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The future protection from the climate change-related hazards and the willingness to pay for home insurance in the coastal wetlands of West Sardinia, Italy

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Abstract

Wetlands are severely endangered ecosystems worldwide. They provide important services, like water supply, recreation opportunities, flood and climate regulation. Still, they are also considered as disruptive areas, a source of mosquitoes and diseases, which is why they are frequently destroyed by changes in land use. Their degradation is likely to advance from this time forth due to climate change processes. It is, therefore, important to examine how the local population understands the importance of wetlands in coping with different coastal risks in West Sardinia. Our study is focused on West Sardinia (municipalities Cabras, Oristano and Arborea), counting for remarkable biodiversity of wetlands. This area is characterized by high environmental and agricultural pressures which intensify the vulnerability of the coastal areas. To test for local population's preparedness to change, data collection was performed through field methods and questionnaires. The study was undertaken by asking key questions on the role of wetlands and willingness to pay to protect from future events (contingent valuation exercise). The results indicate that the locals do not seem to be aware of the regulating services provided by wetlands, but are willing to invest in order to mitigate climate change-related hazards. The obtained results could serve in future governance frameworks for the mitigation of natural hazards in the Mediterranean region and wider.

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1. Introduction

Water is one of the key natural resources at stake in the present and future world, having a crucial role for both societal and economic component of sustainable development. One of the solutions in preserving the healthy water cycle are wetlands, "*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres*", as defined by the intergovernmental Ramsar Convention [1]. The Ramsar Convention aims at conservation and wise use of wetlands in the widest sense, where wetlands may include even coastal zones, islands and the adjacent sea [2]. Wetlands are globally significant carbon stocks, with the organic carbon stored per unit area similarly as in forests [3]. In addition, wetlands mitigate the effects of natural hazards: they provide sediment stabilisation and soil maintenance [4], they regulate water flow and control floods [5] and they scatter sea waves, buffer winds and protect coasts [6]. However, the importance of wetlands is underestimated, and their significant flood regulation and climate change mitigation capacity is overlooked [70]. Only in the Mediterranean region wetlands reduced in area by 48% between 1970 and 2013 [8], which is against our common interest in mitigating climate-change induced risks through adaptation.

The Mediterranean Sea has been detected as fragile and sensitive to climate change and its ecosystems are among the most concerned by global climate change [7]. Likewise, the second biggest Mediterranean island of Sardinia is prone to high level of hazards, particularly its West coast, which is among one third of the Mediterranean coastal areas exposed to the highest level of hazard. That is particularly due to extremely high values of wave heights, as shown in the study in which the research focus were sea level rise, storms and droughts [11]. The area of the Gulf of Oristano was hit by extreme weather events, above all flash floods as a consequence of heavy rainfall, like in November 2013. Coastal storms (*mareggiate*) are frequent during the cold season in the area, with the projections of sea-level rise during the upcoming decades due to climate change. Furthermore, the area of the Gulf of Oristano is a wetland zone. Wetlands do contribute to disaster risk reduction, but is the local population aware of those benefits?

This article presents an analysis of elements that are supporting individual and collective action for risk preparedness. Future investment in protection against natural hazards is evoked and willingness to pay is elicited. Risk management would greatly benefit from understanding whether residents are aware of wetlands as a nature-based solution in coastal hazard assessment and whether this awareness increases the local preparedness to face climate change-related risks in Sardinia.

1.1. The willingness to pay for insurance against disasters resulting from climate change.

Damages caused by climate change consequences have a high economic impact [27]. Economists focused in their analyses on consumers' preferences for technologies and policies that can avoid or mitigate the negative consequences of climate change. Special attention has been paid to analyse the willingness to pay (WTP) to support public policies addressing CO_2 emissions [27]. For example, a recent study on an Italian nationwide survey shows that WTP ranges a lot and the heterogeneity due to proposed public policies and individual characteristics is similar [35]. While these approaches generally focus on green technologies [28, 29], many studies focus on adaptation strategies, such as coastal adaptation policies facing sea-level rise [76, 77]. Very recently studies focused on stated preferences started analysing WTP for the adoption of nature-based solutions [30]. In addition, in the past decades a wide range of studies have analysed the determinants of WTP to reduce climate change risk. European studies of climate change and the insurance industry have mainly been conducted in Germany, the Netherlands, and the United Kingdom [42].

Flood and sea level rise risk are two of the most analysed consequences of climate change. An important part of the literature has analysed the effect of floods and sea level rise on housing prices. The effect of floods on housing market shows negative impact, while the effect of sea level rise is not clear. The meta-analysis of mainly USA studies showed that the flooding risk has a negative effect on housing prices, since houses placed in the 100-year floodplain have 0.3 - 0.8% lower prices [31]. This study was updated by the meta-analysis study which showed different trends of prices within inland and coastal floodplain, the former of price discount of -4.6%, and the latter of price premium of +13.4%. There, the higher prices in coastal flooding areas are explained as a consequence of coastal conveniences, like a view of the sea [32]. In addition, a recent USA study showed that the housing construction in areas exposed to sea level rise varies with climate beliefs, where high belief in climate change is associated with significantly reduced construction in areas vulnerable to sea level rise, which is not the case in more sceptical areas [33]. Finally, a recent Australian case study outlined that, although well-known flood areas show a price discount effect for housing, that is not the case for the sea level rise, whose effect on housing prices is reduced [34].

Other studies focused on the adoption of individual mitigation measures. A study made in 2012 among English and Welsh homeowners indicated that the majority adopted energy-saving improvements, but only a few adopted property-level flood protection [37]. A 2014 German case study showed that the adoption of private mitigation measures increases with past damage experience (but some other studies found an opposite result [38]) and damage expectation for the future [39]. Although some researchers [41] stated that insurance and/or government refund can decrease the willingness of adopting individual mitigation measures, the 2014 German case study showed the absence of moral hazard for most

respondents [39]. Indeed, another study [38] found that living in an area where some technical flood defences had been installed had a positive influence on the purchase of flood insurance: in some cases, respondents stated that the insurance companies encouraged them to adopt further mitigation measures or offered discounts on premiums as a reward for undertaking such actions. Lastly, a recent study on the Italian region of Veneto indicates that residents may agree on the introduction of a compulsory flood insurance system and express WTP (insurance premium) ranging between 26€ and 42€ per year [43]. The EU indeed considers insurance coverage against natural disasters as a fundamental tool in its mitigation strategy [47]. Specifically, a lack of efficient schemes and market in Italy is indicated [85], where climate change damage and related costs are increasing for households and companies in several economic sectors [86].

Finally, there are studies that tried to grasp individual's risk perception, which might influence WTP for protection. As regards developing countries, risk perception is a leading factor related to earthquake insurance demand in China [60], whereas in the case of floods in Pakistan WTP is not significantly influenced by perceived risk, but by respondents' financial position [61]. Conversely, in developed countries, the effect of risk perception on WTP seems to be more apparent. One Dutch case study indicates that the perceived flood risk is a stronger predictor of WTP for a flood insurance than the real risk level based on geographical information [40]. Moreover, a recent Canadian study confirms the influence of the ongoing climate change and storm surge perception on the WTP of the inhabitants of a coastal city of Halifax [67]. However, an influence of risk perception in acceptability of relocation strategies facing sea-level rise in South France was recently examined by a choice experiment method, and there socio-economic variables did not explain preferences when perception variables taken into account [75]. There the respondents from coastal areas revealed an optimism bias facing rising sea levels, and similar is observed in responses from the most exposed inhabitants to coastal risks in another French Mediterranean study [76]. In addition, while perception of the consequences does not appear to be a strong determinant of the choice of adopting mitigation measures in Germany, other socio-economic factors such as having children or being a house owner result in stronger determinants and in spending more money on flood protection measures [36].

1.2. The study site of the area of the Gulf of Oristano, West Sardinia

As far as Sardinia is concerned, the recent studies dealing with environmental issues on the island examine beach erosion on the North Sardinian coast [12], with the groundwater issues and water scarcity [13], and with the agricultural pollution in Arborea plain [14]. Additional research in the province of Oristano includes an analysis of farmers' climate change perception and their adjustment of farming practices. This study found that the scientific top-down approach could limit climate change adaptation locally, due to socio-economic and cultural influences on farmers' adaptation measures [15]. In addition,

although there is a local research with a focus on Sardinian wetlands, one such research is related to floristic composition of plant communities in wetlands [16] another to a touristic promotion of coastal wetlands on the island [17], but none is related to regulating services of climate change mitigation provided by wetlands.

Sardinia is placed in the Mediterranean region, a climate change 'hotspot'. The average temperatures in the region recently rose to 1.6 °C over pre-industrial levels and a rise of 2-3 °C is expected by 2050 [8]. This change will be accompanied by enhanced extremes of storm-related precipitation and the likely increase of frequency and intensity of drought [9]. A set of nature-based solutions was then proposed to tackle global change; among them wetlands, which have a role of shock absorbers against various natural hazards such as floods and droughts, heat waves, sea-level rise and coastal storms [8]. As estimated by the IPCC, wetlands as nature-based solution, along with forests, grasslands and agricultural lands, could provide 37% of the CO_2 mitigation needed by the Mediterranean region by 2030 in order to succeed in holding global warming below 2°C [10].

In addition, by focusing our research on the wetlands' benefits as natural risk mitigation solution for coastal hazards, we build on the conclusions by Antonioli et al., 2017 [18]. In this research, a maximum relative sea-level for the year 2100 at about 949 mm above sea level based on the IPCC AR5 8.5 scenario is expected for the Gulf of Oristano. The assumption is that some sites in the gulf will be partly flooded, notably the Mistras lagoon, unless drainage systems will effectively be installed [18]. The area is severely affected by climate change, both in terms of sea level rise [18, 44] and climate-related extreme weather events (droughts and floods). In addition, although floods did affect this area in the past century, they are now more recurrent. In this context, wetlands play an important role as nature-based solutions regulating floods or scattering storms, but they also create a conflict between urban areas that are preserved and fishing and farming activities that are affected by floods. Sea level rise will be a serious problem in the future decades and some of the current areas (including archaeological sites) will be flooded in the future. While residents in the area are aware of how floods impact the region, they are less aware of how floods are also expected to increase with climate change.

Sardinia counts for 8 Ramsar sites, 6 of them in the Gulf of Oristano, with a surface of 77 km² and with 140 km of coastline. The MARISTANIS[5] project aims at promoting an integrated governance for that area. The wetlands of the Gulf of Oristano, stretching from Capu Mannu to the Marceddì lagoon represent an ecosystem of priceless value. The area is politically in the province of Oristano, where the main city Oristano also borders the pond of Santa Giusta, a rather industrialised and polluted lagoon that is connected to another small Ramsar pond of Pauli Maiori, the only freshwater pond in the area that could be considered a testimony to the original native biodiversity.

[5] http://www.maristanis.org/index.php/en/

Among Ramsar sites, the pond of Cabras is the biggest one. It is important for numerous species of water birds. In its direct proximity is the wetland of Mistras, which borders the coastal plain of the Gulf of Oristano, rich in bivalve molluscs and fish, making the municipality of Cabras a famous fishing site in the zone. Both of them are saltwater lagoons, located close to the mouth of Sardinia's main river Tirso. More to the South, a freshwater pond of S'Ena Arubia is the last remnant of a once broad complex of swamps and lagoons, converted in fertile land in the 1930s. In three lagoons, traditional fishing activities are allowed (Figure 1). Several traditional food and handcraft activities are still maintained in the area and they strictly relate to the presence of wetlands, accompanied by tourism activities.

Figure 1: Traditional way of fishing at S'Ena Arubia lagoon, Arborea

Beside weakness in governance due to an overlapping of competences and constraints of different actors, several issues affect these areas: pollution coming from wastewater treatment plants, former mining activities and agricultural activities (the reclaimed area in Arborea has been declared a Nitrate Vulnerable Area according to the Nitrate Directive). In addition, there are anthropic disturbances (including illegal waste disposal) related to uncontrolled access to the area, as well as the problem of invasive and alien species diffusion. The sites of our studies are presented in the Figure 2.

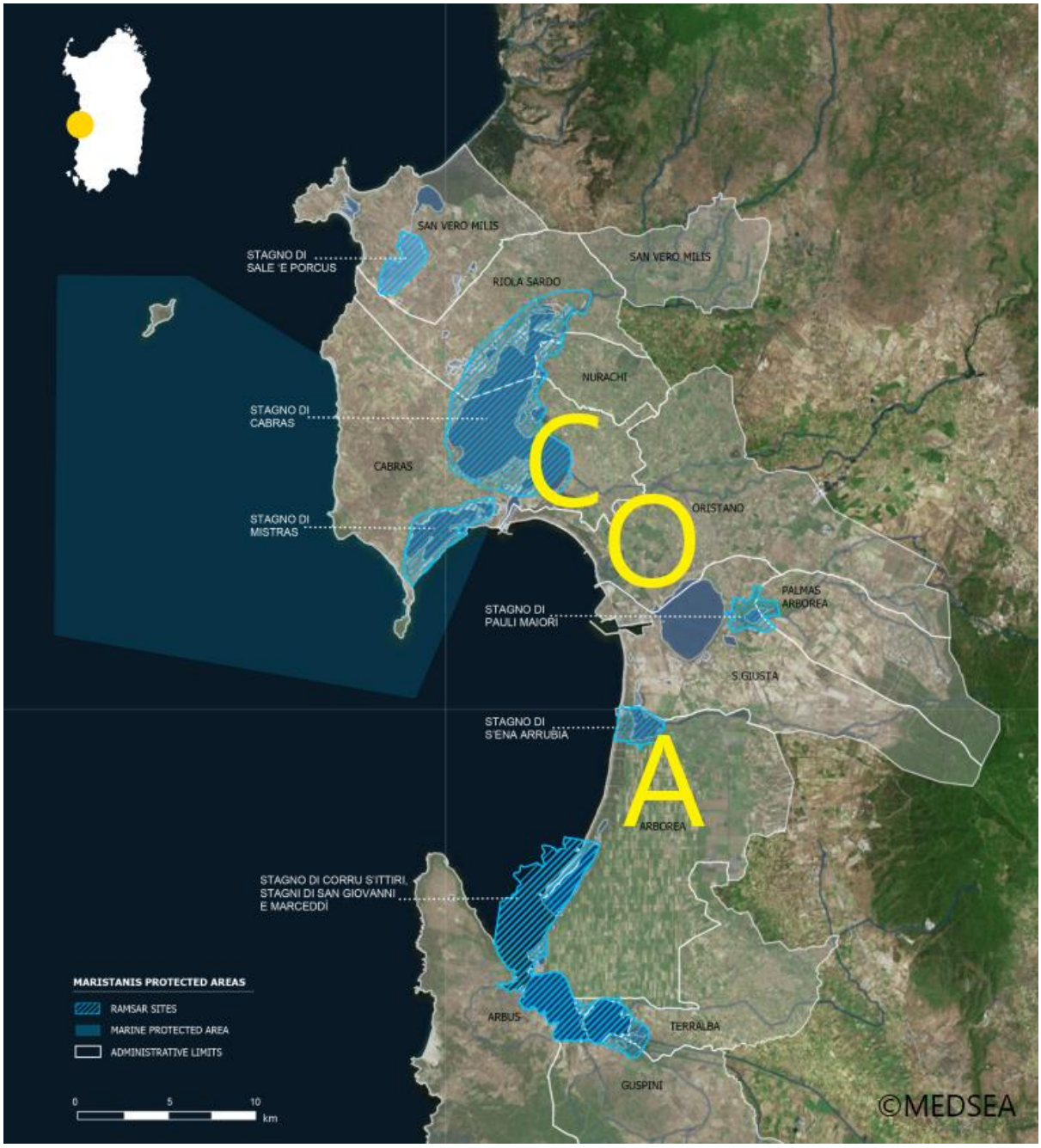

Figure 2: The Gulf of Oristano and the area of the MARISTANIS project, with three sites of study: Cabras (C), Oristano (O) and Arborea (A).

1.3. The cultural context of the area

Risk mitigation measures cannot be efficient without an active participation of the local population [19]. The application of climate change risk mitigation strategies must consider public awareness and local support. Local populations develop a deep understanding of their environment: they are capable of 'converting' social memory into common-sense knowledge, giving sense to what scientific information stands for [21, 22, 23]. The distance

observed between scientific logic and its local appropriation was seen to increase the vulnerability of local populations to natural risks [24, 25]. The same is valid for Sardinia, a Mediterranean island with rich historical and cultural influences that shaped its present existence. A comprehensive disaster resilience index combining indicators for social vulnerability, accessibility, environment and institutions was recently developed at Italian municipality level. The index, which is based on the Sendai's Framework for Disaster Risk Reduction, displays results for the Gulf of Oristano that indicate higher resilience against future disasters [20].

Sardinians autonomously govern their island and are proud of the long history of their legislation, as well as of the natural beauties of their 'endless' island (tourist slogan). An important medieval Sardinian legislative act, *Carta de Logu*, introduced by *juighissa de Arbaree*, lady judge Eleonora of Arborea in the 14th century, regulated all sorts of juridical and administrative questions, stating that all men are equal before the law. Some environmental questions were addressed as well, such as the burning of stubble, which was regulated in order to avoid wildfire, and the protection of hawks and falcons against illegal bird hunters [65, 66].

This area turned famous in the 20th century, between world wars, in which a huge land reclamation work was carried out by the fascist government (the area of 18,000 ha), by drying up the coastal pond of Sassu and other smaller ones, with the deviation of stream Mogoro and the creation of a moderator basin to contain floods and to provide water for irrigation. The village of Mussolinia, later named Arborea, was constructed and inhabited with Italians mostly from northern regions [72]. Even today, the terrain administrated by the municipality of Arborea is a site of extensive agricultural production. This fertile area is home to the main agricultural sector and the agro-food in Sardinia, including one of the main national dairy sector companies and one of the main national aquaculture companies.

Wetlands have long been depreciated as sources of diseases or wastelands, even though they are found to have a global value mean of 6,923 USD/ha/year for flood control service in agricultural landscapes [58, 59]. Considering their paramount importance for disaster risk management it remains to be studied how Sardinians think about these areas.

In addition, the question of environmental protection of Sardinian coasts is more than actual today. The centre-right regional government proposed a new law *Piano Casa*, approved on 12 February 2020, in order to 'develop sustainably' the island and 'to restart the sector of construction'. However, the environmental associations fear that this could lead to beach privatization in Sardinia, allowing more square meters for the coastal structures, as well as new tourist accommodation facilities that could be located even within the mandatory 300 m coastal strip [68, 69].

Finally, Sardinians experienced some disastrous events that strongly marked their local memory, shaped how they approach environmental risks and contributed to building local

solidarity between municipalities. That was the case in the devastating flash flood caused by a heavy rainfall from November 2013, when citizens from Terralba and Arborea worked together to manage the crisis [71] and where the residents of Terralba dedicated a letter of thanks to Arborea for their generosity and help during and after flood (Figure 3).

Figure 3: Residents of Terralba contribute a thank-you note to Arborea for generosity and sacrifice that their neighbours showed while defending their village from the devastating effects of flood on 18 November 2013.

1.4. Summary and goals

As shown above, wetlands have long been depreciated as wastelands, sources of mosquitoes or disease, but are found to be of key importance for disaster risk management. In this Sardinian case study, wetlands are at the basis of local defence and mitigation by offering regulating services and they represent a nature-based solution to tackle climate change related hazards. The individual and social variables have a significant impact on how

climate change-related risks are locally managed, which is why site-specific and cultural particularities need to be acknowledged [19, 46]. With this paper we contribute to risk management in the region of Sardinia by providing useful information to decision makers in charge of adopting climate change mitigation measures and by contributing to resilience of the local population dwelling on Gulf of Oristano's wetlands.

The main research questions that we respond to in the paper are:

a) How do locals understand the role of wetlands in risk mitigation?

b) Are the inhabitants willing to pay to protect from future events and how much are they ready to invest?

c) What are the variables that explain the willingness to invest and to protect from natural risks in the future in the specific context of our case study of West Sardinia?

Since citizens invest their own money and know they would need to pay a cost, they could be more attentive to their choice of behaviour. The result of our study can provide useful indication to policy makers in charge of climate change adaptation in Sardinia, particularly in light of the actual legal change of the regional environmental law allowing further coastal construction on the island. Finally, our exemplary case study could be useful to other Mediterranean and worldwide regions given the lack of analysis on climate change insurance adoption.

2. Methodology

2.1. Participants and fieldwork procedure

Hundred and seventy-six inhabitants of the area of West Sardinia from three different municipalities responded to our questionnaire in a public setting (Figure 2). The chosen municipalities belong to the area of wetlands, Oristano being the main city of the province, and Cabras and Arborea being villages with fishing and agriculture activities that depend heavily on these wetlands. Questionnaires were tested prior to the study with twenty participants chosen randomly among partners of the project Maristanis, with the questionnaire being reduced and some additional changes introduced. This questionnaire-based survey was conducted during May and June 2019. Data were collected face-to-face, by targeting general population. Questionnaires were also prepared online using LimeSurvey software, for those respondents that preferred fulfilling it in that way (only 29 among the total 176 questionnaires). One native (local, female) and one bilingual (foreign, male) speaker were randomly approaching possible participants, trying to pay attention to gender and age quotas despite time and human resources constraints. Participants under the age of eighteen and participants who did not reside in municipalities Oristano (80

respondents), Cabras and Arborea (48 respondents each) were not part of this study. Before starting the questionnaire, the respondents were informed about the project Maristanis and the objectives of this study, as well as reassured that the questionnaires are anonymous and will serve for educational and scientific study purposes only. More educated people were more likely to dedicate their time to answering the survey, and the working class seemed to be less attracted by responding to the questionnaire during their working hours possibly because it was rather time-consuming (around 20 min were needed to complete the survey), so there we encountered some withdrawal.

The sample is composed of 55% of female and 45% of male respondents (figures in population are 51% and 49% from the 2011 census, so our sample underestimates male population). The average participant is 46.4 years old (44 is the average age in population, census 2011), has either high school or bachelor's degree and mainly works in tertiary or quaternary sector. The average household is composed of 3 members (larger than 2.3 that is the average household size in population), with below 0.5 children per person and with a net annual income between 15,000 and 30,000 euro. The majority of participants lives on the periphery of the municipality, at a 5.4 km distance from the sea, in an owned home (83%) that is 34 years-old and of 120 m² on average. This composition characterized several previous surveys made in Sardinia (for ex. [45], [79]).

2.2. Survey content and variables

The questionnaire consisted of thirty questions, twelve among them consisting of additional sub-questions. It started with the question on perception of likelihood for ten natural events (drought, flood, landslide, coastal storm, heat wave, earthquake, coastal erosion, wildfire, sea-level rise, climate change) that could occur in the respondent's town of residence from the study area: Oristano, Cabras or Arborea. A set of questions about the person's experience with natural risks and measures of precaution was asked, followed by questions testing for attachment to their municipality and other citizens.

Next, the respondents were asked for their self-assessed knowledge about risks, followed by the level of information about natural phenomena which was measured in the form of a quiz where every phenomenon was presented by one statement that had to be evaluated. These questions were followed by the trust the respondents have to science in general, scientists, media, public institutes, universities and associations that take part in risk management, and finally to national and regional government. The next block of questions was related to climate change, belief and knowledge respondents have about this phenomenon, followed by questions related to measures that they believe could help if they were taken. The questionnaire finished with socio-economic questions, the questions about the type of housing, housing age and surface, and with the contingent valuation exercise. The types of questions asked were both open-ended (the first question) and close-ended questions (dichotomous and Likert rating scale). The full questionnaire (original in

Italian, translated into English) is available upon request. However, it is to underline that not all questions from the questionnaire were used in this analysis.

The data were firstly described in Excel order to get an initial view of the population from the region of interest. The contingent valuation exercise was calculated using the software Stata. Finally, the regression model used was binary logistic model, using software SPSS, since it permits both binary and continuous data jointly, dividing variables into more blocks, which allows tracing the model's improvement by adding new variables. The first set of variables used in the regression model consists of demographic variables: age, gender, education, annual net income, housing surface, number of household members, number of kids under 12 years old in the household and municipality of living (Arborea, Cabras, Oristano). Secondly, the variables that were considered to contribute more in describing readiness to invest money in order to protect in the future were added, those related to risk awareness and to climate change. The purpose of the final block of questions was to test the additional variables about the future protection behaviour, such as trust, environmental identity, place attachment, source of information and different measures to take.

Risk awareness and climate change

To start with, three indicators that describe the information and risk awareness level were constructed.

Information self-assessment: respondents assessed their estimated level of information about proposed nine natural hazards (drought, flood, landslide, coastal storm, heat wave, earthquake, coastal erosion, wildfire and sea level rise) and about climate change (from (1) "not at all informed" to (5) "very well informed", as in [62]). The assessed answers were summed and averaged, and those with grade four and above were treated as highly considered informed (binary value 1) in the further analysis.

Actual information: actual knowledge about their environment was assessed through a series of statements that the respondents had to judge as 'true', 'false' or 'don't know'. The statements concerned each of the ten above-mentioned phenomena. Those respondents that gave seven or more correct answers were considered as correctly informed (binary value 1).

Risk awareness: respondents were asked about their personal experience with natural hazards, about precautions taken and about risk dissemination sessions, as in [78]. Five different yes/no statements were asked, the answers were summed up and those with four or five 'yes' answers were considered as highly risk aware (binary value 1).

Climate change belief. It was constructed based on the eleven items related to climate change, such as e.g. 'We already feel the effects of climate change in Sardinia' and 'I believe that the climate change is exclusively due to natural processes'. The respondents had to express their level of agreement using a 5-point scale (from (1) "not agree at all" to (5)

“totally agree”, as in [63]). Responses were then dichotomized: participants with responses above mean were part of the ‘high belief in climate change’ group, while those with responses below the mean were part of the ‘low belief in climate change’ group.

Place attachment and environmental identity. The place attachment indicator, although intuitive, is considered as an emotional tie that moves forward a resident to maintain a relationship with a particular place [49, 50]. It was measured using a 5-point scale (from (1) “not agree at all” to (5) “totally agree”, proposed by [49]), using five items (like e.g. ‘I identify as other citizens of my town’). Likewise, the environmental identity indicator was measured to control the degree to which the locals identify their environment as an important part of their personality by two items [51]. The statements were: “I think of myself as someone who cares about the environment” and “I think of myself as someone engaged in environmental activities of my town”, where the participants rated the extent to which they agree with them on the same scale.

Trust. Secondly, people include their personal evaluation of the trustworthiness of the institutions implicated in risk management [52], especially when they cannot manage risks on their own. Statements related to trust in science [53] and in institutions [51] were divided into two groups, the former related to science in general, scientists and scientific information, the latter related to media, associations, national and regional government and public institutions involved with risk management, valued on Likert 5-point scale. The items were averaged into two indicators: trust science and trust state.

Source of information about risk. In addition, the respondents were asked about their source of information about natural risks. Based on the factor analysis the source of information ‘family members, friends, acquaintances’ was left out, and other answers were grouped in two indicators: local source of information (school, municipality, associations) and distant source of information (traditional media, internet, social media networks). Finally, we added some practical measures and we asked respondents to rate the extent to which they think those measures could help to fight natural phenomena in their municipalities (on Likert 5-point scale). Three measures were proposed on municipality level (increase green area, reduce threats on marine ecosystems, protect coastal marine wetlands) and averaged into an environmental measures indicator; three measures on personal level (recycle, use public transport, eat more organic) and averaged into a personal measures indicator. The last three measures were related to direct investing: to improved infrastructure, to general insurance compulsory for everyone, and to personal insurance based on the market offer.

Those independent variables were used in the binary logistic model in order to describe the dependent variable invest money to protect from the future risks. All independent

demographic and constructed variables used in the binary logistic regression are listed in the Table 1a in the Appendix.

2.3. The contingent valuation exercise

There are different techniques for estimating the value of non-market goods. The most relevant distinction is between revealed and stated preferences. Revealed preferences estimate the value of the price of an environmental good by assessing how the presence of the environmental good affects a market good [57]. The example is the hedonic price technique, which assesses the effect of the presence of an environmental asset on property (building) prices. Stated preferences, on the other hand, estimate the value of the environmental asset by asking people to indicate the value for the asset under analysis through the elicitation of WTP or the willingness to accept. Contingent valuation (CV) and choice experiments (CE) are the most recognized methodologies.

CV is a methodology created by environmental economists to attribute an economic value to non-market goods, such as environmental goods. Today it is also used for goods with a 'thin' or incomplete or new market, so as to collect information on consumer preferences. CV is used when only one specific characteristic (the so-called 'attribute') is relevant for the analysis or when the good is a single attribute good, where attributes allow specifying the valued improvements [55]. The basic assumption is that the value of an asset is linked to the utility it generates: in the economic theory, utility is the total satisfaction received from a consumed good or service. Economists state that the rational consumer acts to maximise his utility. The value may arise from the direct or indirect use of the good itself, from the will to keep it for personal future use, for future generations or from the existence of a specific environmental asset regardless of the possibility or willingness to use it.

CV estimates the total economic value (TEV) of an asset through WTP to avoid a loss of utility or the willingness to accept some money as a compensation for accepting the loss of the good/utility [55].

CV questionnaires follow specific protocols to provide correct information on the evaluated good and avoid biases that could affect the estimation [56]. To elicit WTP, we design a hypothetical, but likely scenario (the contingent scenario) that reproduces a market situation where the respondents must decide if they accept the proposal or refuse it. In this analysis, we adopt a double-bounded dichotomous choice, with a first price offer, followed by a second increasing offer if the first offer was accepted, or by a decreasing offer if the first offer was refused. For a more detailed description on the methodology you could refer to [45].

A compulsory insurance system is used as a payment vehicle in this paper, as proposed by the European Commission to promote risk awareness prevention and mitigation [47].

However, to be effective, this proposal needs to solve several issues in the insurance market, including information asymmetry that determines consumers' distrust in insurances, especially in some countries, Italy included. Under this context, it is relevant to analyse the interest of people who live in areas affected by extreme events related to climate change in purchasing insurance. In order to provide useful indication to policy makers and to improve the Italian insurance market, a preliminary information on the WTP for purchasing insurance and its determinants will be determined by the contingent valuation exercise.

Our scenario of the contingent valuation exercise was the last part of the questionnaire, as follows:

"Imagine that you have to take out compulsory insurance against disasters resulting from climate change (but not from the other natural risks seen above) to protect the house where you live. Suppose that this insurance is paid once per year depending on the characteristics of your home and that also those living in rental accommodation have to insure themselves. If you had to pay insurance equal to: (BID) per square meter, would you be willing to pay?"

The bids proposed are the following:

First bid	Second bid if first answer is NO	Second bid if first answer is YES
0,75	0,65	0,85
0,85	0,75	0,95
0,95	0,85	1,05

Several questions on the housing characteristics are added to the questionnaire to take into account differences in house size, age, type etc.

The aim of our CV exercise is twofold. On one side, the objective is to evaluate the risk awareness of the climate change through the elicitation of WTP of residents in Arborea, Cabras and Oristano to protect their houses. On the other side, we aim to assess the willingness to invest one's own money in the protection, using an insurance. Additionally, an analysis of the determinants of WTP has been performed.

All used variables in the contingent valuation exercise are listed in the Table 1b in the Appendix.

3. Results

3.1. The locals are poorly familiar with the wetlands' role in natural risks mitigation

When asked to self-assess their level of information related to different natural hazards, the respondents answered mainly that they considered their level of knowledge to be average, being the least informed on landslides and the most on heatwaves.

However, when respondents were asked to evaluate the statements related to a set of natural hazards as correct or incorrect then the results presented a more complex pattern (Table 2). The locals showed the best knowledge related to floods and drought, where more than 90% of respondents correctly evaluated the statements describing these hazards (*'Inappropriate land management combined with climate change can intensify drought and lead to desertification.'* and *'In Sardinia there is no real danger of floods because floods can only happen if we live near large rivers that are not present on the island.'*). The respondents were less familiar with climate change (around 70%). Surprisingly, a large number of respondents is apparently not familiar with risks associated with erosion and coastal storms.

'Coastal erosion is a very slow process that takes hundreds of years and is unrelated to rising sea levels and the frequency of storms.' was a piece of information correctly evaluated by only 15% of respondents. And the statement *'Coastal wetlands are among our first defence against coastal storms because they slow down the speed of the wind.'* received only 22% of correct evaluations, with 49% 'don't know' answers. Precisely this piece of information on wetlands shows how one of their main regulatory services remains unrecognised by the very inhabitants of these wetlands. This indicates a clear gap between lay and expert knowledge about the benefits that wetlands provide to areas confronted with coastal hazards.

Table 2: Level of information related to natural phenomena

Natural phenomenon	Correct answer		Incorrect answer		Don't know	
	N	%	N	%	N	%
Flood	**163**	92.6	6	3.4	6	3.4
Drought	**159**	90.3	2	1.1	14	8.0
Landslide	**144**	81.8	12	6.8	19	10.8
Sea level rise	131	74.4	10	5.7	33	18.8
Heatwave	130	73.9	11	6.3	34	19.3
Climate change	126	71.6	9	5.1	38	21.6
Wildfire	122	69.3	13	7.4	40	22.7
Earthquake	76	43.2	59	33.5	40	22.7
Coastal storm	**39**	22.2	49	27.8	86	48.9
Erosion	**27**	15.3	108	61.4	38	21.6

However, when asked to evaluate the list of proposed measures that could help in reducing damage by the natural hazardous events (on the scale 1 to 5), the locals seem to recognise the need of protecting coastal wetlands, as well as the need of an integrated coastal wetlands management, although their main concerns are waste reduction and better management of water resources (Figure 4). Other benefit of wetlands is the improvement of water cycle and water management, which is another reason why promoting healthy state of wetlands to local population should be part of an environmental policy.

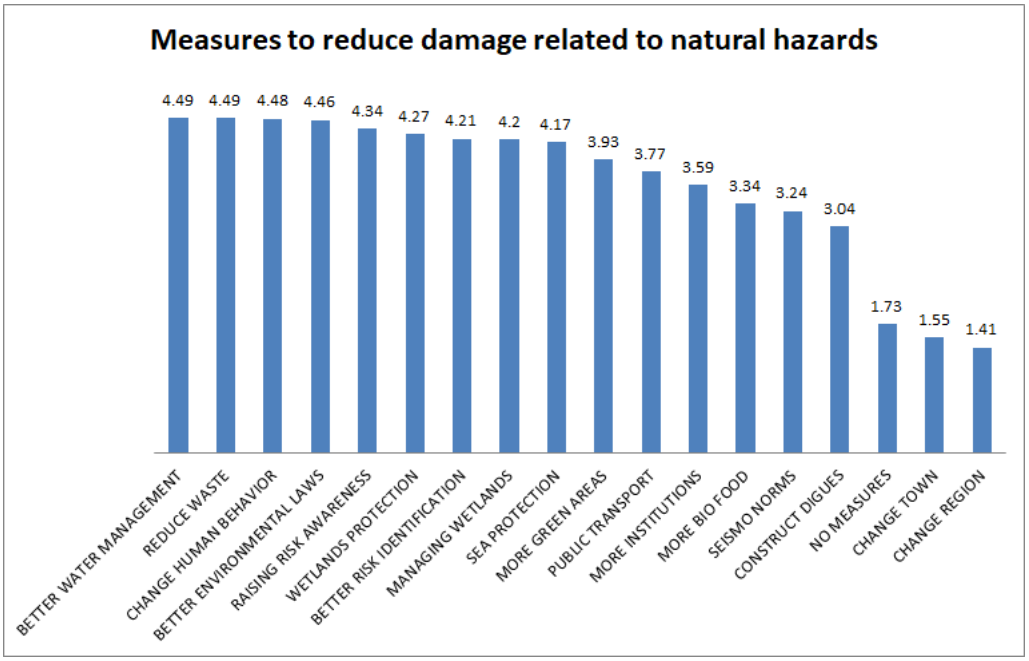

Figure 4: Locals name waste and water resources, as well as behaviour, laws, awareness sessions and protecting wetlands as main measures that could help reducing damage related to natural hazards.

3.2. Explaining future willingness to invest based on actual risk awareness

Readiness to invest money in order to protect from future natural hazards was analyzed through a binary logistic model. Readiness to invest money was regressed on three blocks of variables. The first block included demographic variables of gender, age, municipality, education, annual net income, surface of housing, number of family nucleus members and number of kids under 12 years old. The second block was for risk awareness, information self-assessment, actual information, as well as for the belief in climate change. The last block included variables that we hoped could clarify more which profiles are up to risk investing: trust (science and state), environmental identity, place attachment, source of information (local or distant), measures to take (personal, environmental, infrastructure, general insurance or personal insurance). Results are presented in Table 3.

Table 3: Binary Logistic model of future financial precautionary behaviour (N=112)

Block	*Predictor*	*-2 Log-likelihood*	*Nagelkerke R^2*	*Chi²*	*Df*	*Sig*	*B*	*SE*	*Exp(B)*	***95% C.I. for Exp(B)*** *Lower*	*Upper*
1		104.683	.314	27.452	10	.002					
	Arborea						.385	.753	1.470	.336	6.433
	Oristano						-.416	.631	.659	.191	2.273
	Gender						-1.233*	.537	.291	.102	.836
	Age < 36						.841	.703	2.320	.585	9.196
	Age > 58						-2.201**	.673	.111	.030	.414
	Education						.393	.570	1.482	.485	4.527
	Net Income						.198	.253	1.219	.742	2.001
	Family Nucleus						.006	.206	1.006	.672	1.507
	Kids < 12						-1.423	.748	.241	.056	1.045
	House m²						-.262	.572	.769	.251	2.361
2		94.411	.413	37.724	15	.001					
	Arborea						.491	.851	1.633	.308	8.662
	Oristano						-.341	.680	.711	.187	2.698
	Gender						-1.346*	.606	.260	.079	.854
	Age < 36						1.469	.830	4.345	.855	22.090
	Age > 58						-2.204**	.753	.110	.025	.483
	Education						.349	.607	1.418	.432	4.656
	Net Income						.196	.275	1.217	.710	2.084
	Family Nucleus						-.072	.241	.930	.580	1.491
	Kids < 12						-1.561	.813	.210	.043	1.033
	House m²						-.647	.642	.524	.149	1.843
	Actual Information						.952	.795	2.592	.546	12.302
	Risk Awareness						.895	.877	2.447	.438	13.662
	Information Self-Assessment						-.232	.545	.793	.273	2.306
	High Belief in Climate Change						1.967*	.776	7.152	1.562	32.742
	Low Belief in Climate Change						-.323	.569	.724	.237	2.210
3		72.792	.594	59.344	26	.000					
	Arborea						.765	1.077	2.150	.260	17.750

	Oristano		-.343	.863	.710	.131	3.856
	Gender		-2.111*	.851	.121	.023	.642
	Age < 36		2.569*	1.280	13.057	1.063	160.447
	Age > 58		-2.865**	1.082	.057	.007	.475
	Education		.359	.811	1.432	.292	7.012
	Net Income		.236	.416	1.266	.560	2.862
	Family Nucleus		-.206	.348	.814	.411	1.610
	Kids < 12		-3.396**	1.265	.033	.003	.400
	House m²		-.732	.835	.481	.094	2.473
	Actual Information		.852	1.183	2.345	.231	23.833
	Risk Awareness		.917	1.011	2.503	.345	18.153
	Information Self-Assessment		-.132	.656	.877	.243	3.169
	High Belief in Climate Change		3.735**	1.263	41.897	3.527	497.692
	Low Belief in Climate Change		-.580	.948	.560	.087	3.587
	Trust Science		-.280	.820	.756	.152	3.768
	Trust State		.866	1.034	2.378	.313	18.048
	Local Source of Information		-1.286	.960	.276	.042	1.815
	Distant Source of Information		.880	.841	2.410	.463	12.530
	Infrastructure		3.582**	1.223	35.938	3.267	395.287
	General Insurance		2.813*	1.174	16.658	1.667	166.461
	Personal Insurance		3.942**	1.348	51.535	3.668	724.131
	Environmental Measures		-.825	.838	.438	.085	2.262
	Personal Measures		.063	.785	1.065	.229	4.956
	Environmental Identity		.746	.753	2.108	.482	9.218
	Place Attachment		-1.370	.805	.254	.052	1.231

** with significance < .01 * with significance < .05

Results show that demographic variables that significantly predict 'readiness to invest' are: gender (*-2.111, p < .05*), age of the sample divided by percentiles to younger than 36 years old (*2.569, p < .05*), older than 58 years old (*-2.865, p < .01)* and having kids under 12-years-old (*-3.396, p < .01*). This result suggests that being *under* 58 and *not* having small kids is positively associated with monetary investments for natural risk protection.

Willingness to invest is also positively predicted by belief in climate change (*3.735, p < .01*), belief in investing in infrastructure (*3.582, p < .01*), in having personal insurance (*3.942, p < .01*) and in taking general insurance for all (*2.813, p < .05*). Place attachment is a marginally significant negative predictor (*-1.370, p < .1*) (Nagelkerke R^2 = .594). The environmental identity and both trust indicators were not significantly associated with willingness to invest money in future protection.

3.3. The econometric analysis reveals several interesting results

One important step in the CV analysis is to identify the correct sample size to estimate the willingness to pay. We need to identify those respondents who refused to pay any amount (the so-called "No-No" answers) because the proposed amounts (bids) are not affordable for them. They can be included in the CV sample because they are expressing their correct willingness to pay (so they "entered the market").

However, in a CV exercise, it could happen that part of the respondents refused to "enter the market", i.e. that refused to pay for several other reasons. For example, those who disagree with the policy or tool proposed (they think that the Government has to avoid damages and protect citizens and refund them for damages) or they do not trust in the payment method (i.e. they do not trust in insurance), or for some other reasons and therefore they did not express a real valuation of the bid offered. These respondents are not expressing their correct willingness to pay (so they "do not enter in the market") and are considered by the CV literature as a "protest vote" that needs to be excluded from the sample [45]. As suggested in Strazzera et al. [79, 80], we performed a Heckman model for sample selection in order to avoid the existence of selection bias, jointly estimating the probit model for the WTP and the "entry into the market" choice (i.e. the dependent variable is a dummy where 1 means that the respondents decided not to express a protest vote and 0 otherwise). The Wald test rejects sample selection.

In order to identify the group of people that expresses a "protest vote", a follow-up question has been inserted in the questionnaire and addressed to those that refused to pay any amount. The follow-up question provided information on the reasons to refuse to entry in the market: most respondents stated that they do not want to pay any additional compulsory amount (55%); others stated that they do not trust in insurances or that they are not interested in home insurance (20%); some stated that an insurance against climate change damage is not necessary where they live (12.5%); others finally stated that regional government should compensate damage or invest to find a solution (12.5%) (similar results as in [43]). We kept in the final sample those respondents that declared in a follow-up question that the amounts (bids) proposed were not affordable, while we excluded all the respondents that stated that they refused to pay for any other reason: After doing that, it turned out that 27% of respondents expressed a "protest vote" (Table 4) and were left out

from the final sample. Protest vote percentage can vary widely, based on the specific territorial and sociodemographic context: however, in work that analysed the results of a CV study made in the same area of Sardinia, close to the city of Oristano, the protest vote amounts to 29% [45]. In a similar analysis, this time from the North Italy (Veneto), 37% of respondents indicated a zero WTP and only 23% of these respondents stated that proposed insurance was not affordable for them [43].

Nevertheless, it could be useful to understand the characteristics of those that express a "protest vote". Table 4 shows the result of the probit model where the dependent variable is a dummy with 1 that indicates people who express a protest vote, 0 otherwise. Results indicate that respondents who collect information on natural risks through social networks and respondents who have already invested money to protect themselves and their houses have an inferior probability to refuse to pay. Additional correlation analysis shows that the latter category of respondents is especially sensitive to the sea-level rise consequences and prefers having an additional supporting tool. Concerning the dummies for municipalities, residents in Oristano (the largest city included in the study) have an inferior probability to express a protest vote than residents in Cabras, while the coefficient in Arborea indicates no statistically significant differences.

Table 4: Probit model for protest vote analysis

	Coefficient	Robust Std. Err.
Invest money	-1.877***	0.267
Informed through social network	-0.672***	0.250
Arborea	-0.276	0.320
Oristano	-0.709**	0.304
Constant	1.149***	0.318
Log pseudolikelihood = -64.50		
Wald test (chi-squared, d.f. 4) = 51.25; p-value = 0.0000		
Pseudo R^2 =0.36		

After removing the protest votes from the sample, the sample includes 129 observations. To check if the second bid could be affected by some elicitation bias, a Bivariate Probit model was estimated. If Bivariate model coefficients are not significantly different, the underlying value distributions can be considered as equivalent, i.e. no significant response bias affects the validity of the estimates [81]. The Wald test indicated that we can jointly estimate first and second bid. Additionally, the t-tests on the coefficients on a bivariate

probit model indicate that we can use the double bound model because the second bid answers are unbiased: considering that questionnaires were unbalanced with respect to the bid, we add a weight to the biprobit and the double bound models to correct the bias.

We follow [82] where the author proposed a Stata estimator to estimate the double-bounded dichotomous choice model for contingent valuation proposed in [83] using the maximum likelihood (under the assumption of normality). As reported in [82], Haab and McConnell (2002)[84] refer to this model as the Interval Data Model.

Due to the proposed scenario, we consider, as the price variable, the annual premium that each individual is supposed to pay per year, i.e. the proposed price multiplied by the total square meters of the house.

The data indicate that, on average, respondents are willing to pay 143.68 euros per year for an insurance that protects an their houses from climate-related extreme weather events: we cannot compare our results with those found in the Veneto case study due to the differences in the elicitation model (open-ended questions) and in the proposed scenario [43][6].

Table 5. Double-bound model of WTP to insure their house

Double bound estimation	Coefficient	Std. Err.	Confidence Interval
Annual premium (willingness to pay)	143.68***	14.94	114.40 – 172.95

The model with covariates (all the covariates were tested in the Heckman sample selection model and the correlation was checked) indicates that, as expected, respondents with a lower family income have a lower WTP than other respondents. Respondents who stated that they received enough information on the state of the local environment and participated in a local environmental initiative have a lower WTP for an insurance that will protect houses against extreme weather consequences. This result may appear counterintuitive: we notice that people who work in agriculture, fishing sector and forest management have a high probability to be included in this group. In our case study, these categories experienced the negative consequences of natural hazards, including climate-related extreme weather events (floods), in their economic activities. They could be more interested to preserve the arable land or the lagoon than their houses. In addition, the respondents that participate in local environmental activities and consider themselves to be informed about the state of the local environment tend to be associated with lower

[6] In the case study from Veneto, the respondents were asked to consider a limited coverage for the building (excluding furniture), with a coverage of 50% of the value of the building and a deductible of 5% of damage suffered.

education and live mainly in Arborea. Residents in Arborea demonstrated to be really proactive to preserve their territory and especially the lagoon, but they experienced several floods in the past that affected the countryside and not the village itself, so they could believe that they do not need to protect their houses more.

On the contrary, people who live close to the sea (less than 1 km away from the coast) show a higher WTP: it is easy to understand that they could be more willing to pay as an intuitive result, as they are more easily subject to extreme weather events, although so far storm surges are more frequent and have done more damage on the east coast of Sardinia (Table 6). Additional analysis, in the future, could better understand the effect of the distance on risk perception in the coast areas in Sardinia.

Table 6: Willingness to pay analysis

	Coefficient	Std. Err.
Infoactivists	-35.59**	19.06
Sea distance < 1 km	430.26***	88.51
Low income	-40.80*	22.17
Constant	82.02***	17.09
Log pseudolikelihood = -58.25		

4. Discussion

Individual and social variables have a key impact on how climate change-related risks are locally managed [e.g. 36, 67]. In order to build efficient disaster mitigation plans, local particularities of the site-specific case studies need to be recognized. For that reason, in the West Sardinian case study of the Gulf of Oristano, wetlands should be a showcase study. Wetlands are a nature-based solution to tackle climate change-related hazards, such as coastal storms, floods and sea level rise, by providing regulating services. The question is whether the local population is aware of those services and whether it perceives a need to protect their belongings from possible future events related to climate change.

However, although local population seems not to be aware of wetlands' regulatory services, it does consider that wetlands should be protected and managed and is willing to invest in order to mitigate climate change-related impacts on their houses. The result of our study can provide useful indication to policy makers in charge of climate change adaptation in Sardinia, taking into account the actual change of the regional environmental law allowing further coastal construction on the island.

4.1. More awareness sessions should be organised in order to promote the benefits of wetlands

Based on the results from our survey, the locals from the Gulf of Oristano, although living in an area of wetlands with even 6 Ramsar sites, do not seem to be fully aware of the benefits of wetlands related to coastal hazards. That is evident from the response of only 22% of the respondents that are aware that coastal wetlands protect us from coastal storms by slowing down the speed of the wind. This leads to a conclusion that more risk awareness sessions on wetlands should be organised, since the respondents claim that the management of water resources has to be achieved in an efficient way, while calling for more informative campaigns. In that way they can be informed about wetlands' utility not only for risk management, but also for sustainable water ressource management, among other environmental benefits.

4.2. Variables explaining future investing speak about the locals from the Gulf of Oristano

If we consider investing money against risks related to climate change as one of the indicators of risk awareness, then locals from the Gulf of Oristano are aware of risks. Being young or middle-aged, being possibly better off and without incurring the cost of raising children, seem to be variables impacting the investment. It is even more reasonable that those that are ready to invest do believe in climate change and chose measures of improved infrastructure, general and personal insurance. The influence of the belief in climate change on investing money ($3.735, p < .01$) is in line with the recent Canadian study [67] that showed the impact of the climate change perception on WTP in Halifax, as well as in the German study [36], which showed that perception about the consequences of climate change is one of the factors influencing the uptake of private precautions.

On the other hand, place attachment ($-1.370, p < .1$), is a marginally significant predictor. According to this piece of information, those that are more informed about risks from their schools, municipalities or local associations, as well as those more attached to their municipality, do not seem likely to invest money in order to protect from future climate change-related risks. This can be explained with the fact that the local population is likely to rate environmental problems as more severe on the global than on the local level, as elaborated in the review [54], i.e. the local patriots believe how it is always better and safer in their territory than '*far away in the world*'. Besides, compared with [64], where it was found that risks perceived to be of higher probability, such as global warming, could be understood as less catastrophic or urgent, add to the explanation of why place attachment and belief in climate change contribute to the model in a different way, which is questionable. However, there is no clear-cut answer to relation between place attachment and risk perception, with both positive and negative relationship detected [54]. In addition,

the high psychological distance of the climate change processes, perceiving the climate change concept as abstract or distant, could justify the weak relationship [87].

4.3. Contingent valuation results could be a strong input for risk policy

In Italy, the insurance market is weaker than in other European countries [73]. Housing insurance products offered in the Italian market very rarely include the protection from climate-related extreme weather events consequences.

In addition, citizens are not interested in buying insurance [74], because they are aware of the existence of public subsidies that could refund damages caused by climate change events, such as floods. However, in recent years, climate-related extreme weather events have happened more and more often, leading to a significant increase in expenditure for public bodies responsible for compensation. As these events are expected to become even more frequent in the future, the European Union is considering introducing insurance mechanisms to deal with climate-related extreme weather events [47, 48].

The result of our study can provide useful indication to policy makers that are in charge of adaptation measures to climate change. The basic idea is that if citizens invest their own money, they are more attentive to the consequences of their actions and decisions and may therefore decide to avoid certain choices, knowing that they will have to bear the costs. Currently, as the damages caused by climate-related extreme weather events are reimbursed by public administrations, citizens may have no incentive to adopt the most efficient behaviour.

4.4. Limits of this study

There are several limitations of this study that need to be mentioned. Our sample underestimates the male population and the average age, and overestimates the household size. The sampling was most random and objective, although the study was done without the assistance of a specialized recruitment agency. The participants of this study were therefore not sampled by standards of a professional recruitment procedure, paying attention to socioeconomic status, as it was the case in ex. [26], due to limited resources allocated to the study. Moreover, the questionnaire was qualitative and long and the participants were not compensated for their time, and there was, consequently, some withdrawal. Although we agree that the study could always be improved, we claim that the local awareness on wetlands can, nevertheless, be successfully captured, and this could help in the further policy development process in the specific Mediterranean and global contexts.

4.5. Future perspectives

To better assess climate change impacts such as sea-level rise, coastal storms and floods on the environment and human societies, more local case studies with culturally different contexts are needed [15, 19], which is the case also for Sardinia and the Mediterranean basin. These studies would not only improve the understanding of environmental responses to natural and anthropological forcing factors but they would also improve risk assessment and strengthen the societal resilience, according to suggestions and objectives of the UN Sendai Framework of Disaster Risk Reduction. Further coastal Mediterranean case studies should be implemented to test if the WTP in order to protect is mainly influenced by perceived risk, as demonstrated in the Canadian [67] or Chinese [60] case study, by the population's financial position, as shown in the case study from Pakistan [61], or by a more complex combination of socio-economic variables, as it is suggested in German [36] or the case study at hand.

In addition, socially shared memories are protective elements to populations. In this sense, the historically high inflow of new population around the Mediterranean basin with different cultural and social backgrounds might increase local vulnerability, since new inhabitants do not necessarily share histories about environmental risks specific for their new territory. Without risk memory these people might be lacking a local social support. Then, the divine component and fatalism as disaster risk mitigation tools should also be tested, since there could be both locals and immigrants believing in divine punishment or that nothing could be done against natural hazards. There is thus a growing need to tackle immigrants' awareness of local risks, by organising risk sessions and instructing about, for example, the big November 2018 flooding or strong coastal storms *mareggiate,* as well as about the means of protection, benefits and ecosystem services that wetlands give to this territory.

4.6. Conclusions

Wetlands are one of the nature-based solutions to mitigate climate change-related natural risks and with this paper we contribute to risk reduction in the territory of West Sardinia by providing useful information to decision makers in charge of adopting climate change mitigation measures. The concept of nature-based solutions is very recent and in Italy it is being established only now. People do not see wetlands (or any other type of natural environment) as an opportunity, but as a landscape and that is all. In the case of wetlands, in reality, the notion persists that they are only useful to produce billions of annoying mosquitoes.

There is, hence, a need for awareness sessions, not only on wetlands exclusively, but on nature-based solutions in general, ecosystem services and risk mitigation measures. The question of environmental protection of Sardinian coasts is more than actual today, given

the promulgation of a new environmental law which permits more construction even within the mandatory 300 m coastal strip. In light of the ongoing climate change impacts on the Mediterranean coasts, such law certainly does not contribute to a successful climate change mitigation of the Sardinian coasts.

The results obtained from the analysis of the determinants of WTP are in line with those already found in the literature. The data indicate that the annual WTP for an insurance that protects the house from climate-related extreme weather events is equal, on average, to 143.68 euros. In fact, most respondents accept to pay for a private insurance as a measure to mitigate climate change risk. It is often discussed that those who are insured reduce their attention and make fewer investments thinking they are covered by insurance. In West Sardinia, however, people who have already invested in measures to reduce the damage caused by climate change are also more willing to pay to get insurance. Experience and risk awareness seem to play a relevant role in the decision to adopt a private mitigation measure, as demonstrated by some of the variables in the model. Concerning the protest vote expressed by 27% of the sample, distrust in insurance and the belief that the state should pay for damages is the main motivation.

All these elements could provide useful indication to decision makers in charge of adopting climate change mitigation measures. Due to a lack of analysis on climate change and flood insurance adoption, the results of the study play an important role at national, Mediterranean and global level, despite limited sample size.

Appendix

Table 1a: Variables used in the binary logistic regression.

Variables	Description	Category	N obs.	Mean	St. Dev.	Min	Max
ARBOREA	Demographic	Dummy	176	.2727	.44663	0	1
CABRAS	Demographic	Dummy	176	.2727	.44663	0	1
ORISTANO	Demographic	Dummy	176	.4545	.49935	0	1
GENDER (female = 1)	Demographic	Dummy	176	.55	.499	0	1
AGE < 36	Demographic	Dummy	176	.2614	.44063	0	1
AGE > 58	Demographic	Dummy	176	.2614	.44063	0	1
EDUCATION	Demographic	Dummy	176	.6250	.48550	0	1
NET INCOME	Demographic	Continuous	155	2.12	1.142	1	6
FAMILY NUCLEUS	Demographic	Continuous	166	2.94	1.374	1	9
KIDS < 12	Demographic	Dummy	174	.18	.384	0	1
HOUSE m²	Demographic	Dummy	155	.3032	.46114	0	1
ACTUAL INFORMATION	Constructed	Dummy	173	.7630	.42647	0	1
RISK AWARENESS	Constructed	Dummy	176	.1591	.36680	0	1
INFORMATION SELF-ASSESSMENT	Constructed	Dummy	167	.5090	.50142	0	1
HIGH BELIEF IN CLIMATE CHANGE	Constructed	Dummy	170	.3118	.46458	0	1
LOW BELIEF IN CLIMATE CHANGE	Constructed	Dummy	170	.5471	.49925	0	1
TRUST SCIENCE	Constructed	Dummy	167	.4551	.49948	0	1
TRUST STATE	Constructed	Dummy	167	.4970	.50149	0	1
LOCAL SOURCE OF INFORMATION	Constructed	Dummy	169	.5503	.49894	0	1
DISTANT SOURCE OF INFORMATION	Constructed	Dummy	169	.5266	.50077	0	1
ENVIRONMENTAL IDENTITY	Constructed	Dummy	174	.5805	.49491	0	1
PLACE ATTACHMENT	Constructed	Dummy	169	.5266	.50077	0	1
INFRASTRUCTURE	Additional	Dummy	169	.3609	.48170	0	1
GENERAL INSURANCE	Additional	Dummy	169	.2367	.42631	0	1
PERSONAL INSURANCE	Additional	Dummy	169	.2367	.42631	0	1
ENVIRONMENTAL MEASURES	Additional	Dummy	167	.5689	.49672	0	1
PERSONAL MEASURES	Additional	Dummy	167	.4970	.50149	0	1
INVEST MONEY	Dependent	Dummy	171	.6316	.48379	0	1

Table 1b: Variables used in the contingent valuation exercise.

Coefficient	Category	N. Obs.	Mean	Std. Dev.	Min	Max
Female	Dummy	176	0.55	0.50	0	1
Age < 40	Dummy	176	0.33	0.47	0	1
House age < 34	Dummy	176	0.5	0.5	0	1
m^2 < 100	Dummy	176	0.37	0.48	0	1
Sea distance < 1 km	Dummy	176	0.02	0.14	0	1
Informed activists	Dummy	167	0.50	0.50	0	1
Low income	Dummy	176	0.31	0.46	0	1
Informed through social network	Dummy	176	0.64	0.48	0	1
Already invested money in mitigation measures	Dummy	171	0.63	0.48	0	1
Arborea	Dummy	176	0.27	0.45	0	1
Cabras	Dummy	176	0.27	0.45	0	1
Oristano	Dummy	176	0.45	0.50	0	1

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