impacts caused by the eruption of the Fogo volcano, several key issues on accessibility are considered. The critical transport infrastructure in the affected areas, as well as in other sectors and subsectors that are dependent on a functional road network, highlighted in this PDNA, are addressed as recommendations. The following set of recommendations is proposed, as part of a larger recovery strategy for the communities of Pico de Fogo, their livelihoods. They are aimed to increase the communities' overall resilience to future external shocks. An indicative budget and time frame is also proposed for implementation of the technical recommendations for the sectors, based on discussion with the PDNA technical teams, government officials, and concerned stakeholders from government agencies and partner organizations working at the local level in Fogo island as well as national agencies and organizations and international cooperating entities who provided input at different stages of the PDNA Infrastructure assessment.

The construction of the proposed roads shall be based on the building back better approach and disaster risk reduction principles as well as on compliance with all applicable environmental and social safeguards, in accord with the government of Cabo Verde's regulatory framework and globally accepted best practices. The prioritization and sequencing of the proposed road constructions is important to facilitate the safe travel of farmers and existing residents to and from Chã das Caldeiras as well as to promote sustainable alternative livelihood activities, including those linked to increased tourist visitation to the Fogo Volcano Natural Park. The construction of roads is also justified because it would improve access to the forest area of Monte Velha e Montinho in the event of a forest fire. There will be two evacuation routes to and from the caldera area that would allow for the timely evacuation of people and their property in the event of a new volcanic eruption or emergency situation. These would also ensure connectivity between the municipalities of Santa Catarina do Fogo and Mosteiros, substantially improving safe movement of people as well as the transport of goods and provision of services (See table 2.16 for recovery needs.).

RECOMMENDATIONS

1. Develop a transport system for people, and their goods between Chã das Caldeiras and the new resettlement location (figure 2.1). This system should allow the transport of cargo, and its management could be given to the Natural Park management
2. One vehicle to serve as a water tank and one truck of medium size should be given to the Natural Park management, allowing a better management of the park's transport needs.

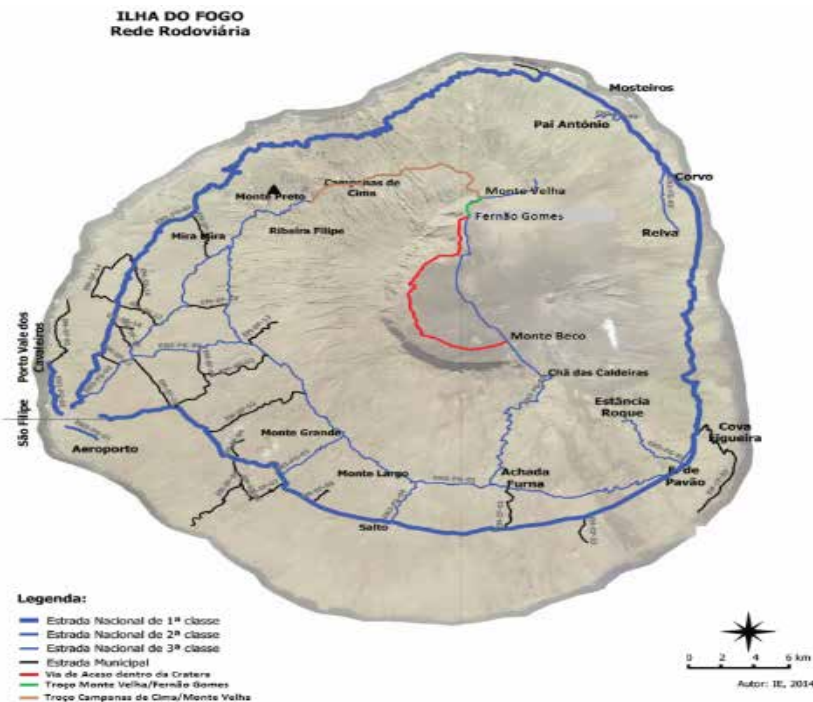


Figure 2.8: Possible Access to Chã das Caldeiras (INGT)

Source: Institute of Roads 2014

Proposed Prioritization of Road Construction Needs

Short term: Access road inside the caldera (between Monte Beco and Fernão Gomes) (shown in red) and road section between Monte Velha and Fernão Gomes (shown in green).

Medium term: Road section between Campanas de Cima and Monte Velha (shown in brown).

Table 2.16 shows identified recovery needs within all the infrastructure subsectors. Meeting these will address reestablishing safe and improved services linked to the affected infrastructure subsectors, as these have a direct impact on the daily life and livelihoods of all members of the communities of Chã das Caldeiras and the economy of the Fogo island in general. In some instances, as expected, these identified needs overlap with those identified by other assessment teams, particularly with interventions proposed by the housing sector team, and may be further addressed by other sectors, as their implementation may depend on cross-sectoral recovery strategies (e.g., the need to build septic tanks may depend on whether or not permanent infrastructures would be allowed within the impacted areas). During the process of identification and prioritization of the proposed recovery needs, the assessment team took into consideration the government's key strategies and development programs for the respective infrastructure subsectors to ensure their alignment with the government's development goals.

Table 2.16: Recovery Needs for the Infrastructure Sector

Short term (up to 6 months)		Costs (CVE)	Costs (US\$)
	Needs		
Energy	<i>Power supply:</i> Acquire portable or semi-portable power generators for emergency preparedness and critical operations (including park management and communication system's power backup system).	To be costed as part of Park Mgmt. recovery needs.	
Water and sanitation	<i>Water for agriculture and livestock:</i> Recovery needs assessed as part of the Agriculture sector analysis.	To be costed as part of the Agriculture subsector needs assessment.	
	<i>Water for human consumption:</i> Acquire water cisterns for the provision of water for basic Park management needs	To be costed as part of the Housing subsector needs assessment	
Telecommunications	<i>Solid waste collection and disposal:</i> Collection, transportation outside the Natural Park, and proper disposal of solid waste to a landfill administered by the Municipalities, in collaboration with the Park management	To be costed as part of Park Mgmt. and Housing subsector recovery needs.	4,327
	<i>Park management:</i> Improve Park Management's radio communication system.	150,000	1,442
Road network	Access road inside the caldera (between Monte Beco and Fernão Gomes): Build a new 17-kilometer long, category 3 road with a 5-meter transversal profile, between the localities of Monte Beco e Fernão Gomes; incorporating standards for safety (of people and good transport) and compatibility with infrastructure development in environmentally-sensitive and risk-prone areas.	289,000,000	2,778,846
	Road section between Monte Velha and Fernão Gomes: Rehabilitation of a 2-km length road, with a 5-meter transversal profile, with brick stone surface	40,000,000	384,615
	Passenger and goods transport system. Establish a reliable transportation system for passengers and goods between Chã das Caldeiras and the new settlement.	To be costed as part of the Housing subsector needs assessment	
		329,600,000	3,169,230
TOTAL			

Medium term (6 to 12 months)			Long term (12 to 24 months)		
Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)
			<i>Support infrastructure:</i> Use of renewable energy (solar panels / photovoltaic or wind turbines) to power infrastructures to be built.	10,000,000	96,154
Water for human consumption: Acquire water cisterns for the infrastructures to be built, to be filled up with cistern-truck-transported water	20,000,000	192,308			
Wastewaters: Build septic tank systems as part of new infrastructures					
Road section between Campanas de Cima and Monte Velha: Build an alternate 12-km long, class 3 brick-stone with 6-meter transversal profile, access road to the Natural Park of Fogo in Chã das Caldeiras through Campanas de Cima.	504,000,000	4,846,154			
	524,000,000	5,038,462		10,000,000	96,154

863,600,000 CVE or US\$ 8,303,856

SOCIAL SECTORS

HOUSING

Predisaster Situation

Chã das Caldeiras encompassed five localities: Djeu de Losna, Cova Tina, Pico do Vulcão, Bordeira, Portela, and Bangaeira. In these communities, more than 90 percent of houses were located in the latter two villages (Portela and Bangaeira). There was a total of approximately 284 housing units prior to the disaster, as well community infrastructure.

Most of the inhabitants were owners of their houses (249 of the households, representing 88 percent of the total), while a minority of the population occupied their houses under some type rental contractual arrangement (23 households, representing 8 percent of the Chã das Caldeiras population). The remaining 3 percent corresponds to occupancy by institutions or the state, with the specific number and regime by type of institution being unknown.

According to the assessments conducted during the preparation of the detailed land-use plan for Chã das Caldeiras, most of the houses were one-story, single-family dwellings with four or fewer divisions. According to complementary data from the socioeconomic diagnostic conducted by the Natural Park of Fogo (PNF), 44.9 percent of the houses had four or more divisions, while 29.1 percent had three. If we cross those data with the census information on household size (41.8 percent have between 5 and 11 members), while 48.7 percent have between 2 and 4 persons, we can notice that the ratio of person to room was relatively high.

In terms of construction materials, the houses were built of cement blocks (58 percent), stone masonry (17 percent, built with a mix of water, sand, and volcanic slag), or a combination of both (25 percent). Roof coverage was mainly of concrete roof slabs, while some houses were roofed with shingles. Eighty-five percent of those houses have their own rainwater collection and storage systems (family cisterns), and various housing units had attached or annexed structures, such as garages or stables.

In terms of energy sources for domestic purposes, considering the absence of the electric grid in Chã das Caldeiras, some houses were equipped with small generators (30 percent), while the majority (80 percent) used candles or petroleum lamps for lighting and wood and charcoal (60.8 percent) or butane gas (34.2 percent) for cooking (INE 2010).

As far as access to water is concerned, household water connections were not available, and the majority satisfied water demand from family reservoirs (65.2 percent) or by other means (public fountains, water trucks, and so forth). Twenty-nine percent of the households have sanitary installations inside their houses (INE 2010), while the rest use open air. It is estimated that only around 30 percent had their own septic tanks. Regarding solid waste, the survey conducted by the Natural Park management team (PNF, 2014) revealed that only 15.7 percent of the respondents used containers for the disposal of their solid waste, while the rest disposed in the open or in plots around their houses.

In regard to the baseline situation in the housing sector, two settlements were built after the 1995 eruption with support from Germany to permanently reallocate the affected population from Chã das Caldeiras.

Out of those settlements' houses, 40 were built in the villages of Achada Furna and 70 in Monte Grande. They were one-story, single-family houses with two divisions (rooms) built on cement blocks. Roof coverage was mainly done with tile. The houses were not equipped with sanitation facilities, kitchen, electricity, or water connections. The property ownership of these houses was not legalized, which, according to some beneficiaries, was a constraint for renovations and expansion.

Despite the fact those houses were built for permanent relocation of the population, what happened in reality is that beneficiaries from those houses abandoned them in the years after the eruption and returned to their houses in Chã das Caldeiras. In most cases, some of the construction materials and basic equipment (doors, windows, and so forth) were removed from resettlement zones and used for reconstruction or improvement of the houses in Chã das Caldeiras. Some of the houses abandoned by the communities returning to Chã das Caldeiras were later occupied by other local communities or even rented out by the owners.

After the 2014 eruption, the houses built in 1995 were again used as relocation dwellings for the affected population. However, considering the intense degradation of these houses, most required internal or external repairs and other interventions to meet the minimum standard of habitability.

Tents or temporary shelters installed in local social centers, schools, or sport facilities had to be prepared to receive the population that did not already have a house in Achada Furna or Monte Grande and represent additional housing needs based on population growth in the caldera (either natural or linked to migration).

Eruption Effects

The eruption destroyed completely more than 90 percent of the houses (260 housing units) located in Portela, Bangaeira, and Djeu de Losna, considered to be in a high-hazard area and a natural path for the lava flows, as had also already occurred in the past. Entire villages of Chã das Caldeiras were submerged by lava. Extensive lava fields and debris covering the villages cannot be removed.

The disaster-affected population took shelter in the 1995 settlements of Achada Furna and Monte Grande, either in temporary habilitated shelters and tents, or they directed themselves to the adjacent urban centers of São Filipe or Mosteiros' municipalities, where they were initially hosted in temporary shelters set up in educational or social facilities, and were later placed in rental housing units paid for by the government.

Table 2.17 breaks down the costs of destroyed houses. Despite the fact that the populations were able to rescue most of their personal assets and household goods from their houses, some of them were damaged or lost during transportation.

Total damage and losses in housing sector are estimated at CVEsc 756.7 million or US\$7.6 million. The damage consisted mostly of the destruction of houses and equipment and is estimated at CVEsc 755.2 million while losses total CVEsc 1.5 million.

Table 2.17: Damage and Losses in Housing, Chã das Caldeiras

Components	Damages (private)		Losses (public)	
	CVE	US\$	CVE	US\$
Houses totally destroyed	693,800,000	7,015,167	0.0	0.0
Houses partially destroyed	46,000,000	465,116	0.0	0.0
Household furniture and other personal assets	15,402,380	155,737	0.0	0.0
Temporary shelters and rental schema (January–April 2015)	0.0	0.0	1,486,500	15,030
TOTAL	755,202,380	7,636,020	1,486,500	15,030

RECOVERY NEEDS AND STRATEGY

The following measures are recommended:

Short Term: Limit New Housing Construction in Chá das Caldeiras

- It is not advisable to reconstruct housing in areas that are extremely hazardous due to recurrent volcano eruptions. Lava is not removable, and a substantial amount of both public and private investment in the recovery and reconstruction may be wasted by future volcano eruptions. The Ministry of Environment, Housing and Land Management (MAHOT), INGT, and Santa Catarina of Fogo Municipality should strengthen land-use zoning and enforcement in the Natural Park of Fogo that restrict urban expansion and new housing construction within the park.

Short to Medium Term: Provide Temporary Shelter Support to Disaster Exposed Population

- The government has been providing financial support to accommodate around 310 persons in private rented housing, and 760 more returned to the houses in Monte Grande and Achada Furna constructed by the German Agency for International Cooperation (GiZ) after the 1995 eruption. The living conditions of the 1995 houses has been deemed substandard and without basic sanitary facilities. Under the leadership of the Ministry of Infrastructure, the government should rehabilitate and expand the houses constructed in 1995 (water and electricity, toilets, expansion of housing units according to family size, and so on) and continuously support private rented housing for the exposed population for an additional year.

Medium Term: Register Land Property Titles to Clarify Property Rights for the Plots and Houses Constructed in 1995

- In the villages, residents acknowledged that land registration remains unclear. The government should identify land ownership and allow people to continue legally with their livelihood activities (e.g., agriculture and/or tourism-related businesses) on their own land. Ownership of 1995 houses should be legalized in order to provide some security to the owners.

Medium Term: Support Relocation of the Exposed People

- In addition to limiting new permanent housing construction in Chá das Caldeiras, the government should provide housing for disaster-exposed people in areas that are less vulnerable to volcano eruptions. There are two locations where the government provided housing with the support of GiZ during the volcano eruption in 1995 (Monte Grande and Achada Furna), and there is an additional site located between Casa Branca and Achada Furna that is proposed for the construction of new houses for the affected population.
- After assessment of advantages and disadvantages of all potential houses, the government announced in June 2015 that the new settlement will be established in Achada Furna village. The cost estimates provided for the new settlement include not only housing construction but basic site infrastructure (streets, street lighting, water and sanitation main network, public spaces, and landscaping).
- The livelihoods of the affected population rely heavily on their agricultural production in Chá das Caldeiras. While available agricultural land has decreased due to continuing eruptions, there is a good opportunity to create jobs by activating tourism in the caldera area. Therefore, the government could identify a location for housing for the affected population, taking into consideration the distance from Chá das Caldeiras, exposure to several hazards, and accessibility to the infrastructure network including water, electricity, and public facilities including school and church as well as daily supplies (figure 2.9).
- Providing housing for the affected population in Achada Furna will minimize the cost of infrastructure construction, environmental impact, and mobility of people. (See table 2.18 for overall costs in housing). Existing houses constructed in 1995 (in Monte Grande and Achada Furna) can be used as permanent housing for the affected population after rehabilitation.

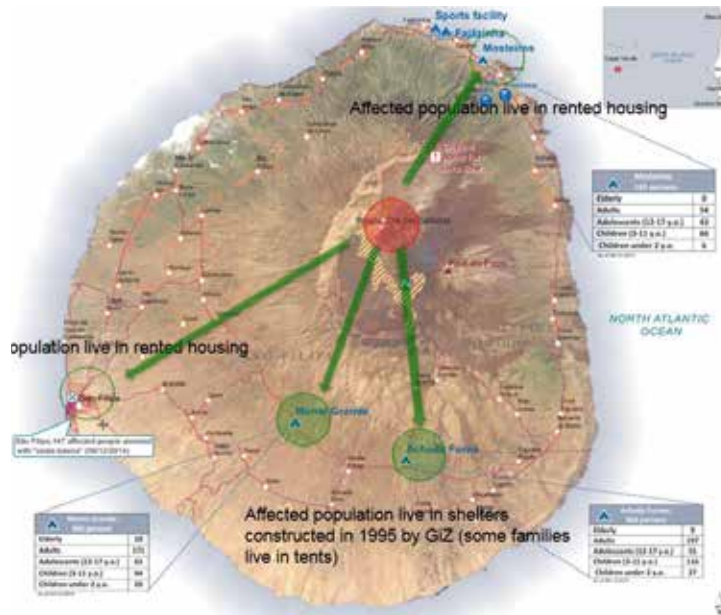


Figure 2.9: Possible Resettlement Sites and Their Relative Distances to Chã das Caldeiras

Source: Courtesy INGT

Note: Possible resettlement sites are indicated in green.

Relevant and sustainable transportation should be established when the affected people are relocated. Arranging community or shared transportation for workers as well as for goods and materials for their livelihood is crucial and also a pragmatic medium-term solution.

The total amount for these recovery activities is estimated to amount to CVEsc 730.1 million or US\$7.3 million.

Table 2.18: Recovery Needs and Strategy for Housing

Short term (up to 6 months)			Medium term (6 to 12 months)		
Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)
Study of most appropriate areas for resettlement and in-depth risk assessment	1,744,860.00	17,642.67	New settlement construction (for 100 housing units)	357,975,000.00	3,619,565.22
Urban detail plan and zoning regulations	12,187,500.00	123,230.54	Registration of land property titles for the plots and houses of 1995	0	0
Land acquisition costs (five hectares)	50,000,000.00	505,561.17			
Rehabilitation and upgrade of 1995 houses	305,230,752.00	3,086,256.34			
Rental houses for construction period (May 2015 through May 2016)	4,459,500.00	45,091.00			
Total by time frame of priority	373,622,612.00	3,777,782.00		357,975,000.00	3,619,565.00

TOTAL

731,597,612 CVE OR US\$7,397,347

EDUCATION

Predisaster Situation

According to the INE (2010) census, 23 percent of Chã das Caldeiras heads of household are illiterate (31 percent women and 14 percent men). The public sector provided education services, namely primary and preschool, and the infrastructure network comprised a primary school (grades one to six) and a kindergarten. The secondary school was located in Cova Figueira, outside the caldera. School attendance rates are high with all children ages 6 to 12 (n=134) enrolled in primary school and 52 (n=52) in preschool (table 2.19).

Table 2.19: Enrolled Students in Chã das Caldeiras, Start of School Year 2013/14

Grade	1	2	3	4	5	6	% Girls
Number of enrolled children	23	36	14	19	18	29	48.9

Source: Education Statistical Report for the school year 2013/14.

Eruption Effects

The eruption completely destroyed the primary school, the kindergarten, the basic sports facility, and all equipment and educational materials. Fortunately, children did not experience disruptions in their schooling, as all displaced children were immediately relocated to schools near the hosting centers. The displaced teachers and preschoolers, were absorbed by those schools; some teachers were involved assisting relief operations for the affected families. Additional equipment and furniture were purchased to meet the needs of the newly arriving children at hosting schools (see table 2.20).

Total effects (damage and losses) in the education sector are estimated in CVEsc 42.3 million or US\$427,958. Total damage is valued at CVEsc 40.2 million and includes damage to school buildings and furniture, equipment, and educational materials. One hundred percent of the damage is for the public sector. Estimated losses totaling CVEsc 2.1 million include the costs of new equipment for the host schools and the cost of schools fees and transportation for the children at secondary level.

Table 2.20: Damages and Losses in Education

Components	Damage (CVEsc)	Property		Losses (CVEsc)	Property	
		Public	Private		Public	Private
Primary school and	36,800,00	36,800,000	0	0	0	0
Equipment and school fees	3,387,500	3,387,500	0	2,137,500	2,137,500	0
TOTAL (CVE)	40,187,500	40,187,500	0	2,137,500	2,137,500	0
TOTAL US\$	406,345	406,345	0	21,613	21,613	0

Recovery Needs and Strategy

Recovery needs and costs are listed in table 2.21 and consist of educational infrastructure restoration or construction and acquisition of equipment and school furniture.

Table 2.21: Recovery Costs and Needs in the Education Subsector

Short term (up to 6 months)			Medium term (6 to 12 months)		
Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)
School fees (May–July 2015)	200,000	2,022	Construction of new school in new settlement	15,000,000	151,668
			Construction of a kindergarten in new settlement	5,000,000	50,556
			Construction of a Sport basic facility	12,000,000	121,335
			Equipment's for new school and kindergarten	5,310,000	53,691
Total by time frame of priority	200,000	2,022		37,310,000	377,250
TOTAL IN CVE AND US\$			37,510,000 CVE OR US\$ 379,272		

The recovery strategy in the education subsector must incorporate the need to build new infrastructure in the new settlement: one primary school, one kindergarten, and one basic sport facility. At the same time, it should continue with the follow-up of students and payment of fees until the end of the school year 2014/15.

The total amount for recovery needs is estimated in CVEsc 37.5 million (-US\$379, 272D) and should be mainly supported by public funds. Children living in Achada Furna and Monte Grande, at the 1995 settlements, can continue at the local schools. In addition, teachers should consider planning for increasing capacity and on accommodating new students without disrupting their education. The mobilization of existing education means and facilities that could be used to reintegrate new students should be part of preparedness plan.

HEALTH

Predisaster Situation

There was only one health facility in Chã das Caldeiras (Unidade Sanitária de Base -USB), inaugurated in 2013, staffed by one health agent, that provided basic services to the population. Medical visits (two), by one doctor from the public service, treated forty patients (n=40) a month. During these visits, children's immunization records were updated. The population had also out-patient consultations available at the Fogo Island for specialized medical appointments and emergencies.

Eruption Effect

While the primary health care unit was destroyed by lava, access to health services was not interrupted, as the displaced population had access to health clinics at the displacement sites. The primary local health profile, therefore, has not been negatively impacted by the crisis and displacement. The loss of goods and assets always as a traumatic effect, and psychosocial support through counselling has been made available at displacement sites. The hospital of São Filipe was the selected health facility for the provision of services to the affected population.

The total damage and losses in health sector are estimated in CVEsc 14.5 million or US\$147,495. The damage consisted mostly of the destruction of infrastructure and equipment, and it is estimated at CVEsc 5.9

million, and losses estimated at CVEsc 8.7 million. In terms of losses, the different departments of the Ministry of Health involved in the disaster relief operation incurred high costs to support service reorganization, preparedness of the regional hospital, and psychological services to meet an expected higher demand. Furthermore, additional studies to assess the quality of water and air were conducted. (For more see table 2.22.)

The higher costs of the relief operation consist of the following:

- Cost of preparedness (additionally recruited medical and paramedical staff) and operations (fuel) for the health structures in villages and cities to provide services (including medical exams, visits and medicines) and psychological support for the displaced population: CVEsc 4.1 million (~US\$41,658).
- Additional costs to ensure regional hospital preparedness to provide (at no cost to patients) reference services and basic drugs to the displaced population. There were also staff costs (nurse, coordinator, and ambulance driver) for an additional six months: CVEsc 1.6 million (~US\$16,499).
- Cost of water quality analysis (on cisterns) and air quality studies and surveillance: CVEsc 3.0 million (~US\$30,883).

Table 2.22: Damages and Losses in Health

Components	Damages (private)		Losses (public)	
	CVE	US\$	CVE	US\$
Health facility (basic health unit)	5,000,000	50,556	0	0
Preparedness in neighborhood health facilities to provide health services and psychosocial support to displaced population	0	0	4,120,000	41,658
Additional cost to ensure regional hospital preparedness	0	0	1,631,748	16,499
Equipment and assets	781,200	7,898	0	0
Water and air quality studies and surveillance	0	0	3,054,400	30,883
TOTAL	5,781,200	58,455	8,806,148	89,040

Recovery Needs and Strategy

The needs of the health sector are related to replacement costs and the establishment of the health facilities in the new resettlement area with provision of equipment and medicines. Table 2.23 shows the recovery needs and related costs.

Table 2.23 Recovery Needs and Costs in Health

Short term (up to 6 months)			Medium term (6 to 12 months)		
Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)
Psychosocial support and medical support to displaced population (May–December 2015)	3,745,000	37,867	Rehabilitation of basic health unit (USB) (Monte Grande and Achada Furna)	4,300,000	43,478
			Equipment for USB (Monte Grande and Achada Furna)	1,800,000	18,200
			Construction of new USB in the new settlement	7,000,000	70,779
			Construction of a child protection center	15,000,000	151,668
			Communication for Development (C4D) Programme	3,500,000	35,389
Total by time frame	3,745,000	37,867		31,600,000	319,514
TOTAL				35,345,000 CVE	or US\$ 395,248

The USBs in Achada Furna and Monte Grande need to be rehabilitated, due to overall deterioration, poor maintenance, and additional pressure exerted by the displaced people from Chã das Caldeiras. Therefore, it is recommended to upgrade the USB in Achada Furna to a health center (Posto de Saúde) in order to meet the current demands, creating a better health care service to the population. The overall recovery strategy for the health subsector, in which child protection assessment is also included, is estimated at CVEsc 35.3 million (~US\$395,248 USD).

In addition, in order to provide durable recovery and ensure family and child protection, the following actions are recommended.

Short to Medium Term

- Develop a program on Communication for Development (C4D) aimed at changing behavior and attitudes to ensure full protection of Chã das Caldeiras’ children and families.
- Build in the new settlement a child protection center in order to ensure that children have a safe space for child protection and family counseling. Considering that habitat and production activities will be developed in different locations (Chã das Caldeiras for economic activities and resettlement site for housing) there is a potential source for disruption in the social network. The center will help women take up productive activities outside their resettlement sites, with the assurance that children are in a safe place.
- Continue with the psychosocial assistance and improve the efficiency of this counselling service by enhancing the synergy between relevant institutions.

The overall cost for these interventions is estimated at CVEsc 18.5 million or US\$187,058 (table 2.24).

Table 2.24: Recovery Costs in the Child Protection Subsector

Needs	Costs (CVEsc)	Costs (US\$)
Construction of a Child Protection Center	15,000,000.00	151,668
Communication for Development (C4D) Programme	3,500,000.00	35,389
Subtotal	18,500,000.00	187,058

Note: In the summary table these figures are included in the health effects section.

CULTURE

Predisaster Situation

The subsector was managed by both public and private entities. Chã das Caldeiras had one auditorium for live shows and other leisure activities, and an associated library, integrated into the Natural Park of Fogo headquarters. Tourism facilities provided some cultural activities, and the annual wine festival was very famous, providing business opportunities for the local population and tour operators. A project to implement a wine museum was planned and some items collected. Handicrafts using volcano stones were produced by the local population and sold to tourists.

Eruption effects

Assessing damage and losses to cultural heritage assets in Chã das Caldeiras is a very difficult task considering the effects of the eruption were felt mostly on immaterial heritage (such as festivals and cultural traditions or not-yet realized cultural projects). The effects related to disruptions to social capital, in particular, are difficult to estimate in quantitative terms. The eruption disrupted the social networks, namely the local associations, which are the basis of social capital.

In terms of physical cultural heritage assets, the damage caused to the auditorium has been considered under the environment sector (due to the fact that the auditorium and handicraft exhibition room were integrated into the Natural Park HQ building). Other elements that are accounted for in this section relate to cultural-religious heritage. According to the assessments, the two churches in the caldera (Catholic and Seventh Day Adventist) were fully destroyed by the lava. The total damage and losses for the culture subsector is estimated to amount to CVEsc 16.2 million or US\$163,933, mainly related to the costs of the destroyed churches (see table 2.25).

Table 2.25: Damage and Losses in Culture

Components	Damage		Property	Losses		Property
	CVE	US\$	Private (CVEsc)	CVE	US\$	Public
Cultural facilities or sites fully destroyed	16,000,000	161,780	16,000,000	0	0	0
Handicrafts and wine museum (items collected)	213,000	2,154	213,000	0	0	0
TOTAL	16,213,000	163,933	16,213,000	0	0	0

Recovery Needs and Strategy

Medium Term

In order to support recovery in the culture subsector, the needs to support resumption of handicraft and other cultural activities have been estimated. Initial investments are needed so that artists and craftspeople have basic equipment and materials (for example, for stone carving) to reactivate and enhance cultural offerings and handicraft production. Some institutional support is also needed for local community associations that organize cultural activities and promote local artists' creativity.

In order to support recovery of social structures and cultural traditions, local associations whose members have sometimes been dispersed to several (and physically distant) resettlement sites need to be reactivated. These might need to redesign their internal organization and mechanisms in order to function under new social and habitat conditions and respond to new social and cultural challenges.

The different religious communities will need to reconstruct their meeting spaces and facilities (churches) to allow reactivation of community celebrations and rituals, which are essential to ensuring social networks and community cohesion. This process must be participatory and the mechanisms for this reactivation discussed with the local population. The needs for recovery and reconstruction are estimated to be CVEsc 16.9 million or US\$170,575 (table 2.26).

Table 2.26: Recovery Needs and Costs for Culture

Needs	Custos (CVE)	Custos (US\$)
Support to craftsman (basic materials and equipment)	60,000	607
Reactivation of social networks and social capital (institutional support to local associations)	800,000	8,089
Construction of new churches in the new settlement sites	16,000,000	161,780
SUBTOTAL	16,860,000	170,475

Table 2.27 Recovery Needs and Costs in Health

	Short-Term (up to 6 months)			Medium-Term (6 to 12 months)			Long-Term (12 to 24 months)			
	Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)	Needs	Costs (CVE)	Costs (US\$)	
Housing	Study of most appropriate areas for resettlement and in-depth risk assessment and	1,744,860	17,643	New settlement construction (for 100 housing units)	357,975,000	3,619,565				
	Urban detail plan and zoning regulations.	12,187,500	123,231							
	Land acquisition costs (5ha)	50,000,000	505,561							192,308
	Rehabilitation and upgrade of 1995 Houses	305,230,752	3,086,256							
	Rental houses for construction period (May 2015- May 2016)	4,459,500	45,091							
SUBTOTAL	373,622,612	3,777,782		357,975,000	3,619,565					
Education	School fees (May-July 2015)	200,000.00	2,022	Construction of new school in new settlement	15,000,000	151,668				
		305,230,752	3,086,256	Construction of a kindergarden in new settlement	5,000,000	50,556				
			4,327	Construction of a Sport basic facility	12,000,000	121,335				
				Equipment's for new school and kindergarden	5,310,000	53,691				
	SUBTOTAL	200,000	2,022		37,310,000	377,250				
Health	Psychosocial support and medical support to displaced population (May-December 2015)	3,745,000.00	37,867	Rehabilitation of USB (Monte Grande and Achada Furna)	4,300,000	43,478				
				Equipment for USB (Monte Grande and Achada Furna)	1,800,000	18,200				
				Construction of new USB in the new settlement	7,000,000	70,779				
	SUBTOTAL	3,745,000.00	37,867		13,100,000	132,457				
Child Protection				Construction of a Child Protection Center	15,000,000	151,668				
				Communication for Development (C4D) Programme	3,500,000	35,389				
	SUBTOTAL				18,500,000	187,058				
Culture				Support to handcrafts (materials)	60,000	607				
				Reactivation of social networks and social capital (Local Association)	800,000	8,089				
				Construction of Church's in the new settlement	16,000,000	161,780				
SUBTOTAL				16,860,000	170,475					
Total costs by timeframe		CVE 821,312,612				USD 8,304,475				

CROSS-CUTTING THEMES

ENVIRONMENT

Predisaster Situation

The PNF constitutes the most significant environmental asset of Fogo island. Covering a total area of 8,468.5 hectares, it was declared as a protected area by Decree-Law 3/2003, of February 24, 2003, that established the juridical framework for the national protected area network of Cabo Verde. The official delimitation was later approved by the Regulatory Decree 3/2008 and its management plan was gazetted by Decree 20/2010, of April 19, 2010. According to the official delimitation, the park covers a total area of 84,685 hectares and is located in the confluence area of the three municipalities of the island, according to the following spatial distribution: São Filipe (1,861 hectares, 22 percent of the park surface); Santa Catarina do Fogo (4,237 hectares, 50 percent of the park surface); and Mosteiros (2,370 hectares, 28 percent of the park surface).

Considered one of the most representative samples of the mountainous humid ecosystem of Cabo Verde, the park hosts a special richness of biological and geological diversity. The range of altitudes and microclimates within the park enables the existence of differentiated habitats that host more than 103 plant species (37 considered as endemic), 3 species of mammals, 2 of reptiles, and 78 of invertebrates. The species and subspecies of endemic birds makes the park of place of global interest for biodiversity conservation. In this sense, the park is considered an Important Bird and Biodiversity Area, according to BirdLife International.

The park encompass several bioclimatic strata, from semi-arid to subhumid, up to the volcano top at 2,829 meters. It covers the Pico de Fogo volcano mountain, the crater, the Bordeira (ancient volcano caldera), and the forest area of Monte Velha.

Besides its biodiversity value, the park area represents one of the most important rainfed fruit-cropping systems of Cabo Verde and supports the main livelihoods of the Chã das Caldeiras community, providing a full range of ecosystem services and functions for the caldera communities and the whole island population.

According to the PNF management plan, the objectives of the declaration of this protected area refers to the conservation of natural (geological and biological) and cultural diversity, as well as the promotion of sustainable socioeconomic development for the island's communities. The services that the park provides fall into several categories: provisioning services (food production, fresh water, and fuelwood); regulating services (water regulation, recharge zones, and pollination); cultural services (spiritual, recreation, aesthetic, cultural heritage, and ecotourism); as well as other general supporting services.

Despite the recognized relevance of those services, the extent and value of each of them were not evaluated prior to the eruption, making it difficult to assess any potential changes as a consequence of the disaster. Figure 2.10 shows the geographical area under the management of the Natural Park of Fogo.

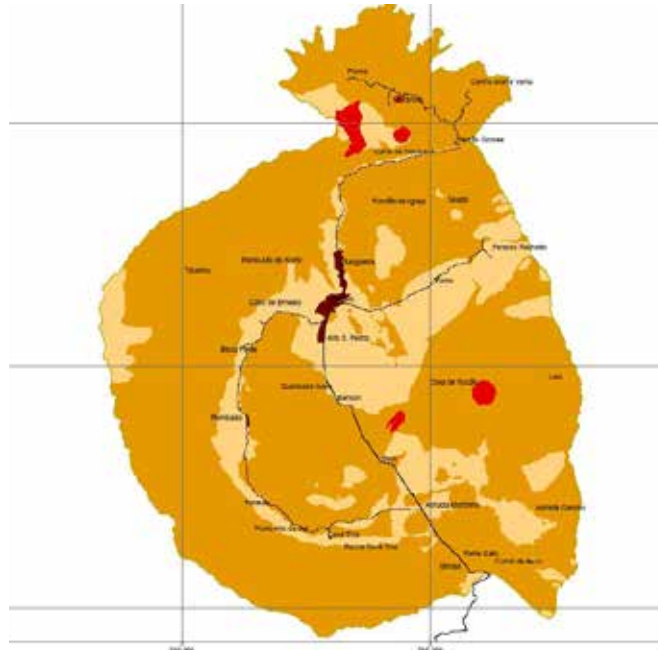


Figure 2.10: Natural Park of Fogo

Source: Map produced under UNDP/GEF MAHOT project, Management Plan of Fogo Natural Park Fogo, 2010.

According to the PNF management, various, noneruption threats had been identified in the park and its buffer zone before the eruption. In light of these, tools such as the PNF management plan, business and executive plans, legislative norms, ecological monitoring, and ecotourism plan need to be adapted to the new postdisaster configuration of lava coverage and free and safe areas. To ensure appropriate planning and management, a zoning exercise was conducted to identify uses and related compatibility, restrictions, and the interdictions. The results were summarized on a compatibility matrix and a zoning map.

Among the main threats to conservation identified, we could highlight the following: extraction of inert materials for civil construction purposes; human action (deforestation or unsustainable agricultural practices); free grazing; deforestation for fuelwood exploration (mainly to satisfy energy need for cooking); and urban expansion (land occupation, waste generation, increase in energy and water use, and pollution via noise, water, or light).

Tourism-related activities were not identified at the time of management plan preparation (2007–8) as a main threat to the park, but if tourism takes place in an unplanned and unmanaged manner it will be detrimental to park. However, tourism also has the potential to mobilize financial resources for sustainable management of natural resources and park biodiversity conservation. (Refer to the subsection on tourism under the “Productive Sector” section of this chapter 2.)

In terms of environmental governance, Law 86/IV/93, of June, 26, 1993, established the basis of the Cabo Verde environmental policy. MAHOT has the mandate to elaborate the national environmental policy, enforce the regulation of, and oversee all aspects related to natural resources management, protected area conservation, land-use planning and management, urban development, and housing.

With regards to conservation, the protected areas system is managed through the Natural Resources Conservation Service Directorate, under the National Directorate of Environment (DNA). The DNA is responsible for environmental regulations and management. The DNA also oversees the national environmental impact assessment process through a specialized department.

The Natural Resource Conservation Service Directorate is in charge of biodiversity monitoring and management in protected areas (PAs). The DNA also oversees the national PA network, including tourism development. These responsibilities on PA management and conservation will be assumed by the future Protected Areas Autonomous Authority, which is the institutional framework under consideration to ensure financial and environmental sustainability of the Cabo Verde PA network.

MAHOT/DNA oversees the Protected Area Management Units (PAMU) on each island and advisory forums of local stakeholders convene through the Advisory Councils for Protected Areas, which support the PAMUs.

Eruption Effects

The assessment of disaster effects on the environment can present specific challenges. The difficulty lies in the fact that the value of damage to the environment is often considered an intangible one; in other cases, the quantification of environmental damage poses major challenges. Costing can be complicated by the fact that some of the environmental hazards' effects can be rehabilitated only through natural processes.

Also, as occurs for other cross-cutting issues, losses are often captured in the sector in which they occur. For example, losses arising from damage to agriculture land are captured within the agriculture sector. In addition, valuation of damage to the environment is sometimes seen as a cross-cutting issue whose reporting responsibility falls under the line ministry.

Cabo Verde in general and Fogo island in particular to date have not been the object of any comprehensive economic valuation of ecosystem services provided by landscapes, seascapes, and protected areas. Such a valuation could have established a baseline for the evaluation of the effects of the volcanic eruption.

Additionally, in terms of habitat losses or disruption of habitat for endemic species, an in-depth ecological assessment is required to allow the park technical staff and researchers to identify the impact of those changes on the species' life cycles.

The PNF had a very specific geological configuration, determined by the geological history and effects of previous eruptions, in addition to the specific location and geomorphology. The changes and the effect of those in terms of ecosystem services, diversity, and habitat schemas are quite subtle, and it is difficult to discriminate and to quantify values. An in-depth assessment to identify environmental changes and the damages and resulting losses would require continuous research and monitoring and involve a broad range of earth sciences specialists, from biology, zoology, and hydrology to volcanology and geology.

Despite these limitations, the assessment conducted for PNF has identified some physical assets that were affected (mainly the park HQ facilities laboratory, interpretation and visitor center, library, office spaces, and auditorium) and that would be counted as disaster effects on the environmental axis, since that facility could be considered as an important element to sustain environmental governance of the PA. This facility was destroyed in the eruption. It was planned to support environmental education activities, host ecological monitoring and research activities, and promote and manage environmentally friendly touristic practices. For those reasons, the park HQ was considered essential as an interpretation center to raise awareness of communities and visitors in order to minimize impact of touristic and livelihood activities. Additionally, it served as a checkpoint to control access and to implement a tax entry system that would have improved the financial sustainability of the PNF and cover the costs of other planned conservation measures.

The damages and losses related to the loss of arable land, and therefore the provision services associated with the park area had already been considered on the agriculture sector report and therefore will not be addressed on this section.

Another main set of environmental services provided by the park, consisting of activities around fuelwood, climate regulation, or pollination, relates mainly to its forest component, which was not directly affected by the volcanic eruption. However, due to effects in other livelihood strategies (e.g., agriculture and tourism) some side effects could be expected in terms of forest resources exploration, although this might not be very relevant considering that most part of the household members have been displaced and might be utilizing different energy sources (e.g., gas, electricity) to satisfy their domestic energy demand.

Another set of environment-related disaster effects that could be addressed under this section refer to the environmental footprint of the relief and resettlement operations. New roads (temporary access) were built within the park to facilitate evacuation efforts, and people were temporarily sheltered in facilities such as high schools, social centers, or sport centers or moved to the settlements of Monte Grande and Achada Furna. In terms of the emergency roads and other access opened, it is important to consider that no environmental

impact assessment was conducted due to the emergency procedures used for these type of operations. The lack of due environmental impact assessments and control, applied in normal times, imply that the effects on the park biodiversity and ecological dynamics are unknown and cannot be quantitatively assessed.

Also difficult to assess but necessary to consider is the resettlement of populations in temporary or semi-permanent facilities or houses has an effect in terms of service provision and its associated environmental footprint. In this sense, solid waste disposal from tents or repopulated houses in the 1995 settlements of Monte Grande and Achada Furna have most surely meant a loss, in the sense of a negative economic flow, for the municipalities that need to ensure sanitation and water provision services. According to their ability or lack of it, managing these new needs in the temporary or semipermanent human settlements could lead to additional environmental pollution-related damage.

In terms of the risk and vulnerabilities that could have been exacerbated or created due to the disaster, the lack of alternate access roads poses severe limitations that impede the ability of local people and also park personnel to control possible fires. The semi-arid and arid conditions of the country, in particular Fogo island, expose an already disaster-prone environment to the additional vulnerabilities of man-made fires, as exemplified by the latest forest fires in Mosteiros on May 2, 2015, during which 70 hectares of the forest of Monte Velha was burned. Thirty military personal were deployed in Fogo to help to contain the fire, which damaged vegetation and agricultural land.

Recovery Needs and Strategy

The short-term needs refer to recovering the capacity of the park management unit to ensure effective management and reinforcing their operational and technical capacities to control tourism development in a sustainable way. The reconstruction, in a safer location, of the park HQ facilities is a priority that will enable improved monitoring of the park. Also important is the establishment of decentralized information and visitor centers in the different main touristic areas (in the city of São Filipe, at the airport, seaport or, city center); in the main access axis to the park; or within the buffer zone and checkpoint located at the park visitors' entrance. In any case, the infrastructure and facilities' siting process should be conducted through a spatial analysis process that considers disaster risks, environmental impacts, transportation access, management effectiveness, and tourism management. Any facilities or equipment found necessary to be established in the more hazard-prone areas should follow the light-footprint principle stated in the recovery strategy and should incorporate structural measures to minimize potential losses.

Short Term

- Conduct a spatial assessment (hazard and risk assessment) and feasibility analysis for decisions on safe and efficient new locations for park facilities.
- Considerations of environmental sustainability should be mainstreamed into the recovery strategy of other sectors, including housing, tourism, and overall infrastructure recovery strategies. In addition to integrating the principles and measures to reduce disaster risk, the new settlements, the new or reconstructed infrastructure (transportation, agriculture-related, and social infrastructure), and any new touristic development should pass through an environmental assessment process that considers the *build back greener* principle and that minimizes carbon emissions and other environmental impacts of those sectors not only on the PA but in the island-wide natural resources' management area. The sourcing of construction materials needs to consider the issue of inert material extraction (sand and rocks) from beaches and/or park areas, since sand and inert material extraction have already been identified as a main conservation threat specifically for the park and is also a major factor causing environmental degradation in the country's coastal zones.

At this point, resilient and sustainable land-use planning processes should consider the impact of service provision (water and sanitation) and propose waste management systems (for solid but also liquid waste) that minimize environmental impact of urban and/or rural settlements and allow for recycling and/or reuse of scarce resources such as water.

Medium Term

- It is necessary to reinforce the capacities of the park management unit to control tourism flows and to ensure environmental sustainability of tourism development and operations within the park. These activities include, for instance, interpretative resources (facilities, equipment, audio-visual equipment, and eco-guides); trails and general park signs; and safety equipment and technical capacities to assess the impact of tourist activities on ecosystems and the services the park provides. Such management operations could include carrying-capacity assessments; development of strategies and concrete interventions to minimize impact; and providing environmental education.
- Additionally, the operational capacity of park management unit will need to be reinforced with support staff (eco-guards) and check-points to establish and manage the entry fee system for visitors and vehicles. The park will also need to develop other income-generating mechanisms to recover management costs and to co-finance ecological monitoring, conservation, and/or restoration activities.
- The sustainable management of tourism and eco-tourism activities in the PAs will require improved technical capacities of the DNA and PNF management structures to deal with tourism operators, propose environmentally friendly tourism operations, develop and/or certify eco-tourism products and packages, apply sustainable certification systems, enforce ecosystem conservation regulations, assess environmental impacts of proposed tourism development projects, and monitor environmental mitigation mechanisms agreed to during project design and approval.

Long Term

- It has been deemed a priority to conduct an in-depth assessment of ecosystem services' economic value, which requires reinforcing national technical capacities to conduct the assessment and to continuously track changes and effects of the different anthropic activities on the park. The upgrade of the ecological monitoring system is considered a priority, as well, in order to track the effects of future eruptions or any other type of disaster on ecosystem processes and the ecological biodiversity.
- In terms of policy and legislative/regulatory framework, the application of strategic environmental assessments for new land-use planning instruments should be incorporated.

In general terms, build back better and also *build back greener* approaches could be adopted as guiding principles for all sector recovery strategy and implementation frameworks. These could include the use of low-carbon technologies to meet the energy demand of communities, facilities (such as schools, health center and administration buildings), and private investments (tourism-related infrastructure and equipment).

The *build back greener* approach should also be applied to the materials (source and extraction processes) used for construction of new infrastructure and houses and in broader terms to the production technologies to be adopted in the different sectors and subsectors, for example, agribusiness-related transformation processes (cheese, fruit processing, wine production); handicrafts; and water and sanitation service provision. (See table 2.28 for associated needs and costs.)

Recommendations

Consider the environmental footprint of new settlements (including waste and water among others).

- Energy demands for construction or resettlement, pollution, and waste production from recovery initiatives need to be considered and managed in a sustainable manner.
- Ecosystem carrying capacities should be appraised for all new proposed livelihood activities.
- Conduct environmental impact assessments for any new infrastructure development.
- Appraise cumulative impact of all projects and interventions on the environment by developing capacities to conduct, review, and apply strategic environmental assessments for new land-use planning instruments or for recovery plans.

Table 2.28: Recovery Needs and Costs for the Environment

	Short term (up to 6 months)			Medium term (6 to 12 months)			Long term (12 to 24 months)		
	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)
Reestablishment and reinforcement of park management	Review and update of park management and ecotourism plans	2,080,000	(US\$)	Construction and equipment of new park facilities	150,000,000	1,516,684			
	Technical feasibility study and spatial assessment (hazard & risk) on safe and efficient location for Park HQ re-construction.	7,800,000	78,868	Reinforcement of Park technical and human capacities for tourism management, regulations enforcement and ecological monitoring	4,200,000	42,467			
	Construction of support facility for interpretation/ visitor center at Sao Filipe	15,000,000	151,668	Creation & security upgrades of viewpoints	6,000,000	60,667			
	Construction of check-points to control entrance at Park Entry points	6,400,000	64,712	Reinforcement of park signage (orientation and interpretation)	7,079,072	71,578			
				Design and development of materials for interpretation (audiovisuals, comps, models, etc.)	11,280,000	114,055			
				Enabling of trekking trails within the park for touristic activities	18,700,000	189,080			
				Reinforcement of security measures and equipment's on existing trekking trails.	8,450,000	85,440			
Strengthening of technical understanding of park assets and environmental services, and threats to which they are subjected	Assessment of impact of the volcanic eruption on the endemic fauna species	2,500,000	25,278	Park Ecosystem's carrying capacity assessment	5,939,200	60,053	Ecosystem services economic evaluation	6,292,700	63,627
	Assessment of the impact of the volcanic eruption on the park biodiversity	1,500,000	15,167	In depth characterization and Assessment of the park geological diversity and heritage conservation status	1,157,000	11,699			
Mainstreaming Green procurement & build back better & greener			Development of Green procurement systems	5,272,500	53,311	Capacity development for implementation	8,108,750	81,989	
Reinforcement of sustainable tourism management capabilities	Environmental Impact assessments-new infrastructures	5,600,000	56,623			(Strategic environmental assessment)	10,695,000	108,140	
Total costs by time frame (US\$)		40,880,000	413,347		218,077,772	2,205,033	Development and rollout of sustainable tourism certification	25,096,450	253,756

TOTAL

284,054,222 CVE OR US\$ 2,872,136

DISASTER RISK REDUCTION

Predisaster Situation

Disaster risk reduction (DRR) in Cabo Verde remains geared primarily toward emergency response as opposed to preparedness and proactive risk reduction. A DRR national platform was established in November 2007, but, the platform has never been fully operational. The country lacks a comprehensive institutional and policy framework for DRR, which consequently results in the absence of a national or local-level DRR strategy. A lack of integration of DRR's concerns into development policies and plans at both national and sectorial levels is an institutional gap to be addressed. Additionally, technical and financial capacities to mainstream DRR are still limited.

The National Civil Protection and Fire Fighters' Service (Serviço Nacional de Proteção Civil e Bombeiros, SNPCB) is the government agency with the mandate for disaster risk management (DRM) in Cabo Verde. Established in 1992, the SNPCB is placed within the Ministry of Internal Administration. The establishment of the SNPCB was led by the Internal Affairs State Secretariat, in close partnership with the Ministry of Health, Cabo Verde Red Cross, and the army administration. The 1995 Fogo volcanic eruption, highlighted the relevance and urgency of the definition of a national civil protection system and accelerated the institutional process that resulted on the enactment, in April 1999, of the first Basic Law on Civil Protection. The Civil Protection Council of Cabo Verde was established with specific mandates for the different civil protection agents at the national and local levels. The Civil Protection Council was conceived as a multisectorial organ for deliberation and coordination on civil protection issues. The council is chaired by the prime minister and integrates with line ministries, army and police representatives, maritime and civil aviation authorities, Cabo Verde Red Cross, and municipalities' representation through the National Municipalities Association. According to the Basic Law on Civil Protection, the objectives of civil protection are: risk mitigation, preparedness and prevention, emergency assistance, and relief and recovery.

Regulatory-Decree 18/99 of December 20, 1999, formally established the National Civil Protection Service, defining its institutional structure, responsibilities, and organigram. The service (lately integrating the fire-fighting responsibilities after the Basic Law reform in 2012) is established as a specialized service providing technical assistance and operational coordination for civil protection at the national level. The SNPCB is mandated to plan, coordinate, and execute the national policy on civil protection. To support its operational responsibilities it counts on a national command and regional commanders that should ensure an integrated operational command of civil protection and firefighters agents, in different emergency and disaster situations, as typified by the law.

At the national level the minister of internal administration, and ultimately the prime minister, are the maximum authorities for the civil protection level, and with the advice from the National Civil Protection Council they are the authorities responsible for civil protection policy, design, and monitoring. At the local level, the president of the municipal chamber is the head of the Local Civil Protection Service, which is also supported by a local Civil Protection Council.

Since the end of 2014, the national command of SNPCB, based in Praia, has been reinforced with regional commanders in five islands—including a command in Fogo, with coverage for both Fogo and Brava islands. The mandate of the SNPCB is for disaster preparedness and response coordination at the national level. At the local level, the municipalities have the responsibility for such functions, but the SNPCB intervenes to support, if requested, or assume operational command in case the scope of the emergency requires it (according to the thresholds established in the emergency and contingency plans) or whenever the disaster surpasses the local response capabilities.

A national contingency plan was officially published in 2010 (Resolução no. 10/2010 of May 15, 2010) and has two main components: risk assessment and mechanisms for the response operations. In terms of risk assessment, the plan outlines the main hazards to which the country is exposed but also clearly recognizes that a more in-depth risk assessment and mapping should be developed at the local level to better inform contingency, land-use, and sectorial planning. As for the response operations, the plan identifies potential risks and emergency scenarios and consequent actions and response mechanisms to be activated. However,

due to technical and financial limitations, the plan has never been fully operationalized and also needs to be updated to reflect on changes on the underlying risk factors, rearrangements on the institutional panorama of the country, as well as lessons learned from previous disasters. Additionally, the line institutions participating on the council and/or listed as civil protection or support agents lack the necessary preparation; financial, operational, and technical capacity; and awareness to fully implement the responsibilities that the plan assigned them during the predisaster, emergency and postdisaster phases.

As for volcanic hazard, a Special Volcanic Emergency Plan for Fogo was prepared in 2004 with an island-wide geographical coverage to establish and systematize a set of norms, rules, and procedures to minimize effects in the case of a volcanic eruption. The plan contains a quite detailed description of all hazards associated with volcanos: lava flows, volcanic tephra fall, rock and bombs, gas expulsion, and seismic activity. From a historic review of past eruptions, the document highlights some figures in terms of frequency and duration of previous volcanic activity on the island, exposed communities, and the specific hazards that were observed. The plan presents a series of measures (including auto-protection for each specific volcanic hazard manifestation) and procedures to communicate alert and to command emergency response operations. The plan identifies the president of the municipality as the head of operations (director plan) in case of an emergency and identifies potential evacuation itineraries. Despite this plan being the basis of two simulation exercises conducted with NATO support in 2006 and 2011, the level of awareness among institutions and communities of those procedures is still very weak and it has not been updated since 2004. Neither the risk assessments introduced nor the scenarios and evacuation plans were ever spatialized and visually presented (in a map or in physical terms on the ground). The assessment remains a narrative presentation of previous hazard expression without further scientific modeling, and the scenario building is nowadays obsolete, considering demographic and physical changes onsite (urban expansion in Chã das Caldeiras and population dynamics within the island), economic dynamics related to wine production, infrastructure building (roads opening, HQ of natural park construction), or even institutional changes (creation of a new municipality). The lack of technical capacities to georeference and spatially analyze disaster effects trends, risk assessments, and emergency scenarios limits contingency planning efficiency during the disaster emergency phase.

At the municipal level, emergency plans were prepared between 2010 and 2011 for 17 municipalities existing at the time. Administrative reforms conducted at the decentralized government level resulted in the creation of 5 additional municipalities that currently do not have a Municipal Emergency Plan (PEM). Among those municipalities without a PEM, there is the municipality of Santa Catarina de Fogo, on Fogo island, to which the Chã das Caldeiras settlement belongs administratively. Generally, the existing PEMs do not present context-specific information, since they were prepared without observing any systematic and accurate risk and vulnerability assessments. As a matter of fact, the plans were mostly prepared along general contingency and operational guidelines and were not adjusted to the local specificities, capacities, and needs.

As for DRM at local level, the president of each municipal chamber assumes the role of local civil protection focal point and chairs the municipal civil protection council. However, so far only one municipality (the capital city, Praia) has established a local civil protection service. For the rest of the municipalities, only few of them can count on any technical expertise and trained staff. Those having a fairly robust technical cabinet for land-use planning and public works could mobilize some technical resources to develop some risk-assessment-related and preparedness actions. However, in most of the cases, the responsibilities are delegated to the council member responsible for environment or social assistance affairs—without any specific training or the provision of appropriate resources (technical, human, and financial) for preparedness, response, and recovery interventions.

Concerning disaster preparedness, several institutions contribute to different components of hazard-specific early warning systems. The National Meteorological and Geophysics Institute (INMG) has played an essential role in terms of climate-related hazards as well as seismic and volcanic hazards. With regards to the latter, technical and scientific research institutions, such as the Laboratory of Civil Engineering (LEC) or the University of Cabo Verde (Uni-CV) have also played an important role on the development of the hazard-monitoring component of the early warning system (EWS) in collaboration with the SNPCB and international partners from Canary Islands, among others.

In 2008, the INMG, with support of international development partners and research programs, managed to install the first components of the national geophysics network that was later expanded to additional islands and reinforced with the installation of a data processing laboratory in Mindelo. This data processing center receives seismic real-time data and produces bulletins that are delivered to the SNPCB. Additionally, a partnership with the Institute of Renewable Energies (ITER) of the Canary Islands, with financial resources from a program for external-border cooperation with ultra-periphery regions (Macaronesia Program) of the European Development Fund made possible, in 2008, the establishment of the Cabo Verde Volcanology Observatory in Fogo. The observatory includes a range of specialized equipment for seismic, geochemical, and geodesy monitoring. A technical and scientific protocol was signed among the Uni-CV, LEC, and ITER. Hosted by the Uni-CV, this observatory has been processing information received from the seismic, geophysics (temperature) and geodesic stations (ground deformation) and conducting periodic geochemical (gas emissions) data collection. The geophysics and geochemical information are complementary to the seismic activity monitoring data gathered by the INMG-owned network and have been useful for improving the scientific understanding of the volcanic phenomenon in Fogo.

Despite some initial gaps between the mandates of the two institutions and some overlaps between the LEC, Uni-CV, and INMG monitoring initiatives, the Regulatory Decree 13/2009 of July 20, 2009, clearly assigns the responsibilities of seismic monitoring to INMG and ordered the transfer of the VIGIL Network equipment from LEC to INMG. This decree confirmed INMG as the national authority for meteorology, climatology, geomagnetism, and seismology. Therefore, INMG is the institution responsible for seismic monitoring, while Uni-CV's role in research advancement in this area is also recognized.

Eruption Effects

Physical damage to assets pertaining to the DRM system of Cabo Verde have been minimal, considering that equipment and other assets available for monitoring, warning, and response were not abundant. In the case of monitoring stations and transmission equipment, some of these were not directly exposed to the effects of the eruption. (See photo 2.2 for an impression of the volcano's destructive power.) In other cases the technical teams managed to dismantle them in time to avoid damages.

The damages consisted mostly in the destruction of equipment (such as optical fiber for data transmission and batteries supporting PV systems for equipment) used for geophysical monitoring and belonging to the Volcanology Observatory of the University of Cabo Verde for a total of CVEsc 838,980 (-US\$8,300).



Figure 2.11: The Pico of Fogo and Lava Field

In terms of losses, the different institutions involved in the disaster relief operation, mainly the SNPCB, municipalities, and the military (army) incurred high expenditures to support domestic asset evacuation:

provision of food, clothing, water and sanitation services, electricity, health-care and accommodation to the evacuated population settled in temporary shelters or houses. Other significant losses refer to the civil works conducted to open alternative, temporary, or emergency access, which were subsequently destroyed by lava flows. These temporary roads were built to ensure evacuation, transportation of relief goods, and movement of operational and research teams during the emergency phase. Those expenditures, also included travel and transportation cost for equipment, relief goods, and operational and research teams that participated in the response exercise. The total costs to provide food items, drinking water, temporary electricity, and accommodation to the population were considered within this assessment. Those costs included purchase of fuel for the evacuation of household items and to ensure transportation of emergency personnel. In global terms, losses were exacerbated due to the extended duration of the eruption (88 days) and amounted to a total CVEsc 38,311,323 (~US\$387,375).

In summary, the disaster effects amounted to CVEsc 39,150,303 (~US\$395,857), considering damage to physical assets and changes in economic flows, the losses representing the most significant share of this value. Additional expenses incurred by the SNPCB and municipalities to provide response and relief support to the affected population contributed to the reported losses.

Performance of the Disaster Risk Management System

The emergency operations were coordinated by the SNPCB in collaboration with the military and local municipal authorities. However, while the SNPCB and the municipalities are responsible for disaster response, the government instituted a crisis cabinet at the outset of the volcanic eruption to ensure the coordination of emergency operations.

In regard to early warning system performance, the onset of the eruption was predicted thanks to the seismic monitoring system, and according to established protocols the national and local authorities were alerted. However, local communities did not receive any official warning alert but initiated evacuation as they perceived by themselves the signs onset of the eruption.

Considering the eruption path the communities were allowed enough evacuation time. However evacuation protocols were not fully defined, evacuation processes were not clearly articulated and coordinated, and orders (especially in terms of access restrictions and evacuation deadlines) by government officials, army, and police were difficult to enforce and conflicted with a self-evacuation initiative from families willing to evacuate all personal belongings and household items (including in some cases cement blocks and roof tiles).

When advised to evacuate, the families whose houses were located in areas not hit by lava flows in the 1995 eruption refused to follow evacuation recommendations and did not accept the vehicle support offered at the time. According to officials of the army, national police, and Civil Protection Service, the population accepted the need to evacuate only when the lava began destroying neighboring houses, revealing a very limited risk perception based on limited previous experience and lack of awareness regarding the lack of predictability of volcanic eruptions and the multihazardous pattern of the specific volcanism of Fogo.

In terms of community knowledge and awareness of the hazard and risk involved, from the reflections and assessments of technical staff participating in the relief operations, the population of Chá das Caldeiras is familiar with the existence of the hazard and aware of the irregularity of activity patterns. While they reaffirm that they “know how the volcano” behaves, from the self-evacuation process it could be deduced that local population bases its assessments of the situation and their evacuation decisions on a limited knowledge of previous events. Considering the demographic structure of the community, with a very young population, at maximum they have previously experienced only two eruptions (1951 and 1995, and in general only the 1995 eruption). While there is a valuable community knowledge (traditional or proximity knowledge) on hazard predictors, such as noise, perceived seismicity, human-detectable gas concentrations, rock falls, and so forth, a full understanding of the volcanic hazard and associated threats has not been yet fully achieved by the scientific community and remains even more limited for local populations.

The national level of knowledge on hazard behavior and associated risks needs to be reinforced, too. The underground structure of the volcano system (lava galleries, fault systems, aquifers, and underground water table system) as well as the probability of all subhazard manifestation, their potential frequency, and duration

and explosivity rates is not well understood yet. While remarkable scientific efforts have been undertaken and there is a quite exhaustive cartography of historical eruptions (in terms of lava extension) and other characterizations, the prediction capacity is based on some precursors (especially seismic activity, geochemical monitoring, and geodesic measurements) but cannot fully estimate probabilities of recurrence and magnitude of the phenomenon.

In terms of the command and operations, a coordination center was established in Mosteiros municipality. The operations command was headed by the National Civil Protection Service and articulated quite efficiently with army and police forces. However, two main difficulties were highlighted by officials in a retrospective analysis of lessons learned: difficulties in communications management (internal but especially official communication to media) and coordination with scientific assessment teams. Several scientific teams and specialists participated in the monitoring activities, but integrating the information capture at different levels and applying it to scenarios-modelling was challenging. In this particular, the lack of detail, updated information, and spatial representation of previous identified scenarios (within the Fogo Volcanic Eruption Emergency plan) limited its usability. Additionally, on the ground some monitoring equipment (and expertise to manipulate it) was missing and the operations command center and team lacked their own resources on hazard modelling and dynamic disaster scenario analysis.

In terms of shelter and humanitarian response (contingency supplies, campaign health care, and so forth), the relief efforts showed that all organizations (including private and social sector) quickly responded. National Civil Protection Services, municipalities, health authorities on the island, and the Red Cross (Fogo delegation and national structure) organized temporary shelter (for people who did not have access to the 110 houses built after 1995 in Achada Furna and Monte Grande) in a quite rapid and effective manner. The same could be said in terms of basic supplies (hygiene items, food and water, clothing) that were organized on the island and later reinforced with supplies donated from the rest of the country or bought locally by the authorities. While no serious issues were detected in terms of contingency supplies, the lack of updates on inventories and limited adherence to stockpiling practices preestablished in the contingency plans could have resulted on some efficiency loss and definitely had an impact on the emergency relief operations costs and response time.

Recovery Needs and Strategy

The recovery needs considered in this section cover only those related to the DRM system in Fogo and at national level. The needs and related costs for integrating DRR concerns into each sector are addressed in individual sector recovery strategies (refer to individual sector sections). (See table 2.28 for DRR-specific needs and costs.)

The volcanic eruption in Fogo has revealed a need for strengthening the DRM system not only on the island of Fogo but also at the national level in Cabo Verde. Besides intrinsic connections between the national and local levels that allow the DRM performance at local level to be more effective, a reason for including in this recovery strategy activities targeting the national level is that as a consequence of the disaster, the government of Cabo Verde will likely be more perceptive to the importance of strengthening its capacity in DRM. As well, the PDNA process might be catalytic to mobilizing resources for a theme that it is not often financially prioritized.

The main challenges identified for the DRM system in Cabo Verde refer to the following:

- Establishment of a National Risk Information System (NRIS) and strengthening of the EWS aligned with international best practices and covering all essential components: (i) risk knowledge, (ii) monitoring and warning systems, (iii) risk information, and (iv) readiness of response capability
- Strengthening preparedness capacity for effective response and recovery
- Promoting a culture of safety and adoption of resilience-enhancing interventions
- Mainstreaming DRR into sectorial policies and plans to ensure that development is risk informed

See box 2.2 for more on improving DRR.

Box 2.2: Proposed Areas of Disaster Risk Reduction Interventions

DRR AND MANAGEMENT

Improve risk understanding

- Develop hazard-specific or multihazard risk assessment and mapping at subnational levels
- Prepare vulnerability assessments (people centered and sector specific)

Strengthen monitoring and warning systems

- Strengthen early warning system for monitoring volcanic and seismic activity at subnational levels (Fogo and Brava) and include equipment and technical capacity
- Strengthen early warning system for floods and drought at national and subnational levels and include technical capacity and equipment;
- Develop standard operational procedures for hazard-specific EWS

DISASTER PREPAREDNESS AND RESPONSE

Improve planning

- Revise and update the national contingency plan at national level
- Revise volcanic-hazard contingency plan for Fogo and Brava
- Revise the emergency municipal plan of Mosteiros and preparation of one for Santa Caterina
- Develop a community-based contingency plan for Chã das Caldeiras
- Develop a community recovery revolving fund/insurance at Chã das Caldeiras

Improve the response capabilities

- Enhance the civil protection's emergency response capacity at national and Fogo levels: equipment, training, prepositioning of stocks, and so forth
- Establish a three-tier system training for improvement of response capability for a national or subregional emergency

Reinforce awareness raising and education

- Develop target campaigns on awareness raising and education through advocacy campaign on DRR at national and local (Fogo) government levels:
 - » Awareness-raising campaign for general population and private sector in Fogo
 - » Schools campaigns on risk awareness and disaster preparedness in Santa Catarina and Mosteiros
 - » Disaster-specific emergency protocols for risk communication supported by training and equipment at national and subnational levels

Mainstream disaster risk reduction and strengthen recovery capacities

- Capacity building for line ministries to mainstream DRR into sectorial development policies and plans (including technical advice and assistance, human resources, equipment)
- Revision of sectorial development policies and plans to integrate DRR
- Preparation of a national DRR strategy
- Reinforce government's capacities in preparedness for recovery planning at national and local levels
- a Detalhes disponíveis na secção sobre prontidão e resposta.

Establishment of a National Risk Information System and Strengthening of the Early Warning System

The establishment of an NRIS based on a comprehensive system for DRR identification, assessment, and monitoring that would in turn serve as a tool for risk reduction, response, and recovery decisions is recognized as a priority. The establishment of an NRIS to identify, assess, monitor, and map disaster risks is an essential first step toward the implementation of evidence-based and sustainable development and planning processes that are focused on reducing disaster risks. Hazard and vulnerability assessments and mapping are

also key to preparedness for response and for disaster recovery. Over the past few years, the relevance of disaster risk assessments has become increasingly evident to the government of Cabo Verde as a key component of the development policy agenda of some sectors, especially in the case of land-use planning. Progress has been made through the implementation of a first national risk mapping initiative. However, the capacities to integrate and to effectively use risk information and to inform development strategies and plans still need to be strengthened. The development of risk information systems, using country-specific decision-making tools to facilitate risk-informed development processes, is still very much needed.

While the LEC or Uni-CV and the INGM have played and play an important role in development of the hazard-monitoring component of the EWS, there is still need for strengthening real-time capabilities for data analysis and for the integration of the different information providing insights on eruption predictions. Additionally, the monitoring services' data analysis needs to be reinforced with improved risk information in terms of hazard characterization—magnitude, duration, frequency, probability, extent, and intensity field (spatial distribution of intensity degree)—and spatial scenario, combined with the assessment of the vulnerability of the different elements at risk (populations and assets). The institutional coordination and communication between the two research and scientific institutions has also to be improved. There is still a need for clarification on the way information integration mechanisms should work and on political orientations for the future reinforcement and upgrade of the system.

In addition to highlighting the need for upgrading and strengthening equipment and capacities of the monitoring network, the Fogo eruption has also clearly highlighted that this system is not yet a fully developed EWS, as components such as crafting of the warning messages, communication of such messages to the decision makers and the community, as well as early action have not functioned. Clearly defined roles and responsibilities and standard operations mechanisms for information sharing and decision-making processes need to be strengthened.

It is deemed essential to establish clear risk-information channels and communication procedures to ensure that all levels of government receive the information they need when they need it and that there is a coherent, clear way to release warning and other information to local concerned populations and the general public. Media and local communities need to be trained as well on how to expect information to be released and how to properly react to the different warning levels and act accordingly. Training and awareness of media, clear information, and unique official communication channels to press will contribute to limiting sensationalism in local media and fear in local institutions that might provoke panic reactions. This will also ensure that the local communities' risk perception is shaped accordingly to the real risk levels.

The early warning system proposed here is based on four interacting components: (i) risk knowledge (knowledge of relevant hazards and societal vulnerabilities); (ii) monitoring and warning service (a technical capacity to monitor hazard precursors, to forecast the hazard evolution, and to issue warnings); (iii) dissemination and communication (the dissemination of understandable warnings, and prior preparedness information, to those at risk); and (iv) readiness of the response capability (knowledge and plans and capacities for timely and appropriate action by authorities and those at risk) (ISDR-PPEW 2005a). This set of elements interacts with each component. The second element, the monitoring and warning service, is the most well recognized part of the EWS, but experience has shown that technically high-quality predictions by themselves are insufficient to achieve the desired reduction in losses and impacts. The human factor in early warning systems is very significant (Twigg 2002). Failures in EWSs warning systems typically occur in the communication and preparedness elements, in the crafting of the warning messages and communication of such messages to the decision-makers and the community at risk.

Strengthening of Disaster Preparedness and Response

The existing national contingency plan and the municipal emergency plans need to be revised and updated on the basis of an accurate risk assessment and, as importantly, they should be operationalized through the availability of adequate human, material, and financial resources. Hazard-specific contingency plans, such as the volcanic hazard emergency plan for Fogo, would benefit from an in-depth review and update. Additionally, incorporating hazard-specific risk cartography and developing hazard modelling and scenario visualization capacities would contribute greatly to plan operationalization.

In terms of response, the capacity of the SNPCB as the mandated agency for preparedness and response should be reinforced both technically and operationally through reinforcement of technical capacity, the provision of equipment, and emergency stockpiling.

The testing of the emergency plans should be regularly conducted at municipal and community levels to ensure effectiveness and coordination among the various actors involved, including the communities themselves. Additionally, scenario-based drill exercises should be conducted at different levels, engaging line ministries to identify gaps and to continuously improve and refine procedures and mechanisms proposed on the different hazard-specific emergency scenarios. Those exercises and dedicated technical discussions should be the forums in which to raise awareness, identify gaps, and develop capacities of sector ministries. Capacity assessments will serve as a basis for the creation of technical capacities call centers that could be mobilized and made available by each institution for technical advice, assistance, or operational task coordination in the case of a disaster.

Community-based DRM should also be reinforced through increasing each community's risk awareness and understanding and through preparation of a community contingency plan for Chã das Caldeiras, as well as other hazard-prone communities in the east flank of the island. Schools and youth centers could serve as entry point for the community contingency plan preparation and testing. For this purposes, previous pilot experiences implemented with UNICEF support in other islands should be reviewed to draw lessons learned and to identify which strategy suits better the local context.

Community radios and local associations should be involved in the preparation of awareness raising materials and best practices. Experiences in using school theater and animation in WASH, food security, environmental education, or health programs should be capitalized.

Additionally, the creation of an emergency needs fund such as a revolving fund could be explored as a community-based mechanism for recovery financing and risk-insurance.

Capacity Development

Continuity management in a disaster situation needs to be ensured and has an important role. It is defined as “management required and planning for the continued availability of services to government and the public including all functions and resources associated with the provision of these services.” The aim is to reduce damage to business, utilities, ministers, elected officials, staff, clients, property, equipment, reputation, goodwill, and credibility.

Civil protection services at all levels have been promoting and using volunteers and army forces in their response mechanisms. However, those volunteer and army officials should be trained in advance (preparedness) to work in disaster-related emergencies. Planning for an emergency is an essential component of preparedness, allowing one to envisage possible disaster scenarios and the possible required community and technical expertise mobilization and intervention.

During the Fogo emergency, several experts from different ministries were called to participate in the task-force created under the Crisis Cabinet. This “requisition system of equipment, services and technical staff” is covered under the Civil Protection law but would benefit, on the expertise level from a continuous training approach to enhance effectiveness of the participation of multidisciplinary experts.

Promotion of a Culture of Safety and Understanding of Risk

Promotion of a culture of safety entails the use of practices that support disaster mitigation and preparedness through the use of education, knowledge, and innovation. Raising awareness and understanding of DRR among the population at large, the government, and other relevant actors as the private sector nurtures changes in behavior that will contribute to building a culture of safety and resilience.

The awareness programs to be developed with schools and community associations should not only focus on knowing what is right to do when a disaster strikes but also on understanding the hazards and the potential to risk to which the community is exposed (volcanic but also forest fires, landslides, flash floods, and droughts) and their underlying causes and the ways a community can reduce their vulnerability.

The existence of public awareness, political will, and sufficient capacity are key to making DRR an underlying principle in all relevant development sectors. Reducing disaster risk is not only necessary to safeguard people's futures but is also a sound long-term investment to protect and expand on hard-earned development gains. Therefore, it is crucial to build a global and national culture of safety and resilience.

Mainstreaming DRR into Development and Strengthening Recovery Capacities

Governments and individuals tend to discount low-probability future losses and are reluctant to invest in DRR. Lack of financial resources is often a constraint for risk-reduction investments, particularly in countries where there are several competing development challenges.

Even when there is a relatively good awareness of what the potential risks are, structured mechanisms to appraise potential losses are often missing, and the government institutions, as well as the private sector, lack the capacities and the appropriate tools to analyze the cost-benefit of risk mitigation investments.

The existence of public awareness, political will and sufficient capacity are key to making disaster risk reduction (DRR) an underlying principle in all relevant development sectors. Notwithstanding recent progress, the institutional awareness on the cost-benefit of risk-informed policies, development planning and implementation is yet to be strengthened at all levels of government in Cabo Verde. The lack of an appropriate DRM institutional, legal and financial framework remains both the evidence and the challenge to the mainstreaming of disaster risk reduction in Cabo Verde.

The work that is currently ongoing in the area of risk and vulnerability assessment could well function as the basis for starting the revision of sectorial development policies and plans (national and subnational) to integrate risk reduction concerns and the preparation of a national DRR strategy. While the risk assessment component has mobilized many stakeholders' interest, there is still a need to reinforce capacities and develop mechanisms for the information to be adequately packaged to serve planning purposes. Most sector-led institutions now recognize the relevance of risk information, but they lack appropriate mechanisms on how to translate it to their sector diagnosis and projection needs and to practically use it when developing their policies and planning their interventions.

Reinforcing government's capacities in preparedness for recovery planning at national and local levels should also be prioritized as a long-term activity, building on the experience of the Cabinet of Reconstruction for Fogo as a temporary task-structure mandated for recovery. Considering that the cabinet will be in place for the duration of the recovery period, it remains essential to reinforce its recovery management capacities and see how the country can institutionalize such capacity.

Preparatory measures remain a critical gap in Cabo Verde, as in many countries. These are necessary to ensure that recovery is adequately planned and effectively and sustainably implemented in order to enhance the country's resilience. Disaster recovery is extremely important to restore peoples' lives and livelihoods as well as the functionality of institutions and social networks to bring people back to sustainable development. More important, disaster recovery offers the opportunity to build back better—not only to restore living conditions as prior to the disaster but to improve them by addressing those underlying risks and vulnerabilities that cause a natural hazard to transform into a disaster.

Key proposed steps are as follows: (i) undertake technically focused workshops for decision makers on mainstreaming DRR into their ministries and sectors; (ii) identify at least two focal points at sector level that will be the liaison with the DRM authority, in this case the National Civil Protection Service or other designated authority; and (iii) revise the structure and strategy of the national DRR platform to promote its reactivation. The national platform should align its strategy to the new Sendai Framework for Action in DRR, approved in March 2015 after the Third UN World Conference in Disaster Risk Reduction. The platform is expected to foster dialogue on DRR among stakeholders and should contribute to the exchange of DRR information on best practices among regional and global platform member organizations.

Table 2.29: Disaster Risk Reduction - Recovery Needs and Costs

	Short term (up to 6 months)			Medium term (6 to 12 months)			Longo prazo (12 to 24 months)		
	Needs	Cost (CVEsc)	Cost (US\$)	Needs	Cost (CVEsc)	Cost (US\$)	Necessidades	Cost (CVEsc)	Cost (US\$)
National risk information system and strengthening of the early warning system	Reinstallation of monitoring equipment	560,000	5,662						
	Harmonization of action between University of Cabo Verde and the INMG	145,000	1,466	Strengthening local research capabilities for volcanic and seismic activity analysis (University of Cabo Verde).	14,454,000	146,148	Purchase of new equipment and/or upgraded for improved volcanic and seismic monitoring (University of Cabo Verde)	77,209,560	780,683
	Purchase of new equipment and/or upgraded for improved volcanic and seismic monitoring (INMG)	6,847,600	69,238	Revision and Preparation of information protocols and standard operating procedures for EWS	5,402,500	54,626	Testing (simulation-exercises) for EWS and early action at national, sub-national and community level.	3,206,000	32,417
	Detail multi-hazard assessment and mapping at municipal scale and conduct a vulnerability assessments - including for the municipality of Santa Caterina, Mosteiros and Sao	9,610,875	97,178	Training for EWS and early action at national, sub-national and community level	2,800,000	28,311			
	Detail multi-hazard assessment and mapping at municipal scale and conduct a vulnerability assessments - including for the municipality of Santa Caterina, Mosteiros and Sao Filipe in Fogo.	1,317,200	13,319						
	-			Preparation of contingency plan for Fogo and Brava	1,560,000	15,774	Establishment of DRR focal points at Ministry Level & DRR training for ministry focal points. pontos focais.	6,578,400	66,516
	Operation and technical capabilities' reinforcement of the Civil Protection System –Fogo island level:			Operation and technical capabilities' reinforcement of the Civil Protection System, central level:					
	Technical training	115,537,420	1,168,225	- Training at national level;	60,138,100	608,070			
	- Equipment			- Training for Search and Rescue;					
				Equipment					
Strengthening disaster preparedness	Revision of the emergency municipal plan of Mosteiro and preparation of a plan for Santa Catarina	3,120,000	31,547	Update of national contingency plan	7,583,000	76,673	Development of a community recovery revolving fund/insurance at Chã das Caldeiras	7,182,000	72,619
			Develop a community based contingency plan for Chã das Caldeiras.	2,130,000	21,537				
Awareness raising and education			Awareness-raising campaign for general population and private sector (including production of printed and audio visual material and conduct of campaign in Fogo)	5,200,000	52,578	Mainstreaming DRR, risk awareness, and preparedness in school curriculum	3,120,000		
			Advocacy campaign on DRR and Recovery at national and local government	3,600,000	36,400				
			School campaign on risk awareness and disaster preparedness in Santa Catarina and Mosteiros	4,784,000	48,372				
Mainstreaming disaster risk reduction and strengthening recovery capacity			Reinforce government's capacities (Cabinet of Reconstruction) in preparedness for recovery planning at national and local level.	2,357,000	23,832	Capacity-building for line ministries to mainstream DRR into sectorial development policies and plans	10,550,000	106,673	
						Revisão de políticas e planos de desenvolvimento para integração da RRD; e elaboração de uma estratégia nacional de RRD;	65,345,440	660,722	
Total costs by time frame		137,138,095	1,386,634		110,008,600	1,112,322		173,191,400	1,751,1773,993,728
TOTAL	420,338,095 CVE or US\$4,250,132								

GOVERNANCE

While potential sector-specific disruptions to the provision of goods and services are addressed in each sub-sector section of this report, the governance section looks mainly at core government functions, identifying potential disruptions to the exercise of power and related decision making. Specifically, four basic government functions are looked at: (i) management of the recovery framework, (ii) aid management (iii) local governance, and (iv) rule of law. Because of its localized nature, the Fogo eruption had consequences for the governance processes exclusively in the affected area of Chã das Caldeiras and partial repercussions in the municipalities where the affected people were relocated.

Predisaster Situation

Administratively, settlements in Chã das Caldeiras belong to the municipality of Santa Catarina de Fogo, one of the most recently established municipalities. Fogo Island is divided in three municipalities: São Filipe, Santa Catarina de Fogo, and Mosteiros. The caldera is located in the intersection of those three municipalities, but the community of Chã das Caldeiras, the most affected by the eruption, depends administratively from the municipality of Santa Catarina.

According to the financial sustainability index calculated by a recent study on municipal finances, Santa Catarina de Fogo own-generated income covers only 21 percent of the operating expenses of the municipality. In 2013, out of the total income of the municipality, 70 percent came from central government transfers; 18 percent is generated by local income sources (municipal taxes, mainly the tax over building assets and vehicles circulation tax, and municipal fees); and the remaining 10 percent from other sources (public land alienation).

Between the central city where the municipality headquarters and central offices are located (Cova Figueira) and Chã das Caldeiras, there are approximately 19 kilometers. Physical isolation has resulted in determined a quite weak administrative presence of local power in the settlement area of the caldera. Previous to the eruption, besides the local school and basic health unit, one could find mainly one administrative building that hosted the municipality delegation and the police station. The administrative services provided by the municipal delegation were mainly for basic land-use registration and certification acts, local services fees and tax collection (namely from commerce licensing, water use, solid waste management, and so forth), payment of social pensions, and the sale of official forms and timber paper.

The 1992 constitution recognizes administrative decentralization and local power autonomy as two main democratic pillars of Cabo Verde. Despite the constitution and the decentralization regulatory framework enabling the establishment of other territorial administrative levels such as regions or intermunicipalities, the local (municipal) and central layers are currently the two main administrative levels.

Currently, the country has 22 municipalities, whose responsibilities, resource bases, and organization are regulated by the Basic Law no. 69/VII of August 16, 2010, on decentralization, the Municipalities Statute, and associated regulatory framework. While the law enables transfer of responsibilities in many different sectors (land-use planning, water and sanitation, rural development, employment, basic education, social work, culture, sports and leisure, environment, public health, civil protection, energy, transportation, social housing, and commerce and economic promotion), not all the responsibilities have been effectively transferred and/or assumed by all the municipalities. As a common denominator, urban planning, water provision, solid waste management, commerce activity licensing, social equipment construction and management (municipal markets, basic sport facilities), school transportation, social scholarships for students (secondary or tertiary education), municipal ways and road construction and/or management, social action and work, culture, and social housing support (mainly retrofits or emergency upgrades for most vulnerable groups) are identified as the responsibilities that most of the municipalities have assumed, either with their municipal budgets, in partnership with national institutions (including public foundations), or through partnership with international cooperation (town twinning or NGO support).

Additionally, many central government institutions (ministries, institutes, and agencies) have structures that provide services or lead implementation of national policies and programs at either regional, island-wide, or municipal levels.

Despite subsidiarity being the guiding principle of the decentralization process in Cabo Verde, effective fiscal decentralization and legal attribution of responsibilities for service provision have not progressed. This has resulted in a large dependency rate of local municipalities on central government fiscal transfers. According to a recent study on municipal income, on average, central government's transfers represent 45 percent of municipal income.

According to the Basic Law on Civil Protection, the municipalities in Cabo Verde have responsibilities for coordinating and executing civil protection policy at the local level. In this sense, the president of the municipal chamber is the responsible for municipal coordination of civil protection and should be supported by a municipal service of civil protection, a municipal council on civil protection, and a municipal center of emergency operations. However, considering the recent creation (1995) of the Santa Catarina de Fogo municipality and its limited resources to assume its responsibilities as civil protection agent, the municipality has not yet developed a municipal emergency plan, a civil protection municipal service, or a municipal center of emergency operations.

Reestablishment of normal livelihood conditions after a disaster is considered by law as one of the main objectives of civil protection in Cabo Verde. However, neither the law nor the national contingency plan clearly identifies the institutional framework for recovery management. According to the national contingency plan, the emergency and recovery aid management is the responsibility of the technical group for financial resources and external support, coordinated by the Ministry of External Relations (MIREX), and after an emergency, despite the Ministry of Employment and Solidarity being indicated as the agent responsible for early recovery, the government should indicate the cabinet and specific groups that will develop and implement the recovery and rehabilitation plans.

In terms of contingency financing, the government passed Law Decree no.68 of December 28, 2009, which created a national contingency fund to financially support local administration in the case of a disaster. The regulation of this fund, whose use could be requested only in the case of a "calamity state" declaration, determines that the government will establish the financial support amounts on the basis of a damage assessment. The implementation of programs supported by this fund was expected to be framed under a program-concession contract with municipalities and supervised by the General Directorate of Local Administration and Decentralization. Despite the fact this fund was legally established in 2009 and was supposed to be sourced from dedicated state budget lines, the fund was not capitalized, nor was it operationalized in the case of Fogo volcanic eruption. An ad hoc mechanism, the Fogo Reconstruction Fund, was set up, and the execution of the program was directly charged to state institutions.

Considering that aid management responsibilities are located at a central level (MIREX and Ministry of Finance and Planning), the analysis of aid effectiveness should be conducted at that level. Cabo Verde, according to the Mo Ibrahim African Index on Governance, Cabo Verde, ranked second in 2014 out of 52 African countries assessed, with a total score of 76.6 out of 100 (Mo Ibrahim Foundation 2014) It ranks relatively well in terms of aid management effectiveness and public finance management good governance indicators. (See table 2.29.)

Table 2.30: Cabo Verde Governance Performance Ranking

RANK 2013	CATEGORY & SUB- CATEGORY	SCORE/100					
		2000	---	2009	2010	2011	2012
2	Overall Governance	69.8	---	75.2	76.4	76.6	76.4
6	Safety & Rule of Law	79.1	---	72.4	79.0	79.5	80.4
6	Rule of Law	79.1	---	72.4	79.0	79.5	80.4
3	Accountability	71.8	---	71.9	71.9	72	71.5
5	Personal Safety	80.6	---	63.9	68.1	59.5	62.6
1	National Security	100.0	---	100.0	100.0	100.0	100.0
1	Participation & Human Rights	72.9	---	79.3	79.4	82.3	83.5
1	Participation	75.5	---	82.7	82.7	96.1	96.1
1	Rights	76.9	---	83.9	84.0	79.0	84
8	Gender	66.2	---	71.2	71.4	70.8	70.2
8	Sustainable Economic Opportunity	52.7	---	61.0	61.3	61.5	63.1
7	Public Management	50.6	---	58.9	58.0	56.1	59.7
9	Business Environment	59.6	---	59.7	59.7	62.1	63.0
10	Infrastructure	39.1	---	42.7	44.8	47.1	49.6
1	Rural Sector	61.4	---	82.8	82.8	80.8	80.3
3	Human Development	70.8	---	83.7	85.1	84.6	81.6
6	Welfare	83.6	---	87.0	88.4	86.6	76.1
3	Education	62.8	---	73.0	75.7	76.5	77.5
5	Health	66.1	---	91.0	91.2	90.8	91.3

Source: Mo Ibrahim Foundation 2014.

Eruption Effects

The total disaster effect for the governance sector is estimated to be CVEsc 8,972,000 (~US\$90,718). In terms of physical damage to public assets sustaining core government functions, the complete destruction of the administrative building that hosted the police station and municipality delegation must be highlighted. The value of the damage to this public administration building has been estimated to amount at CVEsc 6,500,000 (~US\$65,723).

In terms of losses, the change of economic flows that have been considered refer to the loss of tax and fee revenues collected from that municipal delegation as well as the losses due to additional operational costs (transportation and mobilization of additional staff) that the municipalities incurred to ensure the delivery of some basic services (mainly payment of social pension) to the relocated communities into their temporary resettlement sites. Those losses, estimated for a one-year period, total CVEsc 2,472,000 (~US\$24,995).

The additional costs incurred by the local or central government administration to deliver government functions and services and ensure access to basic services (housing, water, sanitation, food relief, and so forth) have been already considered under the specific subsector assessments and are not be addressed here again.

In regard to the four core functions previously identified, the analysis of the disaster event rests on the identification of some immediate and secondary effects that due to their intangibility or the lack of accurate data have not been economically estimated.

National Recovery Management

Despite the mainly localized impact of the disaster, the state of calamity was declared and the national contingency plan activated in consideration of the limited capacities (qualified staff and financial resources) of the municipalities to coordinate the emergency operations and to cope with the disaster effects. The calamity declaration was decided by the Council of Ministry and passed on November 26, 2014, for a period of one year. As noted in the baseline assessment, in the absence of a preestablished national recovery management body and considering the need for external support and coordination between subsectors and between national and local institutions for recovery planning, an ad hoc structure was created (the Reconstruction Cabinet) as a structure responsible for planning, execution, and monitoring of the recovery initiatives. It serves directly under the supervision of the prime minister.

The Reconstruction Cabinet is defined as a “mission or task-structure,” but it has been given fiscal, patrimonial, and administrative autonomy. It is composed of a Directive Council, a technical secretariat, and an advisory council. The Directive Council comprises a chairman and two members. Currently, the General Directorate of Infrastructure (under the Ministry of Infrastructure and Maritime Economy) serves as president of this council. The technical secretariat is composed of the General Directorate of Infrastructure, the General Directorate of Agriculture and Rural Development, the National Land Management Institute, the LEC, SNPCB, and a member from each municipality’s technical cabinet on land-use and public works. The advisory council comprises other sector representatives (education, health, housing, research, and civil society representatives). The Reconstruction Cabinet has been tasked to coordinate the recovery process, including the postdisaster needs assessment, the planning of the reconstruction of infrastructures and of the new settlement, and the promotion socioeconomic recovery. The cabinet operates in collaboration with all relevant line ministries and other national and international stakeholders in the implementation of the recovery strategy, guided by build back better principles.

The slowness of the decision-making process that led to the creation of this cabinet have resulted in some dysfunctionalities in terms of operational control of community self-reconstruction initiatives. There has not been yet formal guidance in terms of access control to affected sites. In regard to visitors and hiking activities, only on May 27, 2015, did the government (through the SNPCB) formally provide guidance on access restrictions. After a massive rock fall occurred around an active fault and landslide risk was subsequently considered high, the government decided to formally interdict access to areas higher than 500 meters from the Pico de Fogo base.

No clear indication has been given on how to proceed with houses that remained unaffected or only partially destroyed in Chã das Caldeiras. Additionally, no formal restrictions were approved outlining under what conditions and for what activities the population would have access to the affected areas. This has resulted in the reoccupation of houses that were not destroyed and rehabilitation of partially destroyed ones, self-reconstruction of the transportation axis (roads and paths) by the communities, reactivation of touristic activities and facilities, and in more general terms some loss of confidence of people on their government structures.

Other challenges involve the capacity to ensure strategic communication with the public; timely disbursement of funds for relief and recovery; capacity to assess needs, including disaggregated needs according to gender and age; capacity to collect, store, and manage information; capacity to produce evidence-based strategies, policies, and plans; and capacity to adapt administrative and business processes for greater rapidity without conditioning transparency, sound management, and accountability.

In terms of need assessment, the capacity gaps are even more accentuated at the local level. However, we could also identify issues regarding central level institutions. While emergency-relief-related needs were quickly identified by the local and central level institutions, recovery-needs identification has taken longer and required external support, especially for actions beyond the short term and for the physical reconstruction of destroyed assets.

Aid Management

Despite the existence of a formally established national contingency fund, in the case of the Fogo eruption, several ad hoc mechanisms were devised in order to manage the influx of aid flows, whether in-kind or in-cash.

The management of those aid flows required additional staff for coordination, inventory, management, and delivery; equipment and space for transportation and storage; software solutions for inventory and delivery tracking; and training for responsible units of aid delivery. In situ, for the most part the SNPCB, in collaboration with the municipalities, was charged with the donations' reception and distribution, while the Red Cross, which managed some of the temporary shelter centers, greatly contributed for some specific aid management and delivery coordination.

The SNPCB established special warehouses for storage of in-kind items in the main municipalities of the islands as well as in the temporary resettlement sites of Monte Furna e Achada Grande, and it ensured the transport, with collaboration of the municipalities, of the food and basic life items collected (clothing and hygiene items). Additionally, the SNPCB with support of Red Cross, conducted a census of temporarily relocated populations to make sure that distribution of aid items was directed to the affected population. Some public unrest was originally created when some aid management deficits were detected and some nonaffected populations receiving aid support were denounced and highlighted by community organizations and media. Confronted with this situation, the SNPCB repeated the initial census operation, conducted this time with improved methodologies and with the support of community leaders from the evacuated populations.

The costs of all those emergency aid-management-related operations (inventory, census, storage, and transportation of equipment) are accounted under the DRM effects subsection and will not be reported here to avoid double counting.

In terms of housing support to place displaced population in temporary rental houses, the municipalities have been acting as intermediaries to identify rental facilities, establish leases with landlords, and pay monthly rents with the resources transferred by the central government.

In terms of the aid received to support reconstruction and recovery, a special ad hoc mechanism has been set up as a special treasury account with specific budgetary and programmatic controls. This ad hoc mechanism was officially established on April 21, 2015, under the form of a Reconstruction Fund (Decree No. 23/2015). The fund is defined as a special account at the public treasury and is set up to manage in a transparent and controlled manner all the financial resources allocated to and mobilized for the recovery, and it will act as under the oversight of the General Directorate of Treasury, which ensures fund management accountability.

The fund is to be fed by four types of resources: tax revenue collected from the 0.5 percent increase in the value-added tax (VAT) decided after the eruption to support reconstruction in Fogo since 31st December 2014; other earmarked allocation from the State Budget; grants and other financial support conceded by public and private institutions or individuals as relief-support aid for the populations and municipalities affected by the eruption; any other subsidies, extraordinary allocations or funds consigned to recovery needs.

The fund is operated through the public finance management systems and is answerable to accounting regulations applied for state budget and programs, all of which are managed with SIGOF tools (a rigorous computerized integrated public financial management system, which enables tracking revenues and expenditures in real time). The fund is also subject to the Court of Auditors (Tribunal de contas), established in 1993 and considered an essential partner in the effort to increase accountability in the use of public resources. This fund not only holds and disburses external aid and donor contributions but also receives the tax revenues from the 0.5 percent VAT increase and other state budget contributions to be approved.

Additionally, in terms of programmatic and strategic control, the Reconstruction Cabinet should approve and validate the programmatic proposals for funds utilization. The National Directorate of Budget is the responsible unit for financial control, monitoring, and reporting to state institutions and donors on the aid utilization. Most donors, even private, have directed aid within the government channels and plans, which reflect a good level of confidence of international development partners in public aid management and in general public finance management mechanisms. The challenge the Reconstruction Cabinet has now is to ensure that international donor and public confidence is maintained and good recovery results (reconstruction, improved livelihoods) per dollar of aid invested are achieved.

The pressure for rapid delivery (requiring short-cuts in administrative procedures for expending public funds) represents a challenge for the country's accountability framework. Another challenge concerns the national and local ownership over this recovery process and how the local populations will be involved in the process.

Local Governance

The limitations in local governance capacities to assess recovery needs do not directly result from direct damage to government infrastructure but were determined by the initial gaps identified in the baseline situation: namely, financial sustainability and technical resources. However, it should be acknowledged that local municipal staff and decision makers were also overwhelmed by the support requests from the population as well as from the different partners and institutions.

Additionally, the lack of dedicated budget lines or funds in the municipal budget to support emergency and recovery operations put an additional stress on local finances when municipalities came to provide initial relief support (food items for temporary shelter populations, transportation support for evacuation efforts, and so forth) and to provide water to families relocated in the resettlements zones in Achada Furna and Monte Grande.

In the case of Santa Catarina municipality, capacity to collect local revenues have been affected, and in the case that the definitive resettlement site will fall administratively under another municipality, it will result in a decreased tax base.

The limitation identified earlier in terms of capacities to assess needs could result in poor alignment of sector interventions to local needs, potential duplications, or slow mobilization of communities.

The Reconstruction Cabinet technical secretariat includes as members a representative of each municipality of the island's technical cabinet of public works, infrastructure, and land-use planning. However, those technical cabinets are not formally organized and properly staffed with technical experts in the three municipalities. This could diminish their ability to effectively participate in the effectively address recovery needs, reduce risks and vulnerability, and incorporate the build back better approach.

Rule of law

The distance and partial isolation of the Chá das Caldeiras settlements from the central site of municipal government and the limited presence of local authorities have determined the difficulties experienced in the coordination of emergency and evacuation operations at the site level. The fear of property thefts partially determined the resistance of some inhabitants to abandoning the area and resulted in an evacuation process that was mainly self-paced and self-organized by the local communities. Some property thefts and vandalism acts were registered against private and public equipment during the eruption/emergency phase and afterward—including some photovoltaic panels or batteries feeding seismic monitoring stations, some equipment received as donations for emergency operations (generators), and other equipment installed at the Natural Park HQ facilities).

During the emergency phase, it was necessary to reinforce local police forces with national police and army forces to ensure evacuation and reentry control, support distribution of relief items, and guarantee the public order. Those forces supported the implementation of operational command directives on the ground, especially in regards to domestic assets evacuation, access-related deadlines, and orders.

Recovery Needs and Strategy

The main goal of the recovery of the core government functions is to enable an integrated and coherent overall recovery and reconstruction process that produces timely and effective improvements in the living conditions and risk profile of the communities. In this sense, the recovery vision for the governance cross-cutting sector should be guided by the country's public sector reform objectives (including decentralization agenda) and should aim to strengthen the national preparedness, ownership and leadership over the planning, implementation, and monitoring of the recovery process across all the areas of intervention.

The two main guiding principles for the recovery of the governance sectors should be inclusion and integrity. It is generally recognized that postdisaster recovery phases create opportunities for increased participation. However, those opportunities could not be capitalized in the absence of specific mechanisms and associated capacity building to design and implement them.

In terms of integrity and accountability, the expectations are very high in regard to standards of transparency

and accountability in the management of public funds made available for recovery. Those expectations, combined with the public and political pressure for rapid delivery, create a challenge and a test for the country's accountability systems.

In terms of participation and institutional coordination, the challenge does not refer merely to public participation but covers as well the need for central coordination of recovery efforts to be underpinned by and contribute to the strengthening of greater responsibility of local governance institutions for the implementation of recovery and reconstruction initiatives.

The need for capacity development, as part of a building back better approach, becomes the principal feature of the recovery strategy.

Short-term Needs

In the short term, the need assessment process identified the rebuilding and improving of administrative facilities and equipment to face surges in the functions and services by the communities. In this case, since the government strategic guidance has already indicated that the resettlement site of the population will be outside the caldera, the rebuilding and upgrading of the administrative facilities will need to be located on the resettlement site, and for this reason it could be considered among the medium-term needs (to allocate time for the resettlement site to be decided and the new settlements built) while in the short term one could focus on the upgrading or creating administrative facilities in the sites of Monte Grande and Achada Furna to facilitate access to administrative services and/or to cope with additional demands originated by the displacement of population toward those sites.

- To be initiated in the short term, but continued a long time, is the capacity strengthening of public staff at municipal and central levels to implement a recovery strategy. This would imply improved capacities for participatory needs assessments, multisector participatory planning and budgeting, gender mainstreaming and compliance, project management and evaluation, and public outreach and social marketing.

Medium-Term Needs

- The reconstruction and equipping of a municipal facility on the new settlement site, estimated at a cost of CVEsc 6,500,000 (or ~US\$60,667)
- Improvement of technical capacities of local municipalities for public financial management
- Improvement of technical capacities of local municipalities for risk-sensitive land-use planning, monitoring, and enforcement

Long-Term Needs

- Capacity development for preparedness for resilient recovery is considered a need at the central and local levels and will require the establishment of institutional and legal frameworks for sustainable recovery, the preparation of sector-specific and local recovery plans, and the revision of lessons learned from the experience of the Fogo Reconstruction Cabinet.
- The revision of the recovery financial mechanism needs to be addressed.
- In the long term, the development of municipal-level risk information systems could ensure that local development planning is risk sensitive and promotes the mitigation of risk and reinforcement of resilience through local sectorial initiatives.

Table 2.31: Governance Needs and Costs

	Short term (up to 6 months)			Medium term (6 to 12 months)			Long term (12 to 24 months)		
	Needs	Costs (CVEsc)	Costs (US\$)	Necessidades	Costs (CVEsc)	Costs (US\$)	Needs	Costs	Costs (US\$)
Rebuilding and improving of administrative	Upgrade of existing public administration facilities in Achada Grande and Monte Furna			Reconstruction and equipment of the delegation of the municipality and police station facilities on the new settlement area	6,500,000	65,723			
Strengthened local governance systems	Capacity building of municipalities and CSD in Fogo in participatory planning	5,190,000	52,477	Development of municipal risk-information systems	6,345,000	64,156			
				Capacity reinforcement of technical cabinets for risk-sensitive land-use planning	6,843,000	69,191			
Reinforcement of capacities for preparedness for sustainable recovery							Technical assistance and capacity development for sustainable recovery planning	5,330,000	53,893
Total costs by timeframe		5,190,000	52,477		19,688,000	199,070		5,330,000	53,893

TOTAL

30,208,000 CVE or US\$305,440

GENDER

The constitution of Cabo Verde and its laws guarantee equal rights for men and women. However, social-cultural habits have led to gender inequalities across a number of areas, including in income and employment opportunities and access to essential services. Overall, there has been an increasing “feminization” of poverty: in urban areas, female-headed households (approximately 46 percent) tend to be poorer than male-headed households, with a widening of the poverty gap and less access to electricity and water than male-headed counterparts. Gender-based violence also remains a serious problem. Women are more affected by unemployment than men (27 percent compared to 17 percent of men). All these facts make them more vulnerable for potential disasters. They are particularly vulnerable to socially unvalued, low paid, and insecure work as they account for the greater part of the unqualified working population (57 percent of employed women are unqualified while 38 percent of men are in this situation). Less secure income sources and limited access to social protection and insurance schemas associated with the informal sector are other factors that increase vulnerability to disaster risk by limiting coping capacities and economic strategies for women’s livelihood recovery.

Although gender parity is inverting in agriculture, women continue to have access to smaller and less productive land, less access to irrigated land, and less access to modern production technology. The overall literacy rate (ages 15 years and older) is estimated at 82.8 percent and is approximately 15 percent lower among women than men.

While promising economic opportunities arise, it should be recognized that expanding sectors are male dominated, especially in the case of tourism. In some cases, existing social risks such as alcoholism, drug dealing and consumption, sexual abuse, and prostitution could be reinforced as a side-effect of some types of tourism development, or as a direct effect of sexual tourism. Those risks, especially related with prostitution, disproportionately affect women and girls.

It was challenging to address gender issues in Chã das Caldeiras, given the limited availability of disaggregated statistics by sector. Additionally, it proved difficult to directly approach community members owing to political and social tension related to water access in resettlement zones and discontentment in regard to the perceived slowness in the recovery process and the temporary housing and shelter arrangements.

In light of tensions related to the shelter options provided to the displaced, constructive public consultations with the communities regarding their living conditions or recovery needs did not take place.

The Forum for the Reconstruction of Fogo held March 2–3 2015 raised a number of psychosocial issues to be considered in the emergency resettlement and temporary housing situation, notably the high proportion of children among the displaced populations, the need to reinforce social protection mechanisms to avoid sexual violence, and the need to reinforce mechanisms to ensure gender rights during the emergency and recovery phase, especially concerning access to land or property titling measures, compensation schemes, and access to job opportunities and financial instruments.

Main Recommendations

- Focus on women’s vulnerabilities in the postdisaster context to ensure that these are addressed through the recovery process.
- Ensure that the recovery process includes principles of the National Gender Equality Strategy.
- Continue to explore gender differences routinely in disaster vulnerability assessments and any disaster information systems as well as sector statistics to ensure that gender disaggregated data is collected.
- Promote women’s empowerment, active involvement, and skills development in the recovery phase.
- Consider gender differences in disaster preparedness actions to ensure that women’s roles in preparedness and response is fully acknowledge and that gender-sensitive contingency plans are developed.

- Establish a counseling center in the new resettlement areas that can offer counselling for families, youth, and especially mothers on child development, family planning, sexual and reproductive health, and gender issues.

EMPLOYMENT, LIVELIHOODS, AND SOCIAL PROTECTION

Predisaster Situation

Out of about 1,000 habitants of Chã das Caldeiras, the active adult population is 465 people: 235 men and 230 women, 9 of whom are household heads (Employment Center of Fogo. 2014). This translates into a local activity rate of 45.6 percent, which is slightly lower than national average (54.8 percent) and lower than the whole municipality average for rural areas, which was 57 percent in 2014 (INE 2014).

According to the INE (2010) census of 2010, 74.1 percent of the households in Chã das Caldeiras are employed, while 10.1 percent depended on family support (5.7 percent remittance from diaspora abroad and 4.4 percent on family living in other parts of the country); 9.5 percent were dependent on social aid and social pensions; and 1.9 percent lived out of rents or benefits coming from self-owned business.

A socioeconomic assessment conducted in August 2014 in the Fogo Natural Park and buffer zones revealed that the 68.6 percent of the active population of Chã was occupied in the primary sector, mostly in agriculture and husbandry-related activities (including agriculture processing and related agro-business). Additionally, as a full time or a complementary occupation, a relevant share (approximately 21 percent) of the population participated in tourism-related activities: hospitality management in hotels, pensions, and other lodging as well as work in restaurants, transportation, and guiding. Small commerce in culture-related activities such as music playing, leisure and animation, and handicraft production (mainly volcanic lava carving but also embroidery and laces) were common but often did not constitute the main economic activity.

Eruption Effects

Most of the effects related to employment and livelihoods have been incurred in the agriculture and tourism sectors, the two main areas of economic engagement of the population of Chã das Caldeiras.

The effects of the disaster on the population in terms of destruction of assets and loss of income are accurately captured in the individual sector sections. In the case of agriculture, the employment-related losses are included in the calculation of losses on the goods produced by this sector to avoid double counting; the cost of the workforce (which also covers the income of the single employee) is in fact already included in the calculation of the losses of the sector goods. In the case of the tourism sector, employment losses were captured separately from production losses considering tourism is a service-oriented sector. However, the loss of income for those engaged in this sector is captured in table 2.31.

Considering that most of the households in Chã das Caldeiras were informally engaged in cottage industry such as production of cheese, wine, jam, and artifacts as well as in receptive tourism (for more details refer to individual sector chapters), the destruction of the houses has also had a substantial effect on the livelihoods of the population, since these activities were undertaken at home and quite significantly contributed to the households' income.

With concern to the agriculture, tourism, and manufacturing or cottage industry sectors, it should be noted that most of the economic activities in the caldera were of both formal and informal nature. Due to the mingling of informal and formal activities as well as lack of official data at local level, it has been not feasible to separate the formal and informal income losses.

In addition, those engaged in the service industry were also affected in terms of destruction of assets and loss of income. The owners of small commerce (10 officially registered, mostly shops and bars) in Chã das Caldeiras lost their livelihood as did the masseuse at the park center, the assistant at the tourist information center, and an assistant to the municipality delegation in Chã who had been working on a need basis contractual arrangement. Due to lack of data and inability to conduct a survey, it was not possible to calculate the exact loss of income for the 10 business owners.

Finally, losses were incurred also by the employment center of São Filipe, which belongs to the Vocational Training and Employment Institute (IEFP) in the Ministry of Youth, Employment and Human Resources Development. In response to the eruption, the center has put in place a tuition-free training package for the affected population, including transportation and in some cases lodging for those who could not directly access the center. Given that the employment center covers all running expenditures and costs related to the courses (materials, teacher salaries, and so on) through the fees paid by the trainees (only staffing costs are covered by the ministry), the provision of the package constituted losses in terms of missed tuition fees and additional costs to provide transportation and lodging.

Table 2.32: Losses in Employment, Livelihoods, and Social Protection

	Total effects (CVEsc)	Total effects (US\$)	Value (CVEsc)	Losses	
				Value (US\$)	Ownership Public Private
Personal Income losses- not reported under other sectors (small commerce, DRR, and governance- related staff)	4,752,000	48,049	4,752,000	48,049	0% 100%
Cost for providing vocational training (tuition waiver plus transportation for affected populations)	1,904,000	19,252	1,904,000	19,252	100% 0%
TOTAL	6,656,000	67,300	6,656,000	67,300	

Table 2.33 presents the loss of income in all sectors assessed.

Sector	Work days lost	Income losses	Income losses (CVEsc)	Private (%)	Public (%)
Agriculture ^a		(US\$)	24,128,930	100	0
Tourism ^b		43,195 (12 months)	4,271,198	100	0
Comércio		43,680 (12 months)	4,319,952	100	0
Governança ^d		728 (12 months)	71,999	100	0
Ambiente ^d		3,640(12 months)	359,996	100	0
RRD		3,640 (12 months)	359,996	100	0
TOTAL		338,856	33,512,858		

a. This income loss has already been taken into account by the agricultural sector when calculating the losses in agriculture production and should not be double counted in the employment, livelihoods and social protection sector assessment.

b. Tourism income loss values are reflected here merely for comparison purposes, but the values have been included within the tourism sector effects assessment.

c. The commerce sector was not fully assessed in this PDNA considering its limited size and its complementary nature to the agriculture and tourism sectors. Bars and general convenience stores were mixed-business, complementary income-generating activities to agriculture and agroproducing activities.

d. The losses under governance and environment include personal income losses of the employee of the municipal delegation, the assistant at the information center, and the masseuse of the park employed on an ad hoc basis. These also include losses of the employment center.

Employment in Agriculture

The agricultural labor force in Chã das Caldeiras involves both the formal and informal sectors. Based on informal interviews it was possible to estimate that more than 100 people were usually engaging in seasonal agricultural labor (sawing, pruning, harvesting, and so on) before the eruption. Of this number, 30 percent were women and 70 percent men. Most of this labor was contracted throughout according to the cycle of the crops. Daily incomes for 8 to 10 hours of work were registered at around CVEsc 1,200 (~US\$12). The cooperative alone employed about 15 part-time workers during the year, mainly women. In addition, the cooperative was contracting fixed-term employees, one woman and five men, for the whole year. The ave-

rage salary for part-time workers per day was CVEsc 1,100 (-US\$11), whereas fixed-term employees were receiving CVEsc 20,000 per month (-US\$200). On the other hand, the informal labor sector consisted in the production of the homemade wine and cheese. Income varied according to the quantity produced and sold. One liter of wine was generally sold at CVEsc 500 CVE (-US\$5), whereas one kilogram of cheese was sold at CVEsc 400 (-US\$4). This information allowed estimating that the employment sector will lose US\$245,000 in the next year if the situation in the caldera does not return to preeruption conditions.

Tourism

At the time of writing this report in spring 2015, it is still unclear how large the effects of the disaster will be in the employment sectors. Much depends on how quickly key attractions and facilities reopen and how easily the industry recovers. As all the tourism facilities in Chã das Caldeiras were damaged and all workers lost their jobs in the area, a total of 32 people. However, some managed to find temporary jobs elsewhere. There were also 40 registered guides, but they did not lose employment as park or government employees. Even if jobs for tour guides are maintained, the financial impact of fewer visitors and limited tourism activities is significant. Additionally, the access ban issued by the government on the May 27, 2015 due to an increased risk of landslides and rock fall will probably have additional consequences in the tourism sector in the caldera. See table 2.33 for personal income loss in tourism-related employment.

Table 2.34: Losses in Personal Incomes in the Six Months after the Eruption

Jobs	Unemployment	Losses in personal income (US\$)
Accommodation (hotels including restaurants)	29	\$18,929
Independent restaurant	2	\$1,305
Tour guides	0	\$35,604
Tourist information office	1	\$890
TOTAL	32	\$56,728

Recovery Needs and Strategy

Enabling households to recover their income-generating activities as soon as possible while also increasing their livelihood resilience toward future shocks will be a key component of the recovery process. Most of the initiatives come under the agriculture and tourism sector and the specific recovery activities are described in the individual sector reports. Additionally, the reconstruction of infrastructure and houses can be proposed as an opportunity to create income through short-term employment. In the medium and long terms, efforts to reinforce the affected populations’ resilience to shocks will also need to be undertaken—through expansion of the employment opportunities and strengthening of social protection schemes.

In order to strengthen people’s capacities in the sectors they were traditionally employed in and provide opportunities to diversify skills, the employment center of São Filipe started in April 2015 to provide free access for the population of Chã das Caldeiras to the certified professional training courses. A package for providing training in five courses (agriculture, livestock rising, cooking, manufacturing, and tourism) has been development to train a total of 125 people. At the time of writing, 54 people had been trained. The center aims as well to reserve five seats for the habitants of Chã in each of the four other courses offered and that are not part of this specific package. The course also offers a business start-up kit to each trainees for costs of CVEsc 200,000\$00 (US\$2,022). Displaced people who were hosted in São Filipe city had direct access to the center, while the IEFP, with donors and own-contributions, facilitated transportation or lodging facilities for some of the Chã das Caldeiras displaced people living in other municipalities (Mosteiros, Achada Furna, and Monte Grande). Informal comments from community members highlighted the appreciation for such an opportunity, which is seen as the only positive aspect of the eruption.

Additionally, the national Agency of Entrepreneurial Development and Innovation (ADEI), which has an

antenna installed at the employment center in São Filipe, has supported through its business incubator, the development of to 25 business feasibility studies and business installation plans for the affected populations. However, financing mechanisms are still to be devised to support the implementation of those projects, which are mostly associated with commerce and tourism-related activities.

The significant differences that can be identified within this sector between effects estimates and recovery needs cost estimates are related to the need to promote diversification of livelihoods, limiting the dependence of agriculture and agroprocessing, and making the communities more resilient to future shocks—not only those related to natural disasters (especially those associated with climate change, such as droughts, plagues, and floods) but also to economic shocks related to the sector development. Additionally, some of the needs identified here will support the recovery strategy identified in sectors such as tourism or environment but also infrastructure by ensuring the active population has developed the required skills to undertake new challenges in these sectors and that financial mechanisms are created for entrepreneurial support.

Moreover, one element contributing to socioeconomic vulnerability relates to informality of the job market. The recovery strategy for this theme proposes a review of the adequacy of existing social protection mechanism for some sectors (especially for agriculture, for which revenues might be very fluctuant, seasonal or very limited for subsistence activities) in which it is hard for self-employed people to subscribe to existing social protection mechanisms. The analysis of gaps and adherence obstacles will allow a proposal for upgrades. At the same time, awareness raising will support efforts to enlarge participation.

The following are the proposed interventions for the recovery process.

Short Term

- Revive existing economic activities, that is, agriculture, receptive tourism, and shops and bars. The recovery needs and strategy specific to the agriculture and tourism sectors are analyzed within the respective report sections.
- Ensure local employment opportunities are created through the reconstruction process. For infrastructure and housing rehabilitation and reconstruction, enhance vocational training for civil construction–related activities of local communities (especially for housing) through in situ, targeted, and intensive efforts, not necessarily through formal vocational education channels, which may take longer and require full time or almost full time and longer term dedication or formal education certification as entry requirements.

Medium Term

- Diversify livelihoods through capacity building and professional training for affected communities and improve value chains.
- Support the design (feasibility assessments) and implementation of financial mechanisms to support new business installations, through agreements for target programs with already existing microfinance institutions or with guaranteed-system to be developed through commercial or national development banks, such as Caixa Economica and Novo Banco.
- Support creative economies (culture, music, performing arts, museums, handicrafts, food testing, new technologies, and so on) and “green jobs” (new posts associated with introduction of renewable energies and energy efficiency technology installation, maintenance, and management). Also support jobs in waste and water management and recycling; biodiversity conservation (guiding, natural outdoor sport activities trainers for speleology, trekking, escalade, and others); and natural resources or landscape interpretation through dedicated allocations to Fogo Island for existing mechanisms such as Banco da Cultura (culture bank) or the Green Jobs ADEI initiative.

Long Term

- Develop a comprehensive employment strategy, including access to microfinance for business development.

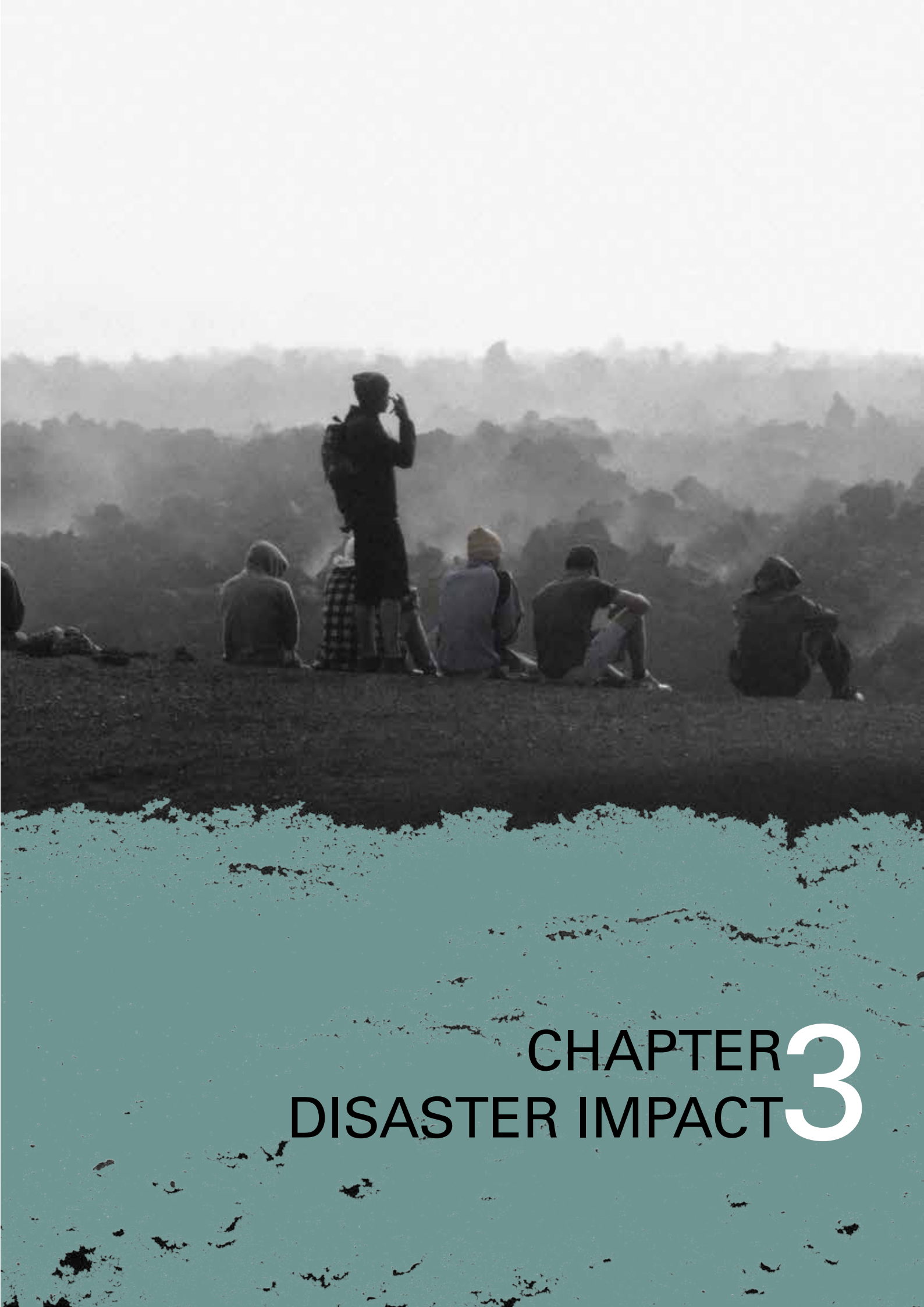
- Promote the review, upgrading, and better adaptation of social protection (adherence to national social security schemes) of employees within the covered sectors (public, tourism-related, commerce, and remunerated agrotransformation employees).
- Support awareness raising to increase social security enrolment of self-employed and employees within the above mentioned sectors.

Table 2.35: Recovery Needs and Costs for Employment, Livelihoods, and Social Protection

	Short term (up to 6 months)			Medium term (6 to 12 months)			Long term (12 to 24 months)		
	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)	Needs	Costs (CVEsc)	Costs (US\$)
Vocational training	Vocational training-intensive civil works and construction sector	5,775,000	58,392	Vocational training for livelihood diversification	9,000,000	91,001			
Employment support and financial mechanism	-			Feasibility assessment for design of financial mechanism (micro-finance support; concessional loans; loan guarantee, etc.	850,000	8,595	Development of a comprehensive employment strategy- Fogo island	1,000,000	10,111
	-			Support for set-up and implementation of financial mechanism (micro-finance fund & loan guarantee for financial schema with commercial banks)to support new business installation associated with Business incubator	69,350,000	701,213			
	-			Support for creative economies & green job strategies	20,000,000	202,224			
Social protection	-						Support review of social protection schemas for agriculture, tourism and culture (self-employed or employees)	3,500,000	35,389
	-						Support review of social protection schemas for agriculture, tourism and culture (self-employed or employees)	24,000,000	242,669
Total costs by time frame		5,775,000	58,392		99,200,000	1,003,033		28,500,000	288,170

TOTAL

CVESC 133,475,000 OR US\$ 1,349,596



CHAPTER 3
DISASTER IMPACT



WILTSCHAPE

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MACROECONOMIC IMPACT

Economic activity in Cabo Verde is vulnerable to shocks, both from the global economy and natural disasters. Before the global financial crisis, Cabo Verde’s economy was thriving, reaching growth numbers of 7 to 8 percent. Cabo Verde is a small open economy and with the global economic downturn, especially in Europe, considerable drops in capital inflows stifled growth on the islands. In 2014, the economy grew by 2.7 percent, an improvement from low growth numbers in 2012 and 2013 but still below potential. The volcanic eruption of November 2014 constituted yet another shock to Cabo Verde’s economy, destroying private and public assets and slowing production in the island of Fogo.

To estimate the effect of the Fogo eruption on economic activity and the fiscal accounts, a dynamic computable general equilibrium model (DCGEM) was calibrated. The DCGEM was developed for the Cabo Verdean economy and underlies the country’s Third Growth and Poverty Reduction Strategy Paper (GPRSP III). To estimate the effect of the Fogo eruption on macroeconomic variables, the model draws on data on capital destroyed and production forgone in the last two months of 2014, as calculated by the PDNA team in the field. The counterfactual scenario (i.e., assuming the volcano had not erupted) is modelled for the years 2014–18.

According to the DCGEM, the macroeconomic impact of the volcanic eruption was small. The damage caused by the volcano eruption translated to a loss of capital stock at the end of 2014 equivalent to 0.42 percent of the total capital stock, with the highest losses occurring in the primary sector. In terms of GDP, there is a small loss in 2014 to account for the 1.5 months of foregone output since the volcano eruption. The highest loss to GDP occurs in 2015 and is equivalent to 0.44 percent of the expected total GDP of that year (figure 3.1). The primary sector is the economic sector suffering the highest impact in relative terms. Expressed as percentage of the sectorial GDP, the loss in 2015 in the primary sector is equivalent to 1.17 percent higher than the 0.57 percent registered in the secondary sector and the 0.32 percent of the tertiary sector. The impact fades away over the simulation period, most rapidly in the primary sector.

However, for Fogo itself, the loss of production was considerable. For example, in the case of agriculture, the loss can roughly be estimated as equivalent to 16 percent of Fogo’s agricultural output.

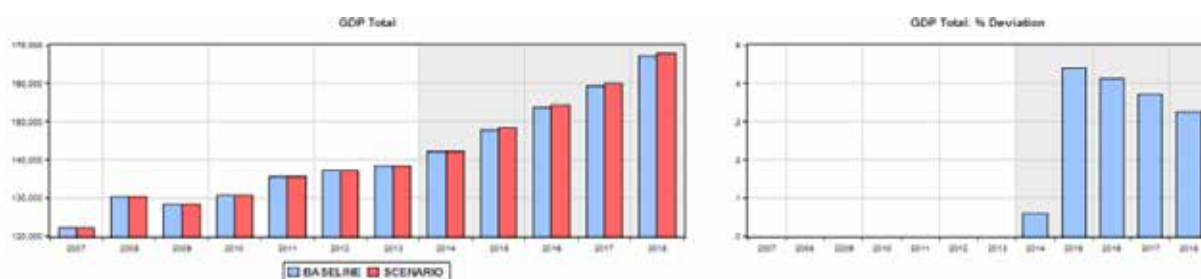


Figure 3.1: Counterfactual Analysis for GDP if There Had Been No Volcanic Eruption

Note: The baseline is the actual GDP (forecasts for 2015–2018), while the scenario assumes no volcanic eruption. The percentage deviation is equivalent to the annual production loss in each year as a percentage of the baseline scenario.

The impact on the country’s fiscal accounts is estimated to be relatively small, too. The associated tax loss associated with output loss is estimated to be equivalent to 0.24 percent of the tax receipts registered in the baseline. However the loss in tax receipts reduces through the simulation period, reaching 0.15 percent of the baseline in the later years of the period. Accordingly, the deficit increases slightly, assuming that no adjustments are made to expenditures. However, given Cabo Verde’s high public debt levels—114.2 percent of GDP in 2014—fiscal space is severely limited and even small increases in the fiscal deficit can pose financing challenges to the government.

The increase in the value added tax (VAT) rate by 0.5 percentage points will be sufficient to finance reconstruction efforts over the following eight years. Given limited fiscal space, the government increased the VAT rate by 0,5 percent VAT for the 2015 fiscal year (valid until December 31) to replenish a reconstruction fund. The model was thus recalibrated to incorporate this tax increase, modelling this tax increase and associated public expenditures to reconstruct destroyed assets. If the total proceeds of the additional tax revenue coming from the VAT rate increase are allocated to public investment (roughly CVEsc 250 million per year), it will require eight years to recover the capital stock damaged by the volcano eruption (8 x 250 million = 2,000 million escudos).

HUMAN DEVELOPMENT IMPACT

Measuring the impact of a disaster on human development can be challenging since human development is somehow intangible. However, such dimensions as education, health, income, gender equality, human rights, and psychological well-being can provide indication of the status of human development in a given community or country. In the case of Chã das Caldeiras, such impact has been assessed along these lines mainly by (i) income, that is, unemployment and livelihoods deterioration (poverty); (ii) access to basic services, particularly water and sanitation; and (iii) food and nutrition insecurity. As expected, the consequences of the eruption have been generally negative in most aspects. However, it is interesting to notice that some positive impact can be expected with regard to access to social services.

With regard to poverty, all the municipalities of the island of Fogo present poverty rates above the national average: 29 percent for S. Filipe, 52 percent for Mosteiros, and 59 percent for Santa Catarina do Fogo, of which Chã das Caldeiras is part (QUIBB 2007). As for specific rates pertaining to Chã das Caldeiras, there are no official data, and hence it is difficult to estimate precisely how the eruption has affected poverty levels in the area. Using the comfort index as a proxy of poverty with the INE (2010) census information, 82.9 percent of households in Chã presented a low or very low index of comfort while 15.2 percent presented medium levels of comfort. Compared with Santa Catarina Municipality as a whole (to which Chã das Caldeiras belongs), where 59.9 percent presented a low or very low index, it is remarkable that Chã das Caldeiras presents worse comfort index results.

Despite comfort index results, informal conversations with habitants of Fogo and representatives of local institutions indicate that the habitants of Chã were comparatively better off, in income terms, than the average of the population of Santa Catarina. However, it should be noted that this information remains unofficial and it was not possible to undertake any survey on the affected population.

It is in any case realistic to estimate that the impact of the eruption on people's income levels has been substantial since most of the habitants were engaged in agriculture and tourism-related activities, and both sectors have been considerably affected by the disaster. Decline in income levels is likely to continue should the resumption of economic activities in these two sectors—especially agriculture—not be sustained and rapidly revamped. Naturally, a decrease in incomes will also generate other negative consequences on the general well-being of the population.

The likelihood of declining income is also compounded by the fact that a good part of the adult population of Chã is illiterate or has limited educational qualifications and/or is unskilled and therefore not particularly employable. At the same time, the labor market on Fogo has a low rate of absorption, and alternative jobs might not be readily available.

As for access to social services such as water and sanitation, health, and education facilities, it should be noted that the disaster might actually have some positive impact on the affected population. Chã das Caldeiras was relatively distant from main center of Santa Catarina and hence its social services facilities. The temporary relocation of some families to São Filipe or Mosteiros has eased physical access to such facilities and the recovery initiatives might further provide the opportunity to gain access to such services previously not available onsite or not easily accessible.

This might be the case particularly for housing standards, energy services for domestic purposes, water, and sanitation. The general housing standards in Chã were in fact low and, with few exceptions, most of the population lived in houses of inadequate services (electricity, water, and sanitary facilities) and size for the number of family members. Houses were also not disposing of running water and waste water in disposal

facilities. As described in the relevant individual chapter in this report, access to energy services, water, and sanitation were not commonly available in Chã das Caldeiras. According to the INE (2010) census, the majority of the population (65.2 percent) was satisfying their water needs from family reservoirs or other means (public fountains, water trucks, and so forth) and only 29 percent of the households had sanitary facilities installed in their houses, while the rest used open air. In terms of wastewater disposal, the estimation is that only around 30 percent had their own septic tanks. The relocation of the population of Chã might actually grant them (at least temporarily) better water and sanitation, energy services, and waste disposal facilities in temporarily rented facilities or the upgraded existing houses in Achada Furna and Monte Grande that were connected to or provided those services in the relief phase. Improved access to those services will also be available for the new houses to be constructed in the new settlement site.

As for health and education, the impact of the eruption did not disrupt provision of such services to the population. However, the quality of such services in Chã was not particularly high, since only a primary health unit, kindergarten, and a primary school were present in the area. Similarly to the situation with water and sanitation, the relocation of the population would allow them to access better health services and ease their access to education opportunities beyond primary school, including vocational training. As already noted in the employment section of this report, for example, the temporary relocation to Achada Furna had the positive consequence of easing the attendance to training run by the employment center in São Felipe.

With regard to food security and nutrition, there is a potential risk of food insecurity and possibly malnutrition that might have arisen from the eruption. Most of the affected families began receiving food assistance (and continue to do so) from the government as they were unable to meet their food needs due to loss of income. Besides the risk of creating dependency, the negative consequence of this form of aid could be that families would eventually revert to negative coping mechanisms such as sale of assets, reducing consumption of meals per day, borrowing money at high return rates, and so forth to meet their food and monetary-related needs. This would in turn also further deteriorate their livelihoods and increase their poverty levels.

As for the psychological well-being of the affected population, the impact of the eruption has certainly had substantial consequences. The loss of property—specifically the houses—and the relocation itself has been traumatic, and psychosocial support through counselling has been made available at displacement sites. The community life has been completely disrupted and, from informal exchanges with the affected population, it is clear that many suffer from the separation from Chã das Caldeiras, as it is regarded as the place they belong to. This feeling goes beyond the fact that Chã is the center of their economic activity; it has strong emotional connotations that are very much linked to a sense of belonging people have had to that area for generations. It is indicative that the history of past eruptions shows that the population of Chã has always returned there. Naturally, such attachment is increased by the fact that agriculture is the primary activity of the population and proximity to their land is essential. The decision to relocate the population of Chã to a new area or resettle them in Achada Furna will bring an enormous change to the community's cultural and social dynamics and additional psychological discomfort. While it is difficult to measure and define these psychological, emotional, and social aspects of the disaster, they should not be underestimated. They should indeed be taken into account during the recovery process and in any decision related to the “new” life of the population of Chã. They might well be issues to include in decision-making processes that support the population's integration into a different setting.

Finally, with regard to the impact of the eruption on the general well-being of the population of the island of Fogo, it is also important to consider that Chã das Caldeiras plays an important role in economy of the island. It should be recognized that wine production and tourism were contributing to income generation for many of the habitants of Fogo. The Natural Park of Fogo and the volcano remain the major tourism attractions of the island, and many of the sector facilities such as hotels and restaurants were located in San Felipe. The temporary closure of the park and the decline in tourist visits will therefore have negative consequences on those engaged in the tourist sectors outside of the caldera. Unfortunately, at the time of the writing of this report it is not possible to provide precise data or estimations of the decline in income that the population of Fogo engaged in tourism will suffer as a consequence of the eruption.



CHAPTER RECOVERY STRATEGY 4





By March 2015, the affected population of Chã das Caldeiras had initiated a process of self-recovery by returning home to resume agricultural activities as well as rebuild destroyed houses, community infrastructure, and the road to access the area. While self-recovery and spontaneous return to disaster affected areas is common in many disaster situations, it is nonetheless significant to note the tenacity of the population of Chã to return to resettle in such a high-risk and location that entails many hardships. Chã das Caldeiras remains the main center of the livelihoods of the affected population, of course, but this process also reveals the strong cultural bond between the population and this part of the island.

A similar process had, in fact, been observed following the eruption of 1995. With the objective of ensuring higher safety to the population, the government decided to relocate the habitants of Chã das Caldeiras to a safer area, and 110 houses were built in the villages of Achada Furna and Monte Grande (Municipality of Santa Catarina do Fogo do Fogo) with support of the government of Germany. However, shortly after the housing construction was completed, most of the people started to return to Chã das Caldeiras and rebuild homes with their own means (many took with them the materials from their temporary houses such as doors, windows, and so on). Considering the lower economic opportunities offered in the village of Achada Furna and the sociocultural attachment to the caldera, the population preferred to move back to Chã das Caldeiras in spite of the hardship of the location and the lack, in 1995, of any social services such as electricity, water, schools, and health clinics.

The past and current self-return processes clearly show that the preference of the habitants of Chã das Caldeiras is to continue their lives in the caldera. However, the experience of the 1995 volcanic eruption also provides some lessons on important considerations for the current recovery process, particularly with regard to housing and socioeconomic activities. In particular, is essential to keep in mind that resettlement sites should allow alternative livelihoods to be developed in order to fix population. Also, if Chã das Caldeiras is expected to continue being a center for economic activities but housing will be relocated, it will be essential to consider which infrastructure and investments for economic development are worth the risks associated with the hazard-prone location Chã das Caldeiras is and which configuration and design will limit potential future losses. Additionally, transportation systems to allow people to live and work in different locations need to be developed.

Other lessons learned from previous eruption recovery process relate to the need to give sociocultural aspects and governance processes appropriate consideration when making decisions on recovery initiatives. Community participation is essential to ensure that those sociocultural considerations are well understood and integrated in habitat-recovery options. Housing types need to be adapted to cultural living styles and economic activities developed by the communities.

RECOVERY VISION AND GUIDING PRINCIPLES

The government of Cabo Verde will adopt a risk-reduction and people-centered approach to recovery (see table 4.1) in Chã das Caldeiras with the vision of strengthening the resilience of the population and promoting sustainable development.

Table 4.1: Vision and Principles Underpinning the Recovery Process in Chã das Caldeiras

Vision for recovery	<p>The resilience of the population of Chã das Caldeiras is enhanced and development better secured through the recovery process.</p>
Guiding principles	<p>Building back better and integrating disaster risk reduction (DRR) concerns in all sectorial recovery initiatives</p> <p>Building back greener: considering the environmental footprint of the recovery strategies and reconstructed infrastructures and promoting low-carbon development actions</p> <ul style="list-style-type: none"> • Prioritizing people-centered interventions and community inclusion and use of local knowledge and skills: This principle further promotes community participation in all aspects of the recovery process and encourages community decision-making, ownership and empowerment to ensure solutions are locally appropriate <p>Focus on the most vulnerable and socially disadvantaged groups such as children, women, female-headed households, and the disabled. Disasters increase the vulnerability of all, but especially of those who are already disadvantaged. .</p> <p>Ensure sustainable environmental considerations are included in all investments and interventions.</p> <p>Strengthening national capacities in preparedness and response and in planning and managing the recovery process</p> <p>Clear communication and transparency within government at all levels and with the affected population</p> <p>Integrity and accountability in the management of public funds made available for recovery</p>
Recovery issues and strategy	<p>Prioritization of needs and interventions (cross-sector)</p> <p>Permanent housing in the caldera will not be allowed, as it is a high-risk area (resettlement will ensure provision of social services and transport).</p> <p>Reestablish safe access to the Fogo Natural Park to allow productive and sustainable livelihoods.</p> <p>No major public investments in permanent infrastructure in Chã das Caldeiras</p> <p>Enhancement of economic opportunities, for example, promotion of tourism, professional training</p> <p>Recovery of the main community's livelihoods associated with agriculture production (winery and so forth)</p> <p>Inter-sectorial collaboration & harmonization of sectorial interventions.</p> <p>Risk-informed land use planning for new settlements and infrastructure siting</p>
Institutional framework	<p>Coordinating government agency: Cabinet of Fogo Reconstruction</p> <p>Implementation responsibility: sectorial ministries and municipalities</p>
Financing for recovery	<p>Coordinating body: Reconstruction Fund</p> <p>Establishment of financing instruments for recovery (for example, increased VAT, redistribution of budgetary national allocations, external aid)</p>

Chã das Caldeiras remains a high-risk area. However, it is also an area offering high economic returns in agriculture and, potentially, in the tourism sector. In recognition of this, as well as acknowledging the fact that the population of Chã is substantially an agricultural-based community with strong cultural and social links to the area, and in order to ensure that the recovery process does take into account the will and specificities of the affected population, the government of Cabo Verde recognizes that the socioeconomic recovery will resume in the caldera

With the objective of increasing the resilience of the population, recovery intervention will focus not only on resumption of existing agricultural production but as well on strengthening households' income-generating capacity in this sector and offering more economic alternatives, possibly through the expansion of the tourism sector. Also, opportunities to freely access professional training will be offered to the affected population

in order to expand their human capital, building on the work that the employment center of Fogo (IEFP/ Ministry of Employment) is already undertaking. The expansion of the economic opportunities for the population of Chá das Caldeiras will need to be considered under a long-term strategy for the strengthening of the economy of the island of Fogo, a process that will be undertaken under the current development strategy of Cabo Verde.

However, with the objective of ensuring higher safety to the population and reducing the risk and impact of the volcano on the development of the area, the government will not allow further resettlement in the area and will adopt a “light footprint” approach as it relates to infrastructure investments. As for housing, the strategy will translate into the relocation of the population to a safer area and in limiting the issuance of building permits for permanent private infrastructures to investments that are critical to current agricultural and tourism activities—therefore excluding permanent housing. Public investments will be directed only toward basic public infrastructure needed to ensure safe access to and from the Fogo Natural Park. In line with such a strategy, the headquarters of the park will also be relocated to a safer area (to be defined) outside the caldera.

The definition of the area of resettlement will take into consideration the need for the population to be located at reasonable short distance to Chá das Caldeiras so it can undertake economic activities in the caldera. Support to access the caldera (transport) and to have social services such as health facilities and schools will be taken into account.

For more details on individual sector strategies, please refer to the individual sector sections.

Recovery Needs

The needs and related costs to allow full recovery in each sector have been presented—integrating disaster risk reduction concerns with the objective of promoting sustainable recovery and the *build back better* approach. The identified recovery needs have been classified and timed according to their priority. The overall focus in the short term is (i) to resume agricultural activities, particularly wine production so as not to lose the 2015 harvest, and (ii) to ensure the settlement of the population of Chá de Caldeiras in a safer location.

Enhancement of access to public services and improvements to disaster risk management system performance have been integrated into recovery needs assessments to ensure that resilience of communities is reinforced through reduced vulnerability and improved capacities.

Within each sector’s recovery needs assessment, the reduction of risk (existing in the predisaster situation or additional risks and vulnerabilities created and/or reinforced by the disaster) has been mainstreamed. As a result of the risk-proofing approach for recovery investments in all sectors, the needs and cost estimates could be higher than the effects values identified on the disaster effect assessment. This is particularly true for the disaster risk management system. Effects were limited since the DRM system of the country is in its initial stage and DRR policies are still to be developed and implemented, especially in terms of disaster risk mitigation, preparedness (early warning systems), response, and recovery mechanisms. See tables 4.2 and 4.3.

Table 4.2: Global Overall recovery needs by timeframe in millions (in CVE and USD)

Sector	CVE (millions)			Total	US\$ (millions)			Total
	Short	Medium	Long		Short	Medium	Long	
Productive sectors	355.4	94.9	45.8	496.0	3.5	0.9	0.5	4.9
Agriculture	91.5	30.3	35.4	157.2	0.9	0.3	0.4	1.6
Livestock	41.0	30.3	-	71.3	0.4	0.3	-	0.7
Agroprocessing	32.4	8.1	-	40.4	0.3	0.1	-	0.4
Tourism	190.5	26.1	10.4	227.0	1.9	0.3	0.1	2.2
Social sector	377.6	443.7	-	821.3	3.7	4.4	-	8.1
Housing and land use	373.6	358.0	-	731.6	3.7	3.5	-	7.2
Health	3.7	31.6	-	35.3	0.0	0.3	-	0.3
Education	0.2	37.3	-	37.5	0.0	0.4	-	0.4
Culture	-	16.9	-	16.9	-	0.2	-	0.2
Cross-cutting issues	189.0	447.0	232.1	840.9	1.9	4.4	2.3	8.6
Environment	40.9	218.1	25.1	284.1	0.4	2.2	0.2	2.8
Employment	5.8	99.2	28.5	133.5	0.1	1.0	0.3	1.3
Gender	-	-	-	-	-	-	-	-
Disaster risk reduction	137.1	110.0	173.2	420.3	1.4	1.1	1.7	4.2
Governance	5.2	19.7	5.3	3.0	0.1	0.2	0.1	0.3
Infrastructure	329.6	524.0	10.0	863.6	3.3	5.2	0.1	8.5
Transport	329.0	504.0	-	833.0	3.3	5.0	-	8.2
Communication	0.2	-	-	0.2	0.0	-	-	0.0
Energy	-	-	10.0	10.0	-	-	0.1	0.1
Water	-	20.0	-	20.0	-	0.2	-	0.2
Sanitation	0.5	-	-	0.5	0.0	-	-	0.0
TOTAL	1,251.5	1,509.6	287.9	3,021.8	12.4	14.9	2.8	30.2

Table 4.3: Recovery needs by timeframe (in CVE)

Sector	CVE			Total	CVEsc (1,000s)			Total (CVE * 1,000s)
	Short	Medium	Long		Short	Medium	CVEsc	
Productive sectors	355,353,694	94,874,100	45,792,000	496,019,794	355,354	94,874	45,792	496,020
Agriculture	91,513,600	30,336,000	35,392,000	157,241,600	91,514	30,336	35,392	157,242
Livestock	40,953,600	30,336,000	-	71,289,600	40,954	30,336	-	71,290
Agroprocessing	32,358,400	8,089,600	-	40,448,000	32,358	8,090	-	40,448
Tourism	190,528,094	26,112,500	10,400,000	227,040,594	190,528	26,113	10,400	227,041
Social sector	377,567,612	443,745,000	-	821,312,612	377,568	443,745	-	821,313
Housing and land use	373,622,612	357,975,000	-	731,597,612	373,623	357,975	-	731,598
Health	3,745,000	31,600,000	-	35,345,000	3,745	31,600	-	35,345
Education	200,000	37,310,000	-	37,510,000	200	37,310	-	37,510
Culture	-	16,860,000	-	16,860,000	-	16,860	-	16,860
Cross-cutting issues	188,983,095	446,974,372	232,117,850	868,075,317	188,983	446,974	232,118	868,075
Environment	40,880,000	218,077,772	25,096,450	284,054,222	40,880	218,078	25,096	284,054
Employment	5,775,000	99,200,000	28,500,000	133,475,000	5,775	99,200	28,500	133,475
Gender	-	-	-	-	-	-	-	-
DRR	137,138,095	110,008,600	173,191,400	420,338,095	137,138	110,009	173,191	420,338
Governance	5,190,000	19,688,000	5,330,000	30,208,000	5,190	19,688	5,330	30,208
Infrastructure	329,600,000	524,000,000	10,000,000	863,600,000	329,600	524,000	10,000	863,600
Transport	329,000,000	504,000,000	-	833,000,000	329,000	504,000	-	833,000
Communication	150,000	-	-	150,000	150	-	-	150
Energy	-	-	10,000,000	10,000,000	-	-	10,000	10,000
Water	-	20,000,000	-	20,000,000	-	20,000	-	20,000
Sanitation	450,000	-	-	450,000	450	-	-	450
TOTAL	1,251,504,401	1,509,593,472	287,909,850	3,049,007,723	1,251,504	1,509,593	287,910	3,049,008

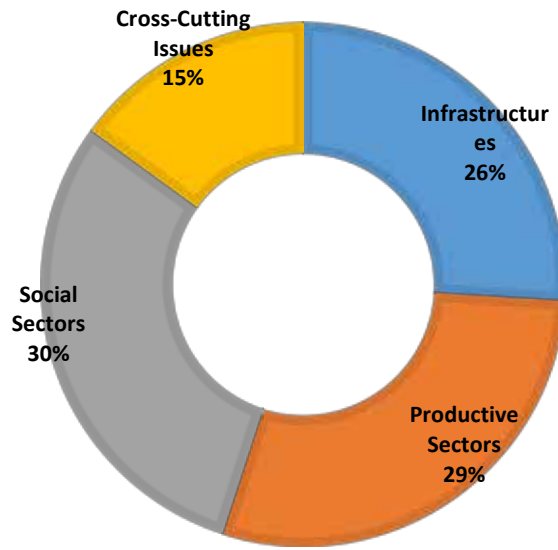


Figure 4.1: Short-Term Recovery Needs by Cluster

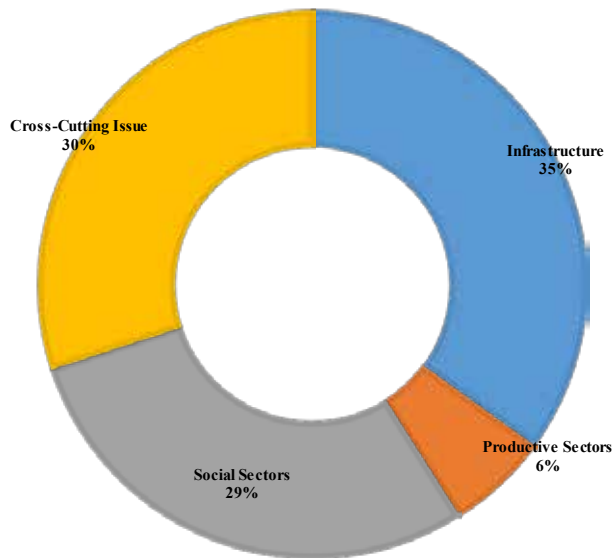


Figure 4.2: Medium-Term Recovery Needs by Cluster

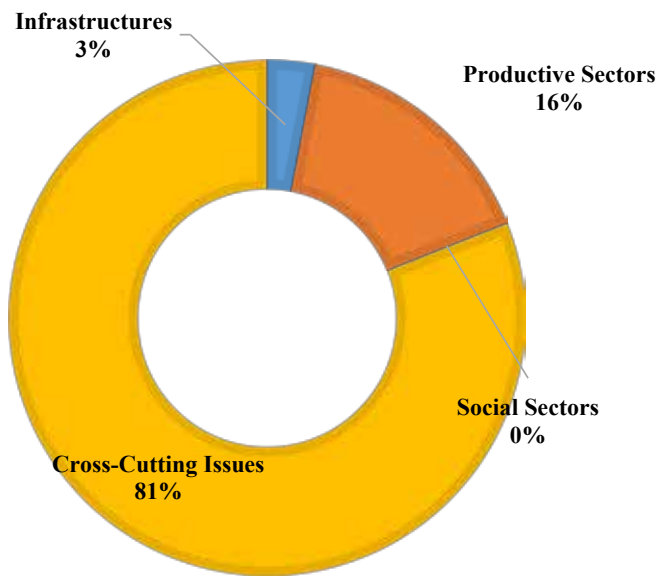


Figure 4.3: Long-Term Recovery Needs by Cluster

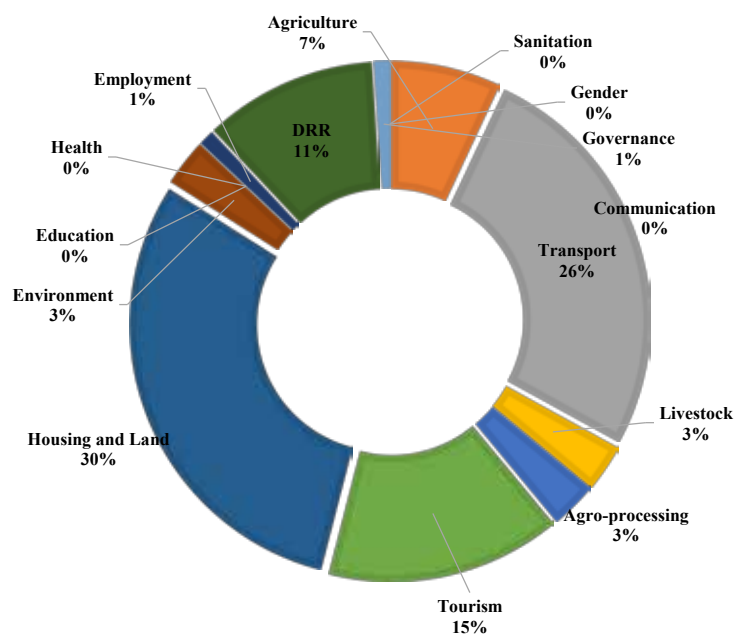


Figure 4.4: Short-Term Recovery Needs by Sector

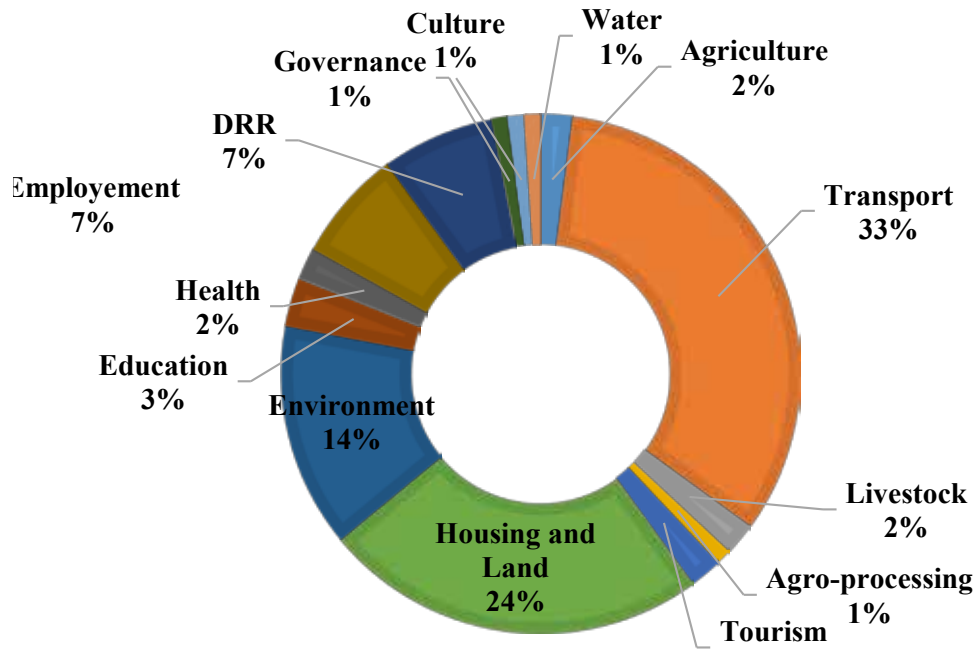


Figure 4.5: Medium-Term Recovery Needs by Sector

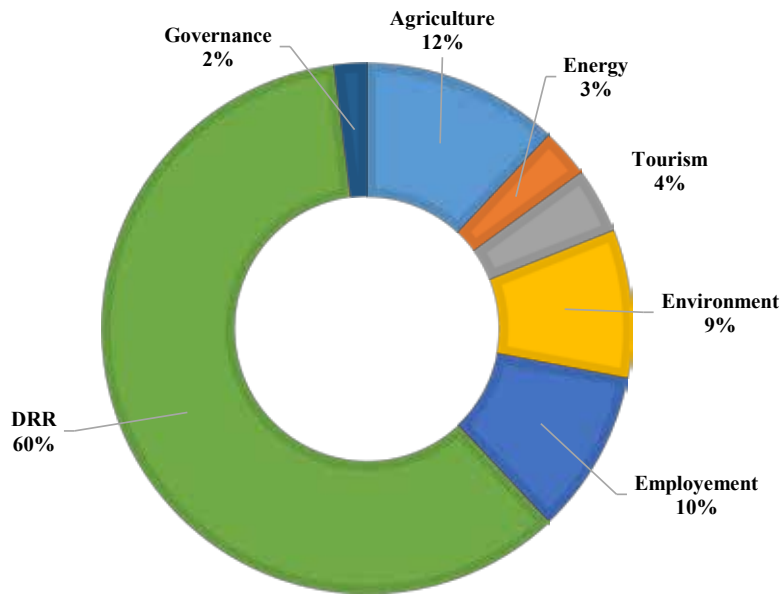


Figure 4.6: Long-Term Recovery Needs by Sector

RECOVERY COORDINATION AND IMPLEMENTATION

The recovery strategy remains aligned with the priorities and recommendations of the Fogo Reconstruction Forum, held in Fogo on March 2–3 2015.

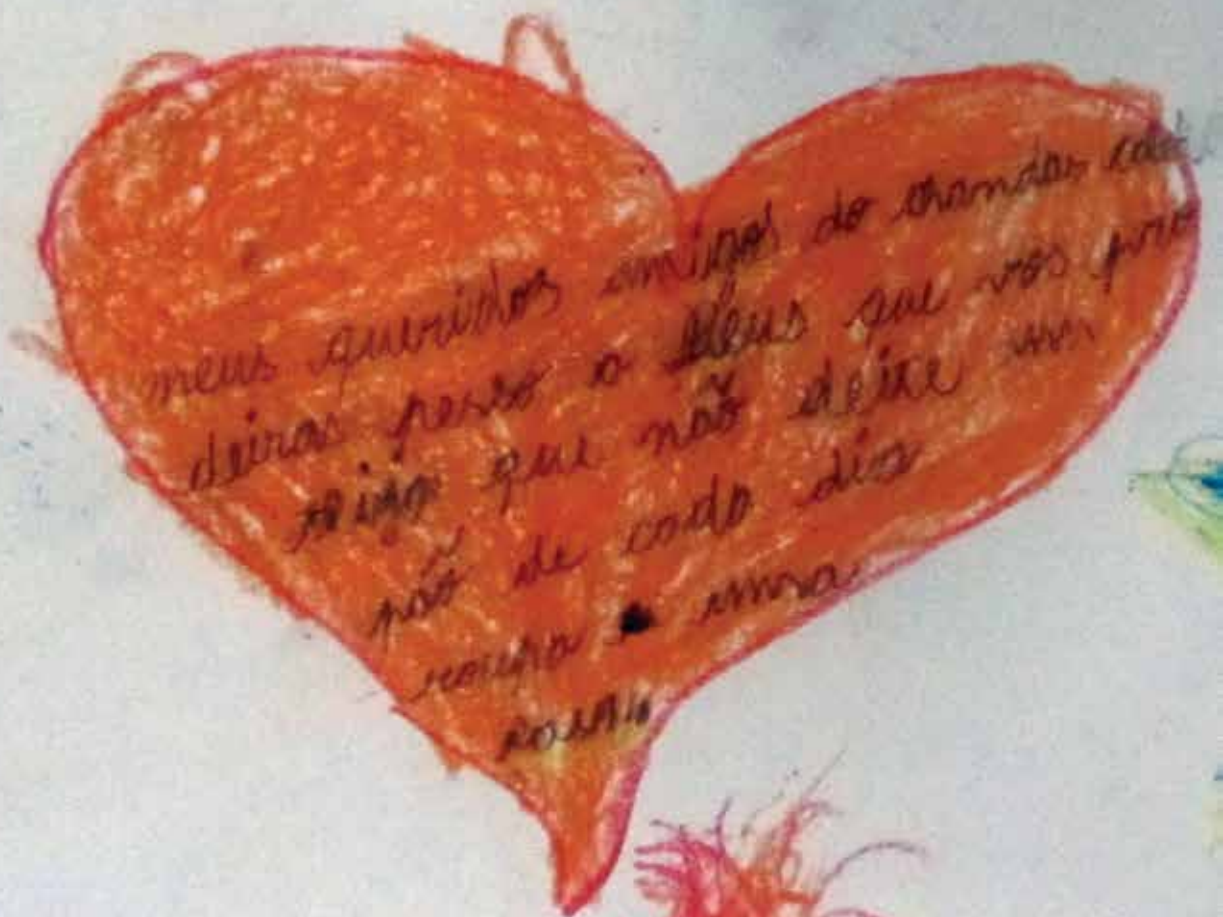
The period of recovery is set by the government of Cabo Verde at a period of two years. This period considers the necessary time for full resumption and enhancement of the economic activities based in the caldera, namely, agriculture and tourism, the reconstruction of houses and infrastructure, and the strengthening of preparedness and risk reduction capacities at the community, local, and national levels. While the immediate focus of the recovery interventions will naturally be Chã das Caldeiras, the interventions might have larger benefits to the whole island of Fogo (for example, the expansion of the tourist sector).

The implementation of the recovery strategy will be overseen by the Reconstruction Cabinet as the governmental institution mandated to coordinate the recovery process. The sectorial implementation will be led by relevant line ministries, concerned municipalities, and other relevant stakeholders such as international organizations, the private sector, and civil society—including the affected population. The Reconstruction Cabinet is also in charge of overseeing a Reconstruction Fund established on April 22, 2015, with the intent of serving as a basket fund for government and external contributions (donors, private sector, and so forth) and managing the disbursement to implementing agents

In the recovery institutional framework it is important to consider effective coordination with local municipalities to ensure the recovery process contributes to local governments' empowerment and reinforcement, in line with the national decentralization policy.

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APPENDIX 1.

SUMMARY: MACROECONOMIC IMPACT ASSESSMENT OF THE VOLCANIC ERUPTION ON THE ISLAND OF FOGO

Using data from the Post-Disaster Needs Assessment (PDNA) exercise, the World Bank conducted an assessment of the macroeconomic and fiscal impact of the eruption of the volcano on Fogo island, Cabo Verde, in late 2014. The results were obtained through the simulation exercise of the dynamic computable general equilibrium model (DCGEM) that already exists at the Ministry of Finance and Planning (MFP).

The Cabo Verde DCGEM, modified specifically for this study, gives the required general equilibrium framework for assessing the impact of the volcano eruption, modifying the rate of value added tax (VAT), and increasing public investment to reconstruct the infrastructure of the affected area.

The DCGEM is an economy-wide model that describes the behavior of producers and consumers and the linkages among them. Producers are depicted by three Cobb-Douglas production functions (primary, secondary, and tertiary sectors) and consumers by a five-linear expenditure system that models the behavior of representative consumers of each quintile at the level of eight consumption categories contained in the Cabo Verde Consumer Price Index. This structure allows for an analysis of the policies for economic growth, inflation, fiscal accounts, public debt, and employment.

The main dynamic elements of the model are the annual level of investment in each sector together with population growth and sectorial employment. Sectorial investment is disaggregated into public and private investment. The closure of the model is done through the equilibrium between savings and investment and the equilibrium between each sectorial production function and its corresponding sectorial demand. In the latter case, equilibrium is guaranteed by the capital utilization factor embodied in each Cobb-Douglas production function.

To simulate the impact of the volcano eruption, two types of input data were used. The first type corresponds to the loss of capital stock associated with the volcanic eruption. These variables have to be identified according to the capital stock of each economic sector. The second type of variables corresponds to the loss of flow of production in the last two months of 2014, since the volcano eruption occurred in November of 2014. Inputs for the simulation model were taken from the PDNA data-gathering exercise underlying this report.

Three scenarios have been simulated with the Cabo Verde DCGEM: the baseline scenario, scenario one, and scenario two. The baseline scenario simulates the evolution of Cabo Verde's economy with the volcano eruption and without increases on tax rates or additional public investment to reconstruct the damaged areas. The Baseline scenario uses similar assumptions set in the Medium-Term Fiscal Framework (MTFF) prepared in 2014 by the MFP. In addition, the baseline scenario exercise was also used to calibrate the model.

Scenario one simulates the evolution of the economy without the impact of the volcano eruption and uses similar assumptions to the baseline scenario, namely, the MTFF's assumptions. Hence the deviations between scenario one results and the baseline scenario are the impact of the volcano eruption on the Cabo Verde economy.

Scenario two simulates the evolution of the economy with the impact of the volcano eruption and the fiscal policy measures taken by the Cabo Verde authorities to mitigate the destruction in the disaster area. The policy measures considered in this scenario are the following: (i) an increase of 0.5 percentage points in the VAT rate; (ii) additional public investment allocated to restore the infrastructure and other capital stock damaged by the volcano eruption; and (iii) all other exogenous variables remaining similar to the MTFF assumptions.

Table A1.1 presents a summary of the results for the three scenarios. It is followed by the main conclusions of the study:

Table A1.1 Summary Results: Macroeconomic Effects of the Fogo Island Eruption of 2014

	2012	2013	2014	2015	2016	2017	2018
PIB Real Total Precos Mercado							
Scenario 2	136,954.80	138,386.30	142,091.50	147,701.40	153,757.20	159,384.30	167,447.40
Baseline	136,954.80	138,386.30	142,091.50	147,701.40	153,699.00	159,147.50	166,976.80
% Deviation	-	-	-	-	0.04	0.15	0.28
Scenario 1	136,954.80	138,386.30	142,175.70	148,349.80	154,330.10	159,734.50	167,514.50
% Deviation	-	-	-0.06	-0.44	-0.37	-0.22	-0.04
IPC NOVO							
Scenario 2	118.47	120.72	122.55	126.41	129.79	132.61	135.45
Baseline	118.47	120.72	122.55	126.39	129.72	132.49	135.29
% Deviation	-	-	-	0.02	0.06	0.09	0.12
Scenario 1	118.47	120.72	122.55	126.29	129.60	132.40	135.23
% Deviation	-	-	-	0.10	0.14	0.16	0.16
Taxa de Desemprego							
Scenario 2	0.168	0.164	0.160	0.151	0.122	0.096	0.094
Baseline	0.168	0.164	0.160	0.151	0.122	0.097	0.097
% Deviation	-	-	-	-	-0.252	-1.194	-2.288
Scenario 1	0.168	0.164	0.160	0.151	0.122	0.097	0.097
% Deviation	-	-	-	-0.014	-0.260	-1.182	-2.263
Impostos							
Scenario 2	27,268.25	27,863.29	27,913.86	30,697.60	33,024.01	34,717.98	38,148.17
Baseline	27,268.25	27,863.29	27,913.86	30,518.99	32,478.51	34,086.15	37,405.42
% Deviation	-	-	-	0.59	1.68	1.85	1.99
Scenario 1	27,268.25	27,863.29	27,913.86	30,600.09	32,541.81	34,141.48	37,460.61
% Deviation	-	-	-	0.32	1.48	1.69	1.84
Divida Publica Total							
Scenario 2	134,768.83	152,496.41	170,179.40	188,559.30	205,973.60	218,701.50	231,384.20
Baseline	134,768.83	152,496.41	170,179.40	188,021.30	204,887.60	217,069.60	229,221.60
% Deviation	-	-	-	0.29	0.53	0.75	0.94
Scenario 1	134,768.83	152,496.41	170,179.40	187,905.40	204,671.90	216,758.00	228,805.00
% Deviation	-	-	-	0.35	0.64	0.90	1.13
POBRESP							
Scenario 2	22.387	22.286	22.291	21.957	21.637	21.377	21.088
Baseline	22.387	22.286	22.291	21.958	21.640	21.387	21.103
% Deviation	-	-	-	-0.004	-0.018	-0.045	-0.073
Scenario 1	22.387	22.286	22.291	21.939	21.624	21.373	21.091
% Deviation	-	-	0.00	0.08	0.06	0.02	-0.01
GINI_F (Baseline)							
Scenario 2	0.452	0.446	0.441	0.438	0.434	0.422	0.419
Baseline	0.452	0.446	0.441	0.438	0.434	0.423	0.420
% Deviation	-	-	-	-0.011	-0.063	-0.175	-0.318
Scenario 1	0.452	0.446	0.441	0.437	0.433	0.422	0.419
% Deviation	-	-	0.003	0.261	0.192	0.078	-0.062

Source: Cabo Verde DCGEM May 2015

The overall impact of the volcano eruption on the Cabo Verde economy is low (0.44 percent of 2015 gross domestic product, GDP). However, since the disaster area is restricted to the island of Fogo, it is expected that the relative damage to the Fogo economy considered alone should be high.

Nationally the primary sector is the most affected economic sector (1.16 percent of primary sector GDP in 2015). Assuming that primary sector GDP is proportional to population across Cabo Verde, then the impact of the volcano eruption on the island of Fogo alone (7.54 percent of Cabo Verde's population) would be over 15 percent of Fogo's primary sector GDP.

Total tax revenue, in the absence of tax policy measures will experience a reduction of around CVEsc 100 million in 2015. This reduction on tax receipts, added to the need for additional public investment for the reconstruction of the damaged areas, will put a dent on the fiscal deficit and the public sector borrowing requirements.

The impact on inflation and unemployment should be low. However, in the case of unemployment the impact would be concentrated in the island of Fogo. Additional studies are required to assess the impact of the volcano eruption in the case of unemployment to treat the island of Fogo as an isolated case.

The proposed 0.5 percentage point increase on the VAT rate will be enough to compensate for the tax revenue fall and to provide funds for the additional public investment needed to reconstruct the damaged areas in four years.

The estimated CVEsc 250 million of additional annual public investment together with the expected increase of private investment should be sufficient to restore the capital stock of the affected areas in four years. Without the expected increase of private investment, the reconstruction period could be extended to six or eight years. The proposed fiscal policy measures should have a positive impact in the medium term on employment, economic growth, and poverty levels. However, there is expected to be a slight increase in inflation (due to the VAT rate increase) and an increase in the fiscal deficit. The fiscal deficit increase should occur in 2015 and will show a downward trend through 2018. A similar behavior is expected for the public debt-to-GDP ratio.

APPENDIX 2. COLLABORATING INSTITUTIONS

Table A2.1: List of Collaborating Institutions: Assessment of Fogo Disaster

National Civil Protection Service
National Institute of Land Management
University of Cabo Verde, Volcanology Observatory
Ministry of Rural Development, Agriculture/Fisheries/Forestry
Ministry of Infrastructures
Ministry of Infrastructure, Road Institute
Ministry of Health
Ministry of Tourism
Strategic Policy Center, Prime Minister's Office
Ministry of Rural Development, Delegation in Fogo
Ministry of Health, Delegation in Fogo
Natural Park Fogo, National Directorate of Environment
Municipality Technical Cabinet
Municipality Responsible for Environment, Land Use, and Public Works
Municipality Responsible for Local Civil Protection
Center for Employment and Vocational training, Ministry of Youth, Employment
Red Cross Cabo Verde—Fogo and Sao Felipe
Ministry of Education, Fogo Delegation
National Statistics Institute
Ministry of National Defense
Ministry of Foreign Affairs
Ministry of Foreign Affairs, National Directorate of Political Affairs and External Cooperation
Prime Minister's Office
Ministry of Finance and Planning, General Directorate of Treasury
Ministry of Finance and Planning, National Directorate of Planning
Ministry of Finance and Planning, General Directorate of Budget

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APPENDIX 3. GLOSSARY

BUILD BETTER: Approach to reconstruction to reduce vulnerability and improve predisaster conditions, while promoting a more effective, resilient, environmentally adequate and sustainable reconstruction. Build back better uses the opportunity of having to rebuild to examine the suitability of reconstructing in the same location and conditions

BUILD BACK BETTER: A predisaster management process that analyses specific potential events or emerging situations that might threaten society or the environment, establishes arrangements (operational, technical, and financial) in advance to enable timely, effective, and appropriate response and recovery processes. Contingency planning results in organized and coordinated courses of action with clearly identified institutional roles and resources, information processes, and operational arrangements for specific actors at times of need. Based on scenarios of possible emergency conditions or disaster events, it allows key actors to envision, anticipate, and solve problems that can arise during crises. Contingency planning is an important part of overall preparedness. Contingency plans need to be regularly updated and exercised.

DAMAGE: Total or partial destruction of infrastructure and physical assets as a result of a disaster, valued at current replacement costs. The value is estimated as the replacement value in current monetary terms (market value at the time of the disaster).

DISASTER: A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

COMMENT: Disasters are often described as a result of the combination of the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease, and other negative effects on human physical, mental, and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption, and environmental degradation.

DISASTER EFFECTS: The effects of the disaster event that result in damages (see damage) and changes in flows, such as economic and production losses, altered access to goods and services, altered governance, and changed risk assessed in all sectors.

DISASTER IMPACT: On the basis of the disaster effects, it is the estimated impact on the economy (macroeconomic and microeconomic impact on the economy and the affected population), and on human development.

EARLY WARNING SYSTEM: Set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities, and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

EXPOSURE: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

COMMENT: Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

LOSSES: Changes in economic flows as a result of the effects of disaster. They include the decline in output in productive sectors and the lower revenues and higher operation cost in the provision of services. Also, losses are the unexpected expenditures to meet emergency needs.

PREPAREDNESS: The knowledge and capacities developed by governments, professional response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current hazard events or conditions.

RECOVERY: The restoration, and improvement where appropriate, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. In the context of a PDNA, recovery encompasses both the reconstruction of damaged or destroyed physical assets including appropriate improvements to reduce risk and build back better; and the recovery from affected flows. The restoration of socioeconomic activities is considered as well as part of the recovery process.

REHABILITATION: Generally used as a synonym of recovery

RESILIENCE: The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

RESILIENT RECOVERY: In the postdisaster context it entails the inclusion of resilience-building measures as a means to improve predisaster conditions allowing a transition to a more sustainable development

RECONSTRUCTION: The process of repair or reconstruction of destroyed or damaged physical assets and infrastructures, allowing for improvements in terms of risk reduction and building back better, as warranted by the damage occurred. Focuses primarily on the reparation, construction, or replacement of damaged infrastructure and other physical assets.

RISK: The combination of the probability of an event and its negative consequences. Risk is the result of a specific hazard impact on preexisting conditions of vulnerability. The word risk has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in “the risk of an accident”; whereas in technical settings the emphasis is usually placed on the consequences, in terms of “potential losses” for some particular cause, place, and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.

RISK MANAGEMENT: The systematic approach and practice of managing uncertainty to minimize potential harm and loss.

COMMENT: Risk management comprises risk assessment and analysis, and the implementation of strategies and specific actions to control, reduce, and transfer risks (risk reduction). It is widely practiced by organizations to minimize risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts, and damage from fire and natural hazards. Risk management is a core issue for sectors such as water supply, energy, and agriculture whose production is directly affected by extremes of weather and climate.

RISK ASSESSMENT : A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods, and the environment on which they depend.

RISK TRANSFER: The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise, or state authority will obtain resources from the other party after a disaster occurs in exchange for ongoing or compensatory social or financial benefits provided to that other party.

VULNERABILITY: The characteristics and circumstances of a community, system, or asset that make it susceptible to the damaging effects of a hazard

COMMENT: There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system, or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element’s exposure.

Based on United Nations Office for Disaster Risk Reduction (UNISDR), “Terminology,” <http://www.unisdr.org/we/inform/terminology>.

