Europ. J. Agronomy 74 (2016) 18–28

Contents lists available at ScienceDirect

European Journal of Agronomy

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

Climate change trends in Malta and related beliefs, concerns and attitudes toward adaptation among Gozitan farmers

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ARTICLE INFO

Article history:
Received 5 June 2015
Received in revised form 3 November 2015
Accepted 9 November 2015
Available online 8 December 2015

Keywords:
Farmer typology
Farmers' perception
Malta
Gozo
Agriculture
Adaptation measures
Climate trend
Small island states

ABSTRACT

In this study we report the results obtained from an island-wide survey aimed at researching an under-emphasized key feature of climate change adaptation—namely *willingness* to adapt on the basis of the perceptions and beliefs held by the Gozitan livestock and crop farmers. Some of the main objectives of this study included the: (1) determination of whether the current perception is in line with the observed climatic changes at the local scale, and (2) identification of the typology of these farmers, together with those factors that affect both skepticism and acceptance of climate change. This study provided an important first step in the objective validation of local farmers' perceptions of climate change, as well as in the development of a comprehensive understanding of their attitude, beliefs, willingness and capacity to adjust their practices in response to climate change. The results pointed to several important conclusions that can be used to inform research, outreach strategies and policy formulation, targeting the Gozitan farming sector to adapt to climate change without delay. The forgoing analysis showed a dire need for more information both on impacts and risks, as well as on ways how to introduce new farming techniques and practices.

1. Introduction

Agriculture plays an important role in guaranteeing food security and is always prominent on the political agendas of both governmental and international agencies. At the same time, the expected impact on productivity within the agricultural sector arising from a changing climate is an ever growing concern (Balzer and Hess, 2009). Studies are showing that there will be a wider variance in susceptibility to crop failure and livestock diseases in various parts of the world, which is expected to lead to income uncertainties and disruption of food systems (Dercon, 2004; Hansona et al., 2004; Thornton et al., 2002).

Specifically, climate change impacts are expected to limit available resources (such as freshwater) and make irrelevant indigenous practices in crop management. In its 5th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC, 2014) emphasized that increased global warming and frequency of extreme weather events in many parts of the world (such as increased drought conditions) will be primary contributing factors to limiting important agricultural resources.

A number of studies have documented the degree of economic and environmental vulnerabilities of small islands states (Briguglio et al., 2009; Bishop, 2012) including that related to food security. While subsistence agriculture has shown to be a basic necessity of food to islanders, agricultural activities are severely constrained by the smallness and insularity which deprive islands from any comparative cost advantage in a rapidly globalizing world. Moreover, islands have a typically high population pressure on extremely limited land which forces islanders to cultivate small, marginal land that is often characterized by a low agricultural productivity. Adverse climatic impacts thus make small islands states amongst the most vulnerable countries in the world to climate change, where national adaptation efforts are often constrained because of their resultant high cost (Tompkins et al., 2005).

The agricultural sector of the Maltese Islands (which lie approximately at the centre of the Mediterranean Sea between 36° 00′ 00″ and 35° 48′ 00′ north-south latitude and 14° 35′ 00″ and 14° 10′ 30″ east–west latitude; Fig. 1), is considered to be a vital resource to the country's economy. It is also seen as instrumental to the preservation of both its rural social fabric and physical landscape. The climate of the Maltese islands shows an annual mean temperature of 18.6 °C, a mean maximum of 22.3 °C and mean minimum of 14.9 °C. Such a temperature regime together with an annual total

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http://dx.doi.org/10.1016/j.eja.2015.11.011
1161-0301/

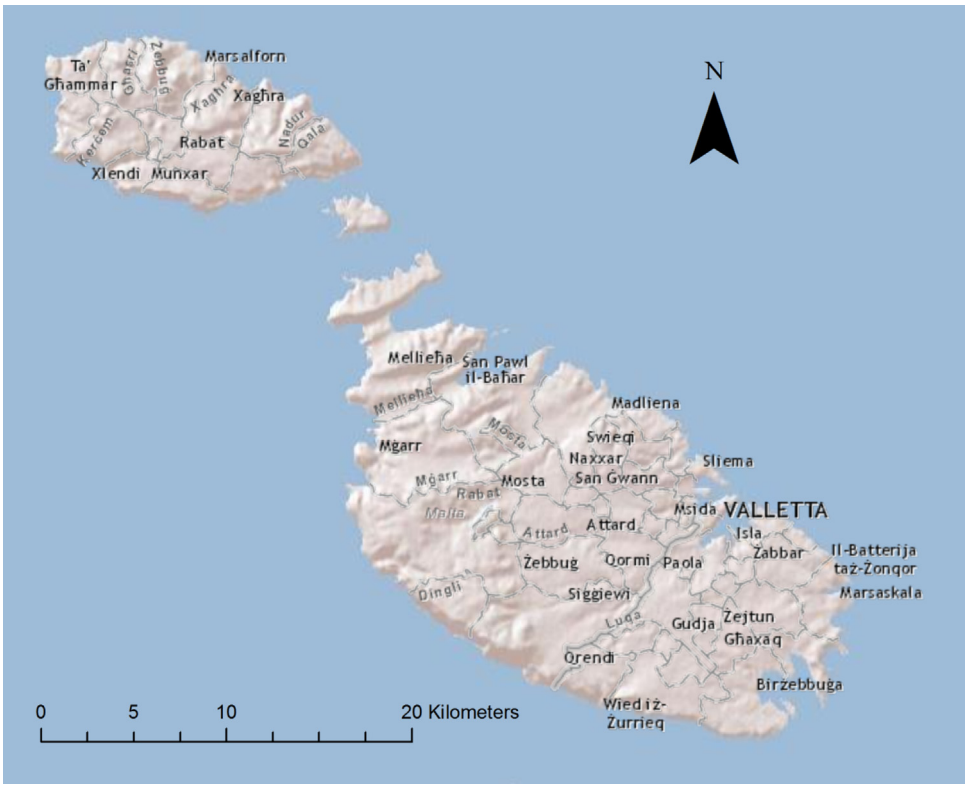

Fig. 1. The Maltese archipelago with a total surface area of 316 km^2.

(Source: ESRI).

precipitation of 553.1 mm makes the archipelago relatively hot and dry.

The Maltese farming sector, in particular that practiced in Gozo, is similarly faced by several constraints arising from climate change (Government of Malta, 2010). Here, agricultural practices are mainly defined by the small size of the land parcels owned or farmed by individual farmers. The spatial distribution of cultivation areas for the most important agricultural crops (such as forage, fruits and grapes, potatoes and vegetables) over arable land in Gozo is shown in Fig. 2. According to NSO (2015) the total arable land in Gozo and Comino is 2888 ha, of which 1950 ha was dedicated to forage, 30 ha to potato crops, 109 ha to permanent crops, 62 ha to vineyards, 142 ha to fallow land, and 596 ha dedicated to other agricultural practices. The great part of arable land is given over to dry-farming having a varying crop-quality according to various exposures, slope and water supply.

The most recent official agriculture statistics collected from Gozo in 2013 showed an annual total estimated volume of 73,933 t of vegetables and 9109 t of fruit. Potatoes (12,644 t), tomatoes (12,287 t), and cauliflowers (5782 t) were the three most popular crops. Regarding fruit production in the same year, grapes (5474 t), strawberries (720 t), and peaches (547 t) were the most popular by annual total estimated volume (NSO, 2015). In 2013, the primary Gozitan livestock consisted of beef with a population of 5179 heads, poultry (223,871), lamb (3118), and pork (4208). Fresh milk was being produced by a total of 45 dairy farms in Gozo.

Indeed, the new RCP4.5 future climate projection scenario published by IPCC (2014) for seasonal temperature and rainfall changes by 2100 predict the following changes for the Mediterranean region: (1) a decrease in precipitation of about 5–6 percent, signaling potential future problems for agriculture and water availability, (2) a likely increase of the length, frequency and intensity of warm spells or heat waves, (3) increase in sea level rise projections of around 0.4–0.5 m similar to global projections, and (4) an increase of around 1.2° to 2.3 °C in surface temperature when compared to the 1986–2005 baseline.

Thus the analysis of long-term statistical trends of historical temperature and precipitation observations is an important prerequisite to validate these projections. Galdies (2010) reported his concerns with the warming trend of +1.2 and +1.1 °C in the maximum and minimum temperature respectively observed between 1951 and 2010 over the central Mediterranean region. The strongest anomalous warming period has occurred during the last 30 years, and this has been coupled to a stronger probability of higher occurrence of extreme temperatures (Galdies, 2011). So far, long term trends of annual precipitation over the Maltese islands showed no significant fluctuations from the climate norm (Galdies, 2011).

But to what extent is the Gozitan farming sector aware of a changing climate and its repercussions? This question deserves special attention since it has already been shown that public's attitudes towards climate change strongly affects their willingness or otherwise, to adapt (Akter and Bennett, 2011). Thus farmers' willingness to respond to climate change through increasing adaptive capacity is largely unknown in Gozo. Elsewhere, Weber (1997) and Arbuckle et al. (2013) showed that Illinois and Iowa farmers who believed in climate change and associated risks were more likely to take up adaptive practices. Interesting results were also obtained by Barnes and Toma (2012) from their analysis of Scottish dairy farmers. Franklin et al. (2006) and Groom et al. (2008) looked at the underlying beliefs, attitudes and cultural influences that affected farmer behavior and how these were in turn based on both intrinsic values and on monetary rewards. Given the scarcity of information on the local scene, it is imperative to develop an informed understanding of farmers' beliefs, concerns and willingness to adapt to climate change since this can fundamentally compel or constrain political, economic and social action to address particular risks arising from climate change (Chen et al., 2015).