urban science

MDPI

Article

Water Management in Urban Sprawl Typologies in the City of Alicante (Southern Spain): New Trends and Perception after the Economic Crisis?

Álvaro-Francisco Morote [1,*], Jorge Olcina [2], Antonio-Manuel Rico [2] and María Hernández [2]

[1] Department of Didactics of Experimental and Social Sciences, University of Valencia, 46010 València, Spain
[2] Regional Geographic Analysis and Physical Geography Department, University of Alicante, 03690 Alicante, Spain; jorge.olcina@ua.es (J.O.); am.rico@ua.es (A.-M.R.); maria.hernandez@ua.es (M.H.)
* Correspondence: alvaro.morote@uv.es

Received: 24 September 2018; Accepted: 2 January 2019; Published: 7 January 2019

Abstract: In recent decades, territorial transformations have occurred on the Spanish Mediterranean coast due to the real estate bubble (1997–2008). The objectives of this research are: (1) to analyse the domestic water consumption trend in the study area ("Beach Sector" of the city of Alicante, Southern Spain) (2000–2017); and (2) explore water use and the characteristics of detached houses and how its residents have introduced water-saving measures to reduce consumption after the economic crisis in the study area. A review and analysis of data on housing and population has been carried out where this urban development type has been implemented. Moreover, surveys of the residents have been conducted in order to determine and analyse water consumption, and the perception and knowledge used to reduce water consumption in detached houses. The results show that consumption decreased between 2000 and 2017 due to different factors and there was no change in the water consumption trend at the end of the economic crisis. In view of the conclusions, it should be mentioned that this reduction has been associated with a greater environmental awareness of the need to save water, the installation of systems that use water more efficiently and water-saving devices. All of this is aimed at reducing the water bill that has been exacerbated by an increase in water prices seeing as this is the type of property that consumes the most water.

Keywords: economic crisis; urban sprawl; consumption; water; Alicante

1. Introduction

The intensive socioeconomic development recorded in European countries since the second half of the twentieth century has, among other aspects, led to a change in lifestyle and an increase in urban-residential areas [1]. In the 2000s, different reports that were prepared by the European Environment Agency such as the State of the Environment [2] and Urban Sprawl [3] highlighted that in the previous twenty years, built-up areas in Europe had grown by 20% and they highlighted the possible repercussions of this dynamic on resources such as land and water, energy demands or the generation of waste [4].

Since the beginning of the twenty-first century, significant morphological and social changes have been taking place in many Spanish cities [5]. During the aforementioned real estate boom, the total number of properties in Spain increased by almost five million (25%) between 2001 and 2011 [6]. Until 2008, in Spain, urbanized and built surfaces increased, together with processes of expansion and the modernization of cities. This has produced contradictions and internal conflicts linked to the overconsumption of resources (land, energy, water) and pollution (air, water, heat islands, urban solid waste) [7–9].

One of the features that characterize the Spanish Mediterranean coast as a result of the recent real estate boom (although its origin has been related to the spread of urban-residential uses since the end of the 1960s) has been the spread and generalization of low-density urban types ("urban sprawl") [10]. In some areas of the Alicante coast, this urban sprawl represents 60% of the total built area [10]. Its expansion is related to the search for less dense, congested urban spaces rather than the town centres and the expansion of residential-tourism development in coastal areas [11]. This type of development is characterized by the presence of outdoor elements, such as gardens and private swimming pools, that consume high amounts of water compared to the traditional compact urban model [12–15]. In this respect, in Australia, Hurd [16] states that approximately half of the water used by these households goes to watering the garden and/or filling up the swimming pool. This development type has also spread in other European Mediterranean countries, such as France [17], Italy and Greece [1], along with in tourist and residential areas of the United States [18], Australia [19], Japan [20] and South America [21].

Despite the significant development of garden areas associated with urban sprawl and their impact on water consumption, the demand generated by these spaces is a topic that has only recently been dealt with in Spanish scientific literature [4]. Relatively little is known about the characteristics of these spaces or the behaviour of their owners. Furthermore, there is a tendency to think that single-family gardens use water in excess as a result of the lack of knowledge about gardening or the low cost of the resource. In Spain, recently, a few studies that consider these lines of research have been carried out in the Metropolitan Area of Barcelona, Girona, Granada, Balearic Islands, Seville, Zaragoza and, in recent years, on the coast of Alicante [4].

The increase in urbanization associated with the real estate boom and the proliferation of urban sprawl development types have demonstrated the unsustainability of the model established due to the high levels of water consumption required [10]. This situation gets worse in periods of drought. However, in the majority of European and Spanish urban agglomerations a drop in water consumption has been observed since the middle of the 2000s [11,22,23].

It is therefore necessary to gain more insight into the factors affecting domestic water consumption and their interrelationships. Studies on water conservation, and especially those on urban water conservation in the developed world [24], have mainly focused on certain areas of North America [25] and Australia [26]. By examining other environmental settings, a wider variety of factors influencing water conservation practices can be assessed more comprehensively. Most notably, the considerable influence of different community water consumption models and the potential of urban and regional planning for water conservation have to be put at the forefront of research and practices on this topic [27]. This is of vital importance in terms of planning future water demand scenarios, taking into account continued urban population growth, episodes of water stress, drought events and the impact of the climate change on the availability of water resources, among other issues [28,29]. Various aspects of the factors affecting the levels of demand for water resources have become priority research topics in recent decades, especially in water-stressed areas that have experienced particularly intensive urban development processes [30]. The relationships between these factors must be analysed along with the changes in water-saving behaviour [31–37]. In the last few years, studies have also been carried out in Europe that analyse the reasons why water consumption has decreased [11]. Numerous studies associated with these results have come up with possible reasons for this decrease that include:

(a) Technological innovation associated with installing new water-efficient appliances as well as water saving devices at home (taps, bathroom fittings, etc.), which have become popular since the late 1990s [22].

(b) Greater environmental awareness among the populace about saving water, thanks to more organized campaigns, especially in times of drought [23,38]. Interesting results have been obtained in the studies about the reduction of water consumption outdoors. In recent years, homeowners have greater environmental awareness. This becomes obvious, for example, in the typology of their gardens, where native species that adapt better to the local environment and

require less water are becoming more popular. This was confirmed in a study by Morote and Hernández [39], who reported a change among homeowners from having central and northern European to Mediterranean-type gardens, which adapt better to the climate of the southeast Spanish coast.

(c) The economic crisis has led to a drastic fall in incomes and increased unemployment. One of the strategies used in response to this significant downturn has been to cut back on all domestic consumption, including water, especially among the middle classes [22].

(d) Water rates and prices have increased at a time when family incomes have dwindled.

(e) The efficiency of the Water Company supply networks has improved.

(f) Drinking water has been replaced by non-conventional water sources (reclaimed water and rainwater) for public water, private gardens (in some residential areas) and street cleaning [40].

(g) An aging population. Morote et al. [11] observed that one of the reasons behind the drop in domestic water consumption along the Mediterranean coastline was the increase in the senior population and the loss of a younger population due to migration that was prompted by the economic crisis, which erupted in 2007. These authors reported that a person aged 65 or more consumes 25% less water than the previous population segment (18 to 64 years).

The interest for the topic of study is accentuated in the case of the city of Alicante since water has always been a resource of vital importance in view of its scarcity and the increase in demands as from the second half of the twentieth century [41]. In terms of supply sources, in south-eastern Spain, in order to guarantee the growing demands for water, both for the agricultural sector and for urban-tourism uses, traditional water solutions have opted for the exploitation of aquifers and water transfers [42,43]. Furthermore, more recently, non-conventional sources (desalination and reclaimed treated water) have been used [44]. These measures have been complemented with increased efficiency in the use of water for irrigation and supply [44]. In addition to these factors, there is also a predominance of detached houses. This urban typology represents 60% of the total of the urban areas on the coast of Alicante [10] and it is characterised by high water consumption compared to other urban typologies. Some studies [11,22] point to the fact that more than 1000 L/day are being consumed compared to the 244 L/day in houses of the urban core. This high consumption becomes even more important if we take into account that: (1) the study area is a semi-arid region with a rainfall average of 350 mm/year; (2) the dependence on water resources from other regions (supply by the Tagus-Segura Aqueduct) and the implementation of desalination as "a new water resource" [45]; and (3) the impact of climate change in the study area, which will become apparent through the drop in rainfall and exacerbated extreme events (droughts and heavy rain). Both processes—a drop in rainfall and exacerbated extreme events—will negatively affect the availability of water resources. The growing interest in this factor is highlighted by the necessity to improve water management, the homeowners' perception of this factor (specifically, the level of relevance) and the measures they have adopted or will adopt to reduce water consumption.

As a hypothesis, it has been established that, owing to the increase in urbanization, and especially, the low-density urban development type, in recent years, cities have become less sustainable with regard to the use of natural resources (in this case water). This would have led to an increase in water consumption in the city. However, since the mid-2000s with the economic crisis, the significant increase in the price of water and the recurring drought episodes may have resulted in a change of the property owners' perception of water saving and the water use trend in urban sprawl development types. These changes may have been due to the attempt to reduce the water bill and to consume water more responsibly. Therefore, one of the research questions would be to check to see if water consumption dropped in the detached houses at the end of the economic crisis (2014) or if it continues to drop; that is, highlight the water consumption trend. Moreover, it should be pointed out that the objectives of this research are, first to determine the perception of water use and the consumption of the population, and second, to compare that perception with the real water consumption, namely, the water bills

of the owners' homes that were included in the survey carried out by the water supply company. This becomes more interesting thanks to a few papers that have related these two issues and even more so considering the climatic characteristics of Alicante (scarce and irregular precipitations) and a water demand that is higher than the existing supply, which makes this region dependent on external water resources. However, as desalination has been promoted in recent years, perhaps this is the end of the "physical scarcity" of water resources as some authors have stated [46].

The objectives of this research are: (1) to analyse the domestic water consumption trend in the study area (2000–2017), and (2) explore the water use and the characteristics of the detached houses and how property owners and residents in the area have introduced water-saving measures to reduce consumption after the economic crisis. After the introduction, which highlights the characteristics of the study area and the research problem, the materials, methods and results are described. Finally, the discussions and conclusions are presented.

2. Study Area, Materials and Methods

2.1. Period and Study Area

The period analysed in this study covers the series 2000–2017. This period was selected because: (a) it coincides with a period of noticeable decline in urban water demand since 2004–2005 [22], (b) 2008 was the year when the economic crisis erupted in Spain, (c) 2014 is the year that was characterized by the economic recovery [47], and (d) 2017 is the last year for which a full set of consumption data is available. It is worth pointing out that, for certain series of data, the period has been conditioned by the fact that it was made available by the water supply company.

An analysis has been carried out on the sociodemographic characteristics (total population and residential properties) of the study area. This includes the sector of the city of Alicante known as the "Beach Sector". This area includes residential neighbourhoods that are characterized by their obvious residential-tourism component (La Albufereta, Vistahermosa, Cabo de la Huerta and Playa de San Juan) (Figure 1) and the predominance of the detached housing urban development type [11]. With regard to demographic data, the data available at the Department of Statistics of Alicante City Council have been used (total population and evolution of the population between 2000 and 2016). As for data concerning the property type (number and type of properties), the data provided by the Spanish National Statistics Institute (INE) (latest census published of 2011) were used.

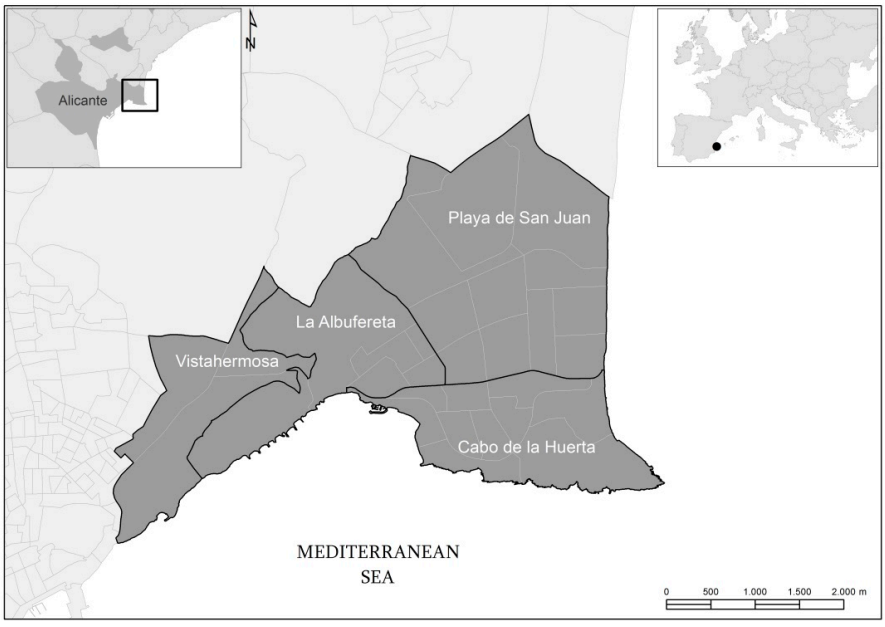

Figure 1. Study area (Beach Sector) (City of Alicante). Source: Compiled by the authors.

2.2. Water Data

The water consumption trend has been analysed, both for the city of Alicante and for the study area. This data was provided by the water supply company, "Aguas de Alicante, Empresa Mixta" (AMAEM) (2004–2017). The first year (2004) is chosen because this is the year that AMAEM began to break down the water consumption data according to the neighbourhoods and by differentiating consumption according to the users (domestic and non-domestic). It should be pointed out that AMAEM and its ownership is divided into equal shares between the City Council of Alicante and the private company *Hidraqua*, *Gestión Integral de Aguas de Levante S.A.*, a subsidiary of Aquadom (Suez Environment). Although under the supervision of the public partner, Hidraqua enjoys ample autonomy in technical decision-making [22]. Furthermore, according to the World Bank, in 1953, Alicante became the first international example of a successful water company of mixed (public and private) capital under the name of "Aguas de Alicante" [48]. Moreover, the water company has also provided information on the price of water (€/m^3) according to the different consumption tariff blocks for the 2007–2017 period. This period was chosen due to the importance of comparing consumption before and after the economic crisis.

2.3. Questionnaire Development and Distribution

Surveys were conducted (between July and December 2017) among the residents of detached houses in this urban sector in order to ascertain their socioeconomic characteristics, behaviour variables and their perception of water saving and use. The process of conducting the surveys involved visiting the detached houses in the study area. The objectives of the survey were explained to the homeowners and they were informed that their data would be processed anonymously and exclusively for scientific purposes. The survey was conducted in-person with those who were in the house at that moment. Age (over 18 years) was an essential criterion to be able to answer questions in the survey along with parity in the number of respondents.

For the survey on domestic users, the population of Alicante over the age of 18 (273,044 inhabitants in 2016) was taken into account. To calculate the representativeness of the population, the population census of the city of Alicante (Department of Statistics, 2016) was used and the population was divided up according to the neighbourhoods of the different sectors of the city. When selecting the survey sample, a margin of error of 5% and a confidence level of 90% were established. By applying these values and taking into account the global population over 18 years of age of the city of Alicante, for the population selected, a sample of 309 surveys had to be obtained (268 were necessary). For the detached houses (the target of this study), 48 surveys were conducted. Since the population census does not disaggregate between the urban development types analysed (it only differentiates the total population according to the neighbourhoods), the population aged over 18 years was calculated on the basis of the districts predominated by the detached house type (object of study) (Table 1).

Table 1. Number of surveys conducted.

	Population over 18 Years of Age	% of Representativeness	Surveys Necessary (no.)	Surveys Conducted (no.)
Urban core	227,882	81.71	219	142
Block of Flats	27,031	9.69	27	79
Terraced houses	14,292	4.30	11	40
Detached houses	14,292	4.30	11	48
Total	**273,044**	**100**	**268**	**309**

The survey questionnaire was structured into eight sections: (A) socioeconomic aspects; (B) characteristics of the property; (C) characteristics of the outside of the property; (D) characteristics of the garden and irrigation system; (E) indoor uses; (F) water consumption habits in the household; (G) behaviour variables and the perception of water saving and use; and (H) perception of drought,

climate change and water scarcity. For this study, the results obtained in sections A, C and G have been used. The results of the surveys form part of the research project "Study of water consumption and smart meters in the city of Alicante. The basis for smart water supply in a smart city" financed by AMAEM. One of the specific aims of that project was to analyse the socioeconomic characteristics and the perception of water use and savings of the population of the city of Alicante by means of conducting surveys.

2.4. Potential and Limitations

To compare the data obtained from the surveys (perception) with the water expenses of the properties, AMAEM provided the water consumption of the houses (m^3/year, 2000–2017) where the surveys were conducted. It is worthwhile highlighting the advantage of being able to use billing data provided by the water supply company. The company does not disaggregate water consumption according to urban development types. What it has done, since 2004, is to differentiate between domestic (homes) and non-domestic (shops, services, restaurants, industries, etc.), according to neighbourhoods.

The limitations involved in research on this scale should be explained and highlighted. It must not be forgotten that the surveys were conducted in the properties themselves and the post code was necessary to subsequently obtain the billing data provided by AMAEM. The signing of a confidentiality agreement with the water company allowed us, according to the postal code, to access (always anonymous data) the water consumption for the period 2000–2017 of the detached houses where the survey had been carried out.

There were a number of advantages of working with real consumption data over other methods such as analyses based on data extrapolation or using information provided by statistical agencies such as the Spanish National Statistics Institute (INE). For example, such data gave us access to information that was not available in conventional statistical sources, which do not disaggregate consumption data beyond large categories (urban, industrial and agricultural). The data analysed was also more accurate and reliable than that obtained by statistical analyses of a small number of real values. Usually, papers on this topic have focused on the population's perception of water consumption (through telephone or street surveys) or on data on average consumption obtained through extrapolations per household. Working with real consumption data is not common in Spain because it is difficult to access this information without knowing the socio-economic characteristics of the residents and their consumption perception. This is one of the main new elements of this research.

3. Results

3.1. Urban Sprawl and Water Consumption in the Beach Sector of the City of Alicante: A Development Type Characterized by High Levels of Water Consumption

The city of Alicante has undergone considerable spatial and socioeconomic transformation since the second half of the twentieth century. The area analysed in this study covers the urban districts of La Albufereta, Vistahermosa, Cabo de la Huerta and Playa de San Juan. They make up what is known as the "Beach Sector", which is distinguished by the predominance of the detached house urban development type [11]. This represents 34.43% of the total urban land of the city, the majority being concentrated in the study area [49]. In 2017, the total population of Alicante came to 329,988 inhabitants. Out of this, around 15% is concentrated in the Beach Sector for which, since the end of the twentieth century, a positive demographic dynamic has been recorded. The registered population doubled between 2000 and 2016, from 28,404 to 53,205 inhabitants, respectively (an increase of 87%). This rise is due to the spectacular increase in the urbanization in this sector, coinciding with the latest real estate boom, which has totally changed the social and landscape physiognomy of this area. With regard to the number of properties, according to the latest census of 2011, the total number of dwellings amounts to 32,745 (17.55% of the total of the city). Out of the 28,707 homes in the city, 10,480 are

located in the study area, that is, 36% of the total. This piece of data on second homes becomes more relevant if it is compared with the overall figure for Alicante, where only 15% of total properties are second homes.

In relation to water consumption it should be pointed out that, in general, in the cities of Europe and the developed world, water use has decreased considerably since the end of the 1990s [11]. In Alicante, this has been apparent since 2004 when a quantity of 30.4 hm^3 was supplied. From this date onwards, the decrease in consumption (for both domestic and non-domestic uses) has been continuous, reaching minimum figures of 22.3 hm^3 in 2013 (an approximate reduction of 25%). The slight upturn in economic activity in Spain since 2014 has not resulted in a substantial change in this trend, although it has been observed in tourist municipalities or urban residential-tourism areas owing to higher occupancy and longer stays in the second residences. Likewise, it should be mentioned that during the years 2015 and 2016, the water supplied in the city increased compared to 2014 owing to the climate conditions, such as drought and heat waves, uses related to the watering of both private and public gardens and to the increase in the number of users connected to the network.

In 2017, the total amount for domestic water billed in the study area represents 26.87% compared to the total for the city of Alicante. In the Beach Sector, the water supplied for domestic uses (consumption in households) decreased by 6.18% from 4.02 hm^3 to 3.77 hm^3 (2004–2017). The trend for the city of Alicante is, therefore, reproduced (a decrease of 13.47%), although somewhat more attenuated. When a more detailed analysis is carried out, two very different realities are observed: (1) urban districts where domestic water consumption has been reduced (La Albufereta with −15.50% and Playa de San Juan with −11.81%); and (2) urban districts where its use has remained the same or even increased (Vistahermosa with 0.09% and Cabo de la Huerta with 9.09%) (Figure 2).

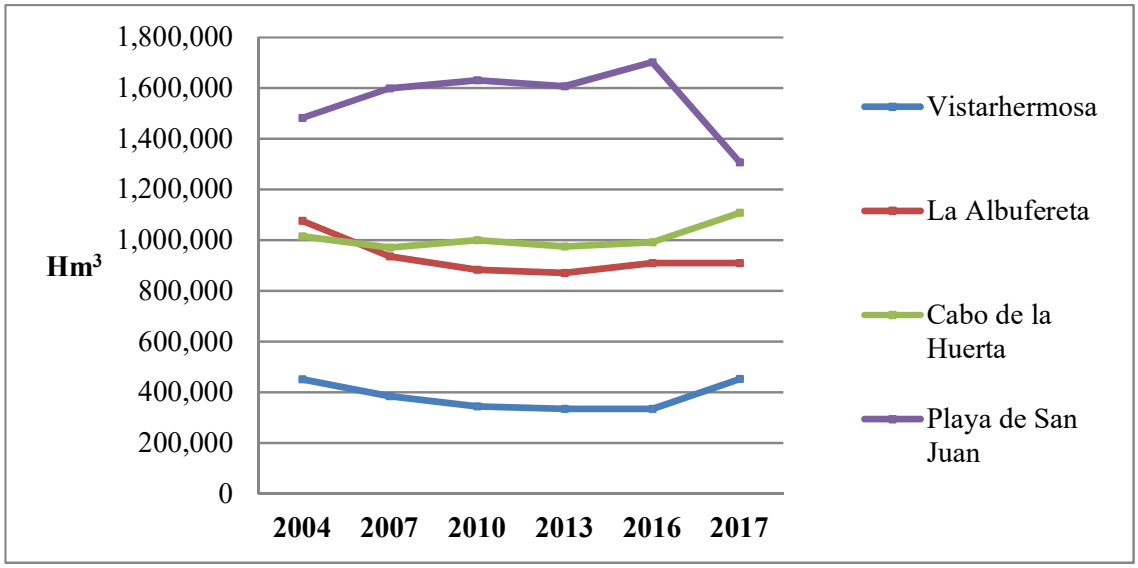

Figure 2. Evolution of domestic water consumption of the Beach Sector (hm^3) (2004–2017). Source: AMAEM. Compiled by the authors.

3.2. Change of Perception, Management and Water Consumption in Detached Houses

After analysing the development characteristics and the water consumption trend in the study area, the socioeconomic characteristics of the residents were examined according to the survey results, a step prior to considering their perception of water use.

The casuistry of conducting the surveys determined the following traits with regard to Section A (Table 2): (a) 100% were Spanish, of whom 56.25% were women; (b) it was an adult population, with cohorts between 35–54 years and over 75 years predominating (35.42 and 33.33%, respectively); (c) from the point of view of the social-employment situation, 52.08% were workers and 23.53% were

retired; (d) the level of education demonstrated that this was a high educational level population (33.33% of those surveyed had a university degree). These data are lower than those provided by the CIDES [50] which, for the study area, comes to 50.2%; (e) in relation to the ratio of inhabitants per household, the average was 2.83 and with few changes, since 75% of those surveyed stated that there had been no reduction or increase in the family unit; and (f) the economic income of the households stands at between €3001 and 4500 per month for net income (41.67% of those surveyed) and, in second place, between €1801 and 3000 per month (33.33%). The average income according to the CIDES [50] amounts to €2439. If these data are compared with the average income for the city of Alicante (€1783/month/household), it is obvious that this is one of the sectors where the wealthier classes of the city live [50].

Table 2. Socio-demographic characteristics of the respondents (Section A of the survey).

Variable		%
Age (years)	18–25	8.33
	26–34	6.25
	35–54	35.42
	55–75	16.67
	>75	33.33
Employment	Student	14.58
	Employee	52.08
	Unemployed	0
	Retired	33.33
Level of Education	No studies	0
	Primary education	33.33
	Secondary education	27.08
	Higher education	39.58
Average income per household (€/month)	<600	0
	601–1200	0
	1201–1800	0
	1801–3000	33.33
	3001–4500	41.67
	>4500	25.00

Source: Compiled by the authors.

With regard to the characteristics of the outside of the property (Section C), the average total plot size of those surveyed comes to 1225 m^2. In order of importance, the plots consist in the garden 35.13% (430 m^2) and, second, paved areas taking up 31.35% of the total plot (384 m^2). A total of 33.33% of respondents acknowledged having made changes to the outside of their property, and of these, 50% stated that they had made changes outdoors. These include planting succulent plants (vegetation adapted to water scarcity and the Mediterranean climate), replacing the lawn (Atlantic vegetation) with them, paving part of the garden and repairing leaks in the swimming pool. All of these are measures that try to reduce water use. None of the participants surveyed stated that they had increased the garden area. With regard to the supply sources, all the water consumed in the property for the different uses (home, garden, vegetable plot and swimming pool) comes from the drinking water supply network. The objective of the last question in this section ("repercussion of reclaimed water") was to ascertain the perception of the respondents with regard to the use of this non-conventional source. However, since none of them use it (because their properties are not connected to the reclaimed water network owing to the inexistence of the network close by) the results obtained show that 100% are "indifferent" to its impact (Table 3).

Table 3. Characteristics of the outside of the property (Section C of the survey).

Variable		%
Plot size	Building	13.7
	Garden	35.13
	Vegetable plot	5.44
	Swimming pool	2.24
	Paved area	31.35
	Other	12.55
Changes to the property	Yes	33.33
	No	66.67
Supply sources	Public network	100
	Well (groundwater)	0
	Rainwater tank	0
	Reclaimed water	0
Perception of the use of reclaimed water	Very positive	0
	Positive	0
	Indifferent	100
	Negative	0
	Very negative	0

Source: Compiled by the authors.

The purpose of the survey questions related to the variables of water saving and use behaviour (Section G) was to ascertain the respondents' perception of water use and saving and the measures that they have taken in recent years to reduce consumption. The majority (66.67%) compare the water bill with previous ones and they are willing to have a remote meter installed free of charge. This shows that there is an interest in favour of saving water, whether for economic or for environmental reasons. Thanks to the existence of these devices (smart meters), the user can find out about the consumption of the household instantly, and they can also be warned about any anomalous consumption (leak or failure). Therefore, there is greater control of domestic water use. The question relating to the homeowners' awareness of water saving demonstrates that the majority are in favour: 83.33% are moderately aware and 16.67% are very aware (Table 4).

Table 4. Behaviour with regard to water saving and use (Section G of the survey).

Variable		No. of Responses	%
Comparison with previous bills	Yes	32	66.67
	No	16	33.33
Installation of Smart meter	Yes	32	66.67
	No	16	33.33
Awareness regarding water saving	Very aware	8	16.67
	Moderately aware	40	83.33
	Slightly aware	0	0
	Not at all aware	0	0
Perception of the consumption trend	It has decreased	0	0
	It has remained the same	24	50
	It has increased	8	16.67
	Don't know	16	33.33
Impact of water-saving measures	Very positive	0	0
	Positive	24	50
	Indifferent	0	0
	Negative	0	0
	Very negative	0	0
	Don't know	24	50

Source: Compiled by the authors.

The results obtained from this last answer can be considered, to a certain extent, as being "politically correct" in view of the results obtained from other replies. This becomes evident when analysing the consumption trend where 50% state that the water use in their household has remained the same, 16.67% say that it has increased and 33.33% replied that they do not know how much they consume. If these values are compared with the billing data for these houses provided by the water supply company, it appears that, in general, there has been a decrease of 43.27% from 1255 to 712 L/property/day (Figure 3). As the ratio of inhabitants/property in the households surveyed was 2.83, water consumption per capita would amount to 247 L/day. This, in 2000, would be situated (maintaining that ratio) at 503 L. This contradiction highlights the users' considerable lack of knowledge about how much water is consumed in their households and their erroneous perception. The factors that may explain this ignorance are a high level of water consumption and the lack of control in its use as a result of not consulting the water bill or that the price of the water is paid without any economic difficulty. The fact that 33.33% of those surveyed state that they do not know how much water is consumed in their household could vouch for this fact.

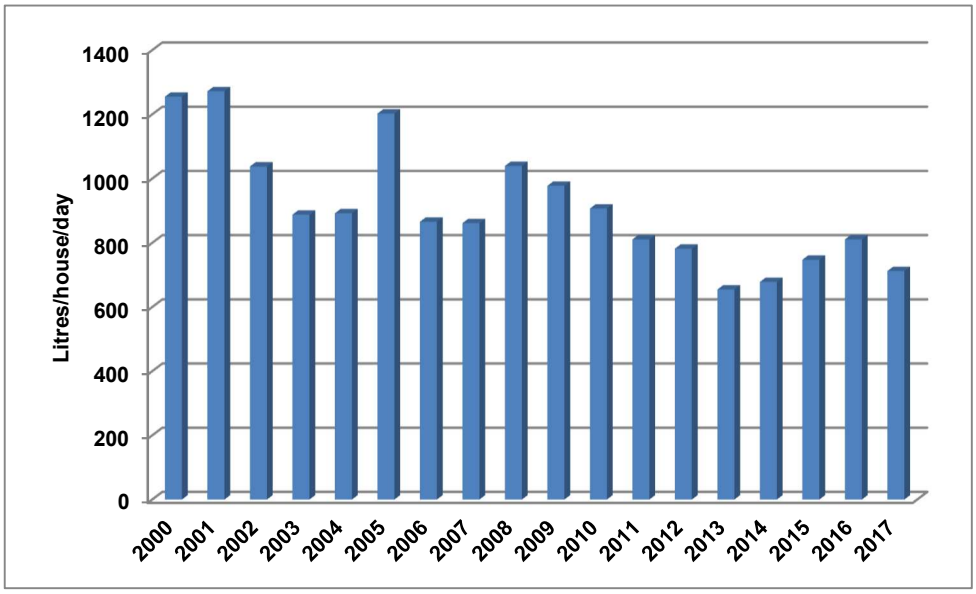

Figure 3. Evolution of water consumption of the detached houses where the survey was conducted (litres/property/day) (2000–2017). Source: AMAEM.

With regard to the impact of the household water-saving measures, 50% replied that they have been positive. However, the rest (the other half), replied that they did not have information or knowledge about this impact. Another one of the questions is related to the different factors that may have affected the reduction in water use at home. According to the answers, the first three factors were: (1) greater environmental awareness, (2) technical innovation (use of domestic appliances or systems that are more efficient in the use of water), and (3) installation of water-saving devices. Factors concerning the increase in the price of water or the economic crisis were in fourth and fifth place, respectively (Figure 4). This order, which is contrary to the results of other neighbourhoods of the city, is explained by the fact that the study area is situated in a high-income sector with a low level of unemployment, thus corroborating the survey data (see section A) and the Survey on Living Conditions and the Employment Situation in the City of Alicante [50]. In terms of future measures to reduce consumption, they reiterate those already adopted. Therefore, when it comes to water-saving devices or more efficient appliances that they consider installing in the future, the majority mention buying eco-friendly washing machines and eco-friendly dishwashers (36.36% in both cases). As for the uses and systems that the participants think consumes the most water at home, these were mentioned in the following order of importance: (1) outdoor elements (watering the garden), (2) washing machine,

and (3) shower. Finally, the last questions of this section are related to environmental campaigns. A total of 66.67% remember some campaign, having seen it on the internet (40%) and on television and awareness campaigns by institutions (water company, council, etc.) (30% in both cases).

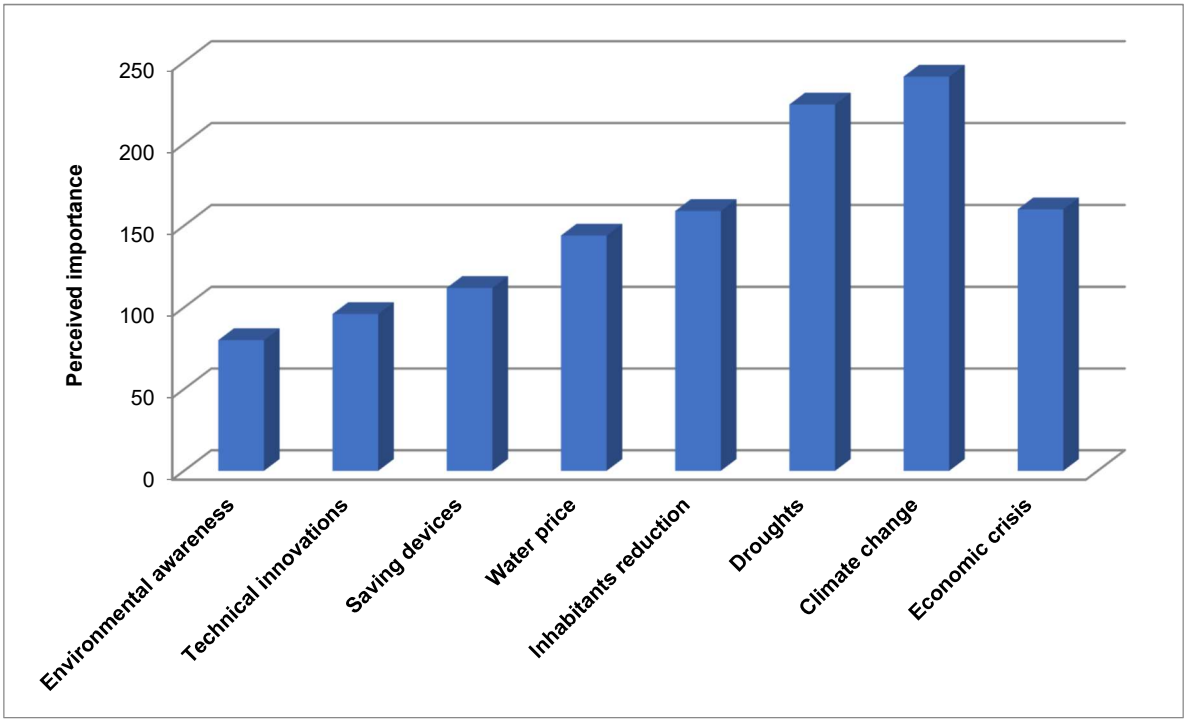

Figure 4. Main perception factors of the water consumption reduction in households according to those surveyed. Source: Results of the surveys. Compiled by the authors. NB: The respondents were required to rate the items on a scale of 1 to 8, the most important being 1 and the least important 8.

The last detail analysed in this study was the annual price paid for the water resource provided by AMAEM. This is of greater interest because water consumption is the highest in these households. In the city of Alicante, billing is quarterly, and it is structured into consumption bands with an increasing price per m^3 as a dissuasive measure against consumption (Table 5). In 2017, the consumption blocks per quarter and price per m^3 (euros) were as follows: (1) from 0 to 12 m^3 (0.01 €/m^3), (2) from 13 to 30 m^3 (0.69 €/m^3), (3) from 31 to 60 m^3 (1.76 €/m^3), and (4) more than 60 m^3 (2.36 €/m^3). It is worth mentioning that this price is final, that is, it takes into account all the service costs (the price of the water, meter maintenance, sewerage, treatment and taxes). It should also be pointed out that, as of 2017, the first two consumption blocks have varied, so has the price per m^3 per block. With regard to the latter (that of the highest consumption), the price per m^3 has increased by 44.78% in the last decade from €1.63 to €2.36. In order to place a property in this band, it would have to consume more than 668 L/property/day.

Table 5. Price of water (€/m^3) per consumption block in the city of Alicante (2000–2017).

Consumption Blocks	2007	2009	2011	2013	2017
From 0 to 9 m^3 per quarter *	0.02	0.02	0.02	0.02	0.01
From 10 to 30 m^3 per quarter *	0.43	0.49	0.49	0.53	0.69
From 31 to 60 m^3 per quarter	1.3	1.52	1.63	1.76	1.76
61 m^3 per quarter and over	1.63	1.92	2.18	2.36	2.36

Source: AMAEM. Compiled by the authors. * NB: As of 2017, the first band of 0 to 9 m^3/quarter has changed to 0 to 12 m^3/quarter, and the second, that of 10 to 30, to 13 to 30 m^3/quarter.

In view of the water consumption data of the households surveyed (712 L/property/day), they are situated in the last block. According to their consumption, the average final amount of the water bill that the residents of the households surveyed pay per year can be calculated. In 2017, this amounted to €613. However, in 2007, with the data provided (price per m^3 in the highest consumption band and consumption that was situated at 861 L/day), this would be €512. If consumption in 2017 had remained the same as that of a decade before, the bill that they would have to pay now (taking into account the new tariff of 2.36 €/m^3), would amount to €741. This means that although water consumption has decreased, water bills have not; on the contrary, they have continued to increase.

4. Discussion

As stated in the initial hypothesis for this research, urban expansion characterized by low-density urban development in the city of Alicante involved implementing an urban model that is not very sustainable; a trait that is exacerbated by the expansion of this development type coinciding with the most recent real estate boom. This study has corroborated the fact that water consumption in these households is high compared to other types. In 2017, water use per detached house amounted to 712 L per day in the study area. Some publications that have analysed water consumption according to residential property types have estimated modules of over 600 L/property/day for houses with private swimming pools and garden modules [11,51,52]. However, other property types characterized by the inexistence of outdoor spaces or where these are very small and arranged in rows as in the case of terraced houses, water consumption is considerably lower. For this type, for example, Rico [53] estimated on the coast of Alicante modules of 456 L/property/day. Regarding the city of Alicante, Gil et al. [22] calculated that consumption was around 387 L in semi-detached or terraced houses, 322 L in properties located in blocks of flats and 244 L in households of the urban core (compact city).

However, despite the significant increase in the urbanized area, a regressive trend has been recorded for urban consumption in the majority of cities in developed countries since the end of the twentieth century [23,54]. On the Spanish Mediterranean coast, Gil et al. [22] explain that this trend is due to an amalgam of factors, among which it is worthwhile mentioning greater environmental awareness in favour of water saving, drought episodes, social and demographic changes (reduction of the population), the increase in the price of the water, more efficient technologies and the effect of the economic crisis since 2008. For the different urban typologies of the city of Alicante, Morote et al. [11] calculated decreases that varied according to economic income and urban development type. In households of the urban core, from 5.86 to 18.84%, in blocks of flats, from 9.18 to 11.89%, in terraced houses from 2.64 to 5.12%. This percentage increases significantly for detached houses (2300 to 1052 L/day) (−54%) to a large extent, as a result of the high starting values and the role played by certain factors (price of water, economic crisis, environmental awareness, incorporation of more efficient technologies, etc.) [11]. This trend, which corroborates the initial hypothesis, makes it necessary to analyse the importance of the role played by those factors in the reduction of consumption by this urban development type in the study area (a decrease of 43.27%).

To examine this matter in more detail, those surveyed were asked about their perception of the different variables that might have influenced this decrease. The three main factors were: greater environmental awareness, technical innovations (domestic appliances and systems that use water more efficiently) and the installation of water-saving devices. According to the answers of those surveyed in this research, environmental awareness is the topic with the greatest repercussion to explain this decrease. It is a factor that is also interrelated with the acquisition of domestic appliances and systems that use water more efficiently, together with the installation of water-saving devices. However, out of the eight factors proposed (from which the respondents had to choose), the price of water was ranked in fourth place and the economic crisis in fifth. These data are opposite to the results obtained by Morote and Hernández [39] in the residential complexes on the coast of Alicante, which are characterized by the presence of a foreign population, where the reasons why changes are made in

favour of water saving were the drought and the bad adaptation of Atlantic vegetation that they had planted in their gardens and the high price of water.

The social and economic profile of those surveyed shows that, to a great extent, they have not suffered from the recession, unlike those in other neighbourhoods of the city of Alicante. Other factors, in addition to per capita income, explain the adoption of initiatives aimed at reducing expenses. The increase in the price of water, the adoption of more sustainable consumption habits (for example, using the shower instead of the bath), using more efficient technology in domestic appliances, the environmental awareness associated with water-saving campaigns, or changes in the garden (replacement of Atlantic for Mediterranean plants) play a fundamental role. They have the spending power to acquire efficient, but also more expensive, domestic appliances, or, as a result of their level of education, they are more environmentally aware [22]. The economic crisis may have encouraged these water-saving measures that were taken. The adoption of practices aimed at a more sustainable use of resources is a practice assumed by many echelons of society, becoming a structural fact that is still a personal saving habit.

With regard to the water bill (price of water and other concepts) the data show that, currently, more is paid for this resource than a decade ago, even with less water being consumed. The rise in prices (in addition to the increase in tariffs due to the incorporation of desalinated water and recovery cost related to implementation of the Water Framework Directive) could be a result of the current reduction in water consumption. The operating costs, depreciation, investment, etc., have not decreased. For this reason, to offset the lower consumption of drinking water, the supply company has been obliged to increase the price of water to maintain the service at optimum levels. Morote and Hernández [47] prove that, for a water bill of 30 m^3/quarter, the price paid for this bill has increased by 92% since the year 2000 in the city of Alicante. Furthermore, this has occurred (and therefore the consumers have had to deal with it) in a context of economic recession. In the detached houses of this study the price of water has increased by 44% (2007–2017) (61 m^3 per quarter and over). However, if the evolution of the consumer price index (CPI) and the family's income is compared, the conclusion can be drawn that families have lost their purchasing power in relation to the increase in water prices. For example, according to the data provided by the INE [55], the CPI of the province of Alicante between 2007 and 2017 increased 15.3%, but the income of families dropped 6.85% (25,802 €/year in 2007 and 24,034 €/year in 2017) [56].

The relationship between the increasing water rates and their influence on the consumption drop cannot be considered to be a direct cause. The elasticity of water demand in relation to its price is low in moderate consumption, because a basic minimum consumption of drinking water must be covered (basic needs). Hence, the incorporation of water saving measures does not affect a reduction in the water bill, or the decrease in consumption [57]. In addition to this, the water bill incorporates a series of variables that increases the final price, which are not associated with consumption. The use of consumption blocks as a saving element must provide for the non-elasticity in the price of water in the first blocks of consumption; the last blocks of consumption have a greater impact. This is related to consumption associated with external uses that are not included in the basic supply.

In terms of garden areas, one point that corroborates their effect on the high levels of water consumption is that the participants in the survey state that the main water use in their household is watering the garden. Furthermore, this is mainly due to their size and the presence of Atlantic vegetation. In this respect, it is appropriate to point out that the water requirements of a lawn on the coast of Alicante vary between 1000 and 1200 mm/year (depending on evapotranspiration), and this is exacerbated given that average rainfall in the city amounts to 311 mm/year [58]. Morote and Hernández [59] estimated that a garden on the north coast of the province of Alicante consumed 556.08 L per day (47% of the consumption of a detached house). In the Metropolitan Area of Barcelona (Spain), Domene and Saurí [51] calculated that, in the summer months, 48.8% of total water consumed daily at home was used for irrigation. Higher percentages were recorded in the arid and semi-arid

regions of the west part of the USA, where this reached 50% of total household consumption [60]. Authors, such as Loh and Coghlan [61], raise this to 56% in the city of Perth (Australia).

As a result of this research, it has also been ascertained that there has been a change of perception and management of the use of water outdoors, with a predominance of initiatives aimed at reducing consumption. Various processes corroborate this point. First, there is the reduction of gardens. Areas used as gardens stand for 35.13% of the plot, but paved areas have become more popular in the last decade. They currently represent 31.35%. The substitution of plant species is in second place. This is highlighted in the participants' answers concerning the changes made outdoors where 33.33% of those surveyed said that they have replaced the lawn area and plants that require large amounts of water with succulent plants and they have paved part of the garden. These initiatives are complemented by the repair of leaks in the swimming pool. Therefore, these are measures to maintain and reduce consumption from the point of view of demand management. In addition to this, there is the possible impact of awareness campaigns and how they have been able to make a change and improve the environmental awareness of the residents; 66.67% replied that they remember these campaigns.

One of the questions included in the survey was the perception regarding reclaimed treated water. In this case, its use was related to the possibility of using lower quality water for activities that do not require drinking water (watering the garden). Furthermore, in this way, it reduces the pressure on the latter and increases the resilience of the urban model. A total of 100% of those surveyed said they were "indifferent", and this resource was even ruled out. This lack of acceptance may be due to either the perception of the quality of the water or the fact that it is not used since there is no reclaimed water network for the watering of private gardens near their homes. As the reclaimed water distribution network in the different urban sectors of the city is a new concept, a precise evaluation of the role played by this new source in saving drinking water in the city cannot be obtained. Therefore, the survey shows a high value for the option "indifferent", when the increasing importance of this type of resource in the urban use of water as a means of saving drinking water is evident. In the city of Alicante, it should be pointed out that in certain urban areas, reclaimed water is supplied to satisfy watering needs in private properties. According to the calculations of Gil et al. [22], its incorporation, together with other factors, has led to a reduction of 54% in the consumption of drinking water between 2007 and 2013, from 2300 to 1052 L/property/day in detached houses in the urban district of Vistahermosa (city of Alicante).

5. Conclusions

Detached houses represent the urban development type that consumes the highest amount of water due to the existence of uses characterized by high demands such as watering the garden and/or filling the swimming pool. In the city of Alicante since the year 2000, there has been a decrease in water consumption of 43.27% in detached houses, from 1255 to 712 L/day. This process, which forms part of a more sustainable use of resources has not, however, been accompanied by a reduction in the cost of the water bill. On the contrary, users now pay 19.7% more than a decade ago. This demonstrates that, despite the fact that families have made a considerable effort to reduce domestic consumption, this has not led to a reduction in the water bill owing to the increase in the price per m^3 of water (44.78%) and also in the different levies applied to consumption (treatment costs, for example, or charges associated with the maintenance of the service, which the company passes on in the price of the water). This increase has also had a dissuasive effect, since the band in which the price per m^3 has increased the most has been that of the highest consumption (61 m^3 per quarter and over, which applies to detached houses).

The reduction in water use has been a constant since 2004 in the city, as corroborated by the volumes billed by the supply company. However, the results deriving from the surveys highlight that the residents do not know exactly what their consumption is, or their trend is, either because they are not concerned or because they do not monitor their domestic expenditure in detail. They are more concerned (and have greater perception) about matters concerning the adoption of more sustainable

practices in the consumption of water resources as corroborated by their responses, and this is shown by the decrease in consumption. The factors that have led to this reduction include, in order of relevance: greater environmental awareness, the existence of systems that use water more efficiently and the installation of water-saving devices. However, their choice, out of a total of eight factors, leads to the question as to whether these three have been influenced by the increase in the price of water and the economic crisis; meanwhile the average annual salary dropped by 6.85% from 2007 to 2017. That is, whether the reason behind adopting practices of this type is to save money owing to the increase in the price of water and the impact of the economic crisis. This has occurred with other domestic expenses that have been reduced. One of the hypotheses of this paper was to see if water consumption in detached houses had recovered after the end of the economic crisis in 2014. Despite the fact that the wealthier population of the city live in these houses (see Reference [11]), the economic crisis has also affected these families. Furthermore, water consumption is no exception. Morote and Hernández [47] have shown that in these households (detached houses), the ratio of fraud in properties connected to the network is similar to that detected in the poorest neighbourhoods of the city of Alicante. The increase in fraud, as these authors explain, is related to the need to save water owing to high levels of water consumption generated in this urban development type, which is exacerbated in periods of drought.

Finally, it is worthwhile pointing out that a change of paradigm and perception is taking place with regard to an improvement in water management with regard to measures for demand management. Perhaps the price of water is an indicator of the control of consumption, which has already been corroborated by other authors [62] and this helps to make cities more sustainable and respectful when it comes to using natural resources [40]. Furthermore, the uncertainty associated with the availability of future water resources must be mentioned, taking into account the climate change scenarios [63–65], along with the need to set a goal to not compromise future generations in terms of the guaranteed availability of water.

Author Contributions: The four authors wrote the paper. Investigation, Á.-F.M., J.O., A.-M.R. and M.H.

Funding: A preliminary version of this article was presented at the XIV Urban Geography Colloquium held at the University of Castilla-La Mancha and the University of Valencia (Spain). The results presented in this article are part of the research projects "Study of water consumption and Smart Meters of the city of Alicante. The basis of the intelligent water supply in a Smart City" (I-PI 27-17) financed by Aguas Municipalizadas de Alicante, Empresa Mixta S.A and "Uses and management of non-conventional water resources on the coast of Valencia and Murcia as an adaptation strategy to drought" funded by the Spanish MINECO under grant number CSO2015-65182-C2-2-P.

Acknowledgments: The authors would like to express their cordial thanks to Aguas Municipalizadas de Alicante, Empresa Mixta S.A. for providing the data on water consumption and especially Asunción Martínez, Francisco Bartual, Francisco Agulló, César Vázquez, Vicent Martínez and Antonio Sánchez.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Salvati, L.; Venanzoni, G.; Serra, P.; Carlucci, M. Scattered or polycentric? Untangling urban growth in three southern European metropolitan regions through exploratory spatial data analysis. *Int. J. Urban Reg. Environ. Res. Policy* **2016**. [CrossRef]
2. European Environment Agency. *Señales Medioambientales 2002. Referencias Para el Milenio*; Agencia Europea del Medio Ambiente: Copenhagen, Denmark, 2002; Available online: http://www.eea.europa.eu/www/es/publications/environmental_assessment_report_2002_9-sum (accessed on 5 June 2018).
3. European Environment Agency. *Urban Sprawl in Europe. The Ignored Challenge. Informe nº 10/2006*; Agencia Europea del Medio Ambiente: Copenhagen, Denmark, 2006; Available online: www.eea.europa.eu/publications/eea_report.../eea_report_10_2006.pdf (accessed on 9 June 2018).
4. Morote Seguido, A.F. Espacios ajardinados privados en España y su incidencia en el consumo de agua: Estado de la cuestión. *Anales de Geografía de la Universidad Complutense* **2017**, *37*, 415–443. [CrossRef]
5. Burriel, E. La "década prodigiosa" del urbanismo español (1997-2006). *Scripta Nova* **2008**, *XII*, 270.

6. Ministerio de Fomento. Estimación del parque de viviendas, 2001-2011. 2012. Available online: http://www.fomento.gob.es/BE2/?nivel=2&orden=33000000 (accessed on 5 March 2018).
7. Lois González, R.C.; Piñeira Mantiñan, M.J.; Vives Miró, S. El proceso urbanizador en España (1990–2014): Una interpretación desde la geografía y la teoría de los circuitos de capital. *Scripta Nova* **2016**, *XX*, 539.
8. Piñeira-Mantiñan, M.J.; Durán-Villa, F.R.; Taboada-Failde, J. Urban vulnerability in spanish médium-sized cities during the post-crisis period (2009–2016). The cases of A Coruña and Vigo (Spain). *Urban Sci.* **2018**, *2*, 37. [CrossRef]
9. Romero, J.; Brandis, D.; Delgado Viñas, C.; García Rodríguez, J.L.; Gómez Romero, M.L.; Olcina, J.; Rullán, O.; Vera-Rebollo, J.F.; Vicente Rufí, J. Aproximáción a la Geografía del despilfarro en España: Balance de las últimas dos décadas. *Boletín de la Asociación de Geógrafos Españoles* **2018**, *77*, 1–51. [CrossRef]
10. Morote, A.F.; Hernández, M. Urban sprawl and its effects on water demand: A case study of Alicante, Spain. *Land Use Policy* **2016**, *50*, 352–362. [CrossRef]
11. Morote, A.F.; Hernández, M.; Rico, A.M. Causes of Domestic Water Consumption Trends in the City of Alicante: Exploring the Links between the Housing Bubble, the Types of Housing and the Socio-Economic Factors. *Water* **2016**, *8*, 374. [CrossRef]
12. Leichenko, R.; Solecki, W. Exporting the American Dream: The globalization of suburban consumption landscapes. *Reg. Stud.* **2005**, *39*, 241–253. [CrossRef]
13. Morote Seguido, A.F.; Hernández Hernández, M. Jardines y patrones de ajardinamiento en las urbanizaciones del litoral de Alicante. *Boletín de la Asociación de Geógrafos Españoles* **2016**, *70*, 31–56. [CrossRef]
14. Morote, A.F.; Saurí, D.; Hernández, M. Residential Tourism, Swimming Pools and Water Demand in the Western Mediterranean. *Prof. Geogr.* **2017**. [CrossRef]
15. Llausàs, A.; Hof, A.; Wolf, N.; Saurí, D.; Siegemund, A. Applicability of cadastral data to support the estimation of water use in private swimming pools. *Environ. Plan. B* **2018**, 1–17. [CrossRef]
16. Hurd, B.H. Water conservation and residential landscape: Household preferences, household choices. *J. Agric. Resour. Econ.* **2006**, *31*, 21–32.
17. Fernández, S.; Barrado, D.A. El desarrollo turístico-inmobiliario de la España mediterránea e insular frente a sus referentes internacionales (Florida y la Costa Azul): Un análisis comparado. *Cuadernos de Turismo* **2011**, *27*, 373–402.
18. Robbins, P. *Lawn People: How Grasses, Weeds, and Chemicals Make Us Who We Are*; Temple University Press: Philadelphia, PA, USA, 2012.
19. Troy, P.; Holoway, D. The use of residential water consumption as an urban planning tool: A pilot study in Adelaide. *J. Environ. Plan. Manag.* **2004**, *47*, 97–114. [CrossRef]
20. Torrero, A. El final de la burbuja especulativa y la crisis económica de Japón. *Ekonomiaz* **2011**, *48*, 92–127.
21. Hidalgo, R.; Arenas, F.; Santana, D. Utópolis o distópolis?: Producción inmobiliaria y metropolización en el litoral central de Chile (1992-2012). *Revista de Estudios Urbanos y Regionales* **2016**, *42*, 27–54. [CrossRef]
22. Gil Olcina, A.; Hernández Hernández, M.; Morote Seguido, A.F.; Rico Amorós, A.M.; Saurí Pujol, D.; March Corbella, H. *Tendencias del consumo de agua potable en la Ciudad de Alicante y Área Metropolitana de Barcelona, 2007–2013*; Hidraqua Gestión Integral: Alicante, Spain, 2015.
23. March, H.; Saurí, D. When sustainable may not mean just: A critical interpretation of urban water consumption decline in Barcelona. *Local Environ.* **2016**. [CrossRef]
24. Inman, D.; Jeffrey, P. A review of residential water conservation tool performance and influences on implementation effectiveness. *Urban Water J.* **2006**, *3*, 127–143. [CrossRef]
25. House-Peters, L.; Chang, H. Urban water demand modelling: Review of concepts, methods, and organizing principles. *Water Resour. Res.* **2011**, *47*. [CrossRef]
26. Llausàs, A.; Saurí, D. A research synthesis and theoretical model of relationships between factors influencing outdoor domestic water consumption. *Soc. Nat. Resour.* **2016**. [CrossRef]
27. Saurí, D. Water Conservation: Theory and Evidence in Urban Areas of the Developed World. *Ann. Rev. Environ. Resour.* **2013**, *38*, 227–248. [CrossRef]
28. Intergovernmental Panel on Climate Change (IPCC). Special Report Global warming of 1.5 °C. 2018. Available online: https://www.ipcc.ch/report/sr15/ (accessed on 9 November 2018).
29. Chang, H.; Praskievicz, S.; Parandvash, H. Sensitivity of urban water consumption to weather and climate variability at multiple temporal scales: The case of Portland. *Int. J. Geospat. Environ. Res.* **2014**, *1*, 7.

30. Hernández, M.; Morales, A.; Saurí, D. Ornamental plants and the production of nature(s) in the Spanish real estate boom and bust: The case of Alicante. *Urban Geogr.* **2014**, *35*, 71–89. [CrossRef]
31. Chu, J.; Wang, C.; Chen, J.; Wang, H. Agent-Based Residential Water Use Behavior Simulation and Policy Implications: A Case-Study in Beijing City. *Water Resour. Manag.* **2009**, *23*, 32–67. [CrossRef]
32. Hurlimann, A.; Dolnicar, S.; Meyer, P. Understanding behavior to inform water supply management in developed nations—A review of literature, conceptual model and research agenda. *J. Environ. Manag.* **2009**, *91*, 47–56. [CrossRef] [PubMed]
33. Jorgensen, B.; Graymore, M.; O'Toole, K. Household water use behavior: An integrated model. *J. Environ. Manag.* **2009**, *91*, 227–236. [CrossRef]
34. Howarth, D.; Butler, S. Communicating water conservation. How can the public be engaged? *Water Supply* **2004**, *4*, 33–34. [CrossRef]
35. Fielding, K.S.; Russell, S.; Spinks, A.; Mankad, A. Determinants of household water conservation: The role of demographic, infrastructure, behavior and psychosocial variables. *Water Resour. Res.* **2012**, *48*. [CrossRef]
36. Linkola, L.; Clinton, J.A.; Schuetze, T. An Agent Based Model of Household Water Use. *Water* **2013**, *5*, 1082–1100. [CrossRef]
37. Cosgrove, W.J.; Rijsberman, F.R. *World Water Vision: Making Water Everybody's Business*; Routledge: Abingdon-on-Thames, UK, 2014; Available online: http://www.worldwatercouncil.org/index.php?id=961 (accessed on 6 January 2019).
38. March, H.; Hernández, M.; Saurí, D. Percepción de recursos convencionales y no convencionales en áreas sujetas a estrés hídrico: El caso de Alicante. *Revista de Geografía Norte Grande* **2015**, *60*, 153–172. [CrossRef]
39. Morote, A.F.; Hernández, M. Jardines y urbanizaciones, nuevas naturalezas urbanas en el litoral de la provincia de Alicante. *Documents d'Anàlisi Geogràfica* **2014**, *60*, 483–504.
40. Morote Seguido, A.F.; Hernández Hernández, M. El uso de aguas pluviales en la ciudad de Alicante. De Viejas ideas a nuevos enfoques. *Papeles de Geografía* **2017**, *63*, 7–25. [CrossRef]
41. Morales Gil, A.; Gil Olcina, A.; Rico Amorós, A.M. Diferentes percepciones de la sequía en España: Adaptación, catastrofismo e intentos de corrección. *Investigaciones Geográficas* **2000**, *23*, 5–46. [CrossRef]
42. Hernández Hernández, M.; Morales Gil, A. Trascendencia socio-económica del trasvase Tajo-Segura tras 30 años de su funcionamiento en la provincia de Alicante. *Investigaciones Geográficas* **2018**, *46*, 31–48. [CrossRef]
43. Rico Amorós, A.M. La Mancomunidad de los Canales del Taibilla: Un modelo de aprovechamiento conjunto de fuentes convencionales y desalinización de agua marina. In *Libro jubilar en homenaje al profesor Antonio Gil Olcina*; Olcina Cantos, J., Rico Amorós, A.M., Eds.; Publicaciones de la Universidad de Alicante: Alicante, Spain, 2016; pp. 367–394.
44. Gómez Espín, J.M. *El Trasvase Tajo-Segura. Propuestas para su Continuidad y Futuro*; Editorial Académica Española: Saarbrücken, Germany, 2017.
45. March, H.; Saurí, D.; Rico, A.M. The end of scarcity? Water desalination as the new cornucopia for Mediterranean Spain. *J. Hydrol.* **2014**, *519*, 2642–2651. [CrossRef]
46. Morote, A.F.; Rico, A.M.; Moltó, E. Critical review of desalination in Spain: A resource for the future? *Geogr. Res.* **2017**, 1–12. [CrossRef]
47. Morote Seguido, A.F.; Hernández Hernández, M. Unauthorized domestic water consumption in the city of Alicante (Spain): A consideration of its causes and urban distribution (2005-17). *Water* **2018**, *10*, 851. [CrossRef]
48. Cabrera Román, C. *Aguas de Alicante*; Ed Aguas de Alicante: Alicante, Spain, 1999.
49. Morote Seguido, A.F. Transformaciones territoriales e intensificación de la demanda de agua urbano-turística en la provincia de Alicante. Ph.D. Thesis, Universidad de Alicante, Alicante, Spain, 2015.
50. Centro de Investigación y Desarrollo Estratégico (CIDES). Encuesta de Condiciones de Vida y Situación Laboral en la Ciudad de Alicante. 2016. Available online: http://www.alicante.es/es/documentos/encuesta-condiciones-vida-y-situacion-laboral-ciudad-alicante-diciembre-2016 (accessed on 10 April 2018).
51. Domene, E.; Saurí, D. Modelos urbanos y consumo de agua. El riego de jardines privados en la región metropolitana de Barcelona. *Investigaciones Geográficas* **2003**, *32*, 5–17. [CrossRef]
52. Morote Seguido, A.F.; Hernández Hernández, M.; Rico Amorós, A.M. Patrones de consumo de agua en usos turístico-residenciales en la costa de Alicante (España) (2005-2015). Una tendencia desigual influida por la tipología urbana y grado de ocupación. *Anales de la Geografía de la Universidad Complutense* **2018**, *38*, 357–383. [CrossRef]

53. Rico Amorós, A.M. Tipologías de consumo de agua en abastecimientos urbano-turísticos de la Comunidad Valenciana. *Investigaciones Geográficas* **2007**, *42*, 5–34. [CrossRef]
54. Deoreo, W.; Mayer, P. Insights into declining single-family residential water demands. *Journal-American Water World Assoc.* **2012**, *104*, 383–394. [CrossRef]
55. Instituto Nacional de Estadística. Cálculo de Variaciones del Índice de Precios de Consumo. 2018. Available online: http://www.ine.es/varipc/verVariaciones.do?idmesini=1&anyoini=2007&idmesfin=1&anyofin=2017&ntipo=3&enviar=Calcular (accessed on 6 December 2018).
56. Instituto Nacional de Estadística. Renta por Hogar por Comunidades Autónomas. 2016. Available online: http://www.ine.es/jaxiT3/Datos.htm?t=9949 (accessed on 6 December 2018).
57. Del Villar, A. Los precios de los servicios del agua. Un análisis prospectivo de demanda sobre los usos domésticos. *Estudios de Economía Aplciada* **2010**, *28*, 333–356.
58. Agencia Estatal de Meteorología (AEMET). Servicios Climáticos. Datos climáticos. 2018. Available online: http://www.aemet.es/es/portada (accessed on 5 June 2018).
59. Morote Seguido, A.F.; Hernández Hernández, M. El uso y consumo de agua en los jardines de las viviendas unifamiliares del litoral de Alicante. *Cuadernos de Geografía de la Universidad de Valencia* **2016**, *98*, 29–44.
60. St. Hilaire, R.; Spinti, J.E.; Van Leeuwen, D.; Smith, C. *Lansdcape Preferences and Attitudes toward Water Conservation: A Public Opinion Survey of Homeowners in Las Cruces*; New Mexico State University: Las Cruces, NM, USA, 2003.
61. Loh, M.; Coghlan, P. *Domestic Water Use Study: Perth, Western Australia 1998-2001*; Water Corporation: Perth, Australia, 2003.
62. Sánchez García, V.E.; Blanco Jiménez, F.J. El uso sostenible del agua en núcleos urbanos: Las tarifas como herramienta de control del consume. *Observatorio Ambiental* **2012**, *15*, 35–59. [CrossRef]
63. Intergovernmental Panel on Climate Change (IPCC). Climate Change 2013 and Climate Change 2014 (3 vols.). 2014. Available online: http://www.ipcc.ch/ (accessed on 25 March 2018).
64. Agencia Estatal de Meteorología (AEMET). Proyecciones Climáticas Para el Siglo XXI en España. 2015. Available online: http://www.aemet.es/es/serviciosclimaticos/cambio_climat (accessed on 15 August 2018).
65. CEDEX. *Evaluación del Impacto del Cambio Climático en los Recursos Hídricos y Sequías en España*; Ministerio de Agricultura, Pesca, Alimentación y Medio Ambiente y Ministerio de Fomento: Madrid, Spain, 2017; 320p. Available online: http://www.cedex.es/NR/rdonlyres/3B08CCC1-C252-4AC0-BAF7-1BC27266534B/145732/2017_07_424150001_Evaluación_cambio_climático_recu.pdf (accessed on 25 March 2018).