



# An institutional analysis to address climate change adaptation in Tenerife (Canary Islands)

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## ABSTRACT

Heat waves and Saharan dust outbreaks have been acquiring more frequency and intensity in the Canary Islands during the last decades. Both climatic hazards are known to produce impacts on human health such as mortality (due to heat waves) and morbidity (due to dusty weather). This work addresses possible climate adaptation policies in Tenerife assuming the increasing impact of heat waves and Saharan dust outbreaks in the island under a climate change scenario. It explores the institutional setting of climate change adaptation planning in Tenerife and evaluates the statu quo of adaptation planning in the island through the engagement of key social actors. An historical review of the local and regional press articles and legislation, an in-depth round of interviews, together with questionnaires to the main social actors allows framing the social and political context in which climate change adaptation in Tenerife is embedded. Key social actors were engaged, including international organisations, atmospheric research centres, local Universities, regional and insular governments, trade unions, and environmental NGOs, among others. The main obstacles mentioned by the social actors that hinder the development of an effective climate adaptation policy address scientific knowledge, data collection and policy making, focusing on the uncertainty of climate models, the lack of epidemiological data and contrasting opinions regarding the existing climate adaptation policies. Public participation, mainstreaming of climate policies and an integrated approach between mitigation and adaptation plans were identified as key policy issues. The outcomes of this study could be meaningful for climate adaptation initiatives at local or regional level, such as the Global Covenant of Mayors, that intend to promote climate resilience through the setup of climate adaptation strategies and plans at municipality level.

## 1. Introduction

### 1.1. Objectives

This work focuses on possible climate adaptation policies in Tenerife assuming the increasing impact of heat waves and Saharan dust outbreaks in the island under future plausible climate change (CC) scenarios. Furthermore, it explores the institutional setting of CC adaptation planning in Tenerife and evaluates the statu quo through the engagement of key social actors.

### 1.2. Heat waves and Saharan dust outbreaks in Tenerife

Climate in the Canary Islands is mild, due to the influence of the

NNE trade winds and the cool waters of the subtropical North Atlantic. Periodically, cool trade wind weakens and easterly Saharan air reaches the Canaries with high temperatures -dropping relative humidity- (Dorta, 1991) and suspended desert dust. The combination of these two factors, high temperature and desert dust, is known locally with the name of "calima".

Heat waves can reach temperatures of 44–45 °C (Dorta, 1991), bringing tropical nights of 26–30 °C (Dorta, 2007). Whilst Alonso Pérez (2007) argues that these episodes might have become more intense and frequent in the Canary Islands since 1970, Sanz et al. (2007) states that the average number of heat waves has quadrupled since 1994 and five out of the ten strongest heat waves recorded over the whole period have been detected during 2004–2007. Recent heat waves in the Canary Islands have left 13 premature deaths, more than any other

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meteorological hazard (Dorta, 2007). Several authors point out that a general rise of temperatures is expected in the future for the Canary Islands (Martín et al., 2012), intensified in the upper parts of the islands (Expósito et al., 2015; Martín et al., 2012). Meanwhile, the number of warming days is expected to increase from a minimum of 7% to a maximum 36% by 2070–2099 with respect to 1961–1990, depending on the global warming scenario (Cardós et al., 2007).

There are two Saharan dust seasons in the Canary Islands, one in winter and another in summer. During winter, dust events are associated with the easterly winds prompted by the occurrence of high pressure expanding from the North Atlantic over Western Europe and North Africa (Alonso-Pérez et al., 2011). These events may induce extremely high dust concentrations at ground level (up to 2000  $\mu\text{g}/\text{m}^3$ ) and are not necessarily associated with high temperatures. During summer, dust events are associated with the circulation of the dusty Saharan Air Layer, resulting in hot, dry and dust air between 500 and 5000. a.s.l., whereas trade winds prevail at lower altitudes. Recent long-term analysis (1941–2013) shows that there is an important multidecadal variability in summer dust export (García et al., 2016). The islands have historically received Saharan dust as a consequence of large scale meteorological processes (Cuevas et al., 2016) but episodes have acquired more frequency and intensity since 1970 (Alonso Pérez, 2007), leading to a dusty and “naturally” polluted air with particulate matter ( $\text{PM}_{10}$ ).

In terms of socio-economic impacts, reduced visibility tends to affect both Tenerife’s airports and their transport services (Dorta, 2007). However, the impacts on human health are amongst outstanding ones, since respiratory pathologies, anxiety disorders, and atypical thoracic pain usually affect local population (García-Carrasco et al., 2001), leading to increased use of air liquid as a respiratory therapy (Belmonte et al., 2010). Saharan dust events might also be related to the introduction of microbial communities in the Islands (González-Martín et al., 2013).

Even though a seasonal change has been reported and associated with CC (Alonso Pérez, 2007), several authors suggest that a clear connection between Saharan dust outbreaks and CC cannot be argued (Dorta et al., 2005). Rodríguez et al. (2015) indicate that, in order to establish a clearer connection between Saharan dust outbreaks and CC, a better understanding of the North African dipole would be needed. Therefore, climate change-related impacts on Saharan dust outbreaks may be said to be under discussion (Alonso-Pérez et al., 2007).

### 1.3. Climate change policy in the Canary Islands

Institutional arrangements can either hinder or strength CC adaptation. Diverse case studies have reflected on these issues, referring to power relations, politics and values as possible constraints, at both local and regional level. For instance, and institutional analysis carried out in Semarang (Indonesia) concluded that the absence of local reports on CC has led to unclear communication and poor coordination among stakeholders (Artiningsih et al., 2016). Francesch-Huidobro et al. (2017) pointed out (after reviewing the cases of Hong Kong, Guangzhou and Rotterdam) that the practice of climate adaptation depends on the level of exposure to flood risks, as well as the approach and methods applied. It has also been highlighted that political corruption might lead to low coverage and poor quality of adaptation (Gebreyes, 2018). Mandryk et al. (2015) concluded that the heterogeneity of social actors’ interests and the lack of resources are the main barriers for agriculture adaptation in Flevoland (the Netherlands). The lack of funds for hiring coordination personnel has also been indicated in an analysis developed in North-Rhine-Westphalia, Germany (Roggero, 2015).

A case study carried out in Norway on flood adaptation, point out that local power structure increases the rapidity of measures implementation when powerholders’ interests are represented, whereas the same power structures tend to slow down the process of social learning when their stakes are at risk (Næss et al., 2005). An

institutional analysis carried in Mozambique highlights the lack of data, low institutional continuity, and the lack of financial resources as the main constraints for mainstreaming CC adaptation into development assistance (Sietz et al., 2011). A coastal management analysis implemented in Coastby (Sweden) concluded that building capacity is hampered by a combination of factors, such as poor vertical and internal coordination of administrations (leading to lack of coherent policy), tensions and trade-offs between policy agendas, values and political priorities (Storbjörk and Hedrén, 2011). Lastly, an institutional analysis of water governance in Pakistan indicated that the lack of trust between provinces to share water resources hinder the capacity of food production to adapt to CC (Yang et al., 2014).

The institutional arrangements of the Canary Islands share most of the constrains presented above due to the lack of a clear climate governance in the archipelago. In April 2009 a CC Agency was created by law in the Canary Islands. It was intended to promote, encourage, orient and coordinate local policies, initiatives and measures to reach sustainable development, including mitigation and adaptation to CC (BOC, 2009). This Agency developed a CC strategy, including a CC mitigation plan (Gafó-Fernández, 2009), and a CC adaptation plan (Martínez Chamorro, 2010). The 25<sup>th</sup> of June 2012 the Government of the Canary Islands launched a regional law adopting measures aiming at reducing public administration expenditure in order to respond to the financial crisis. Consequently, the CC Agency was dissolved so as to “guarantee public expenditure sustainability” (BOC, 2012) and the Canary Islands CC Strategy was consequently paralysed.

To compensate this lack of climate governance, the Gran Canaria Island Council (the second most populated island of the Canaries) created a Climate Action Group in 2016 with the aim of taking over the process of developing a climate strategy.<sup>1</sup> This strategy is currently being developed along with the collaboration of social actors and citizens. Conversely, the Island Council of Tenerife has not followed Gran Canaria’s approach and remains without a CC strategy of its own: only a civil protection plan and a disaster risk management plan are currently into force (see Table 2 in Section 2). Notwithstanding, an Observatory for CC has been established in Lanzarote by the Government of the Canary Islands in April 2017, replacing the former CC Agency. However, this Observatory does not have the necessary resources to develop an updated CC strategy for the region.<sup>2</sup> Nowadays, the islands still lack a common climate adaptation strategy in a context of high vulnerability to the effects of CC (López-Díez et al., 2016).

## 2. Institutional analysis and participatory approach

Environmental governance often concerns long time horizons and multiple social actors, which further complicate the governance processes, increasing the uncertainties involved in it (Kangas and Kangas, 2004). Environmental governance is characterised by values in dispute, high stakes and urgent decisions (Funtowicz and Ravetz, 1991). These values in dispute are further aggravated by the uncertainties related to the environmental systems (Corral Quintana, 2004; Corral and Hernandez, 2017; Funtowicz and Ravetz, 1993; Guimarães Pereira and Corral Quintana, 2009; Hernández González and Corral Quintana, 2016; Hernández-González and Corral, 2017). All these elements complicate the traditional scientific approach, where a mixture of (partial) knowledge, assumptions, and ignorance are the rules rather than the exception. In these cases, institutional analysis might be of use to shed light on all these “backstage” elements.

Institutional analysis might be considered as a fact-finding procedure to examine different structures and social relationships (Corral Quintana, 2004), providing a more detailed approximation to the prevailing social and institutional arrangements, assumed as the social

<sup>1</sup> Personal communication obtained from the in-depth interviews.

<sup>2</sup> Ibid.

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