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Assessing environmental profiles: An analysis of water consumption and waste recycling habits

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Abstract: Individual pro-environmental attitudes and behaviours are determinant for long-term sustainability. We assessed household profiles in terms of their water consumption and recycling patterns using Latent Class Analysis (LCA). This methodology allows for households to be classified into groups without imposing any *ad hoc* criteria when classifying them and provides information on the determinants of belonging to each group. We used information from an exclusive database of 1,351 households in the municipality of Gijón, Spain. The database includes the water consumption, self-reported environmental attitudes, and socioeconomic characteristics of the households. The results showed four significant household groups, where smaller families located in urban areas containing at least one homemaker and equipped with water efficient devices are more likely to present the best pro-environmental attitudes and behaviours related to water use and recycling habits. Furthermore, we found that providing better information in terms of water and waste services and the environmental impact of human behaviour is also important to fostering environmentally friendly habits.

Keywords: Residential water consumption; Recycling habits; Latent Class Analysis; Microdata; Pro-environmental attitudes

JEL codes: C35; Q25; Q53; D19.

1. INTRODUCTION

Achieving efficient levels of water consumption and waste generation is key for achieving the SDGs set out in the 2030 Agenda for Sustainable Development (United Nations 2015), particularly those related to the 6.1, 6,5, 6b, 11.3, 11.6, 12.2, 12.5, 12.8 and 13.3 specific targets (United Nations 2015). However, according to the most recent SDG Report (UN, 2022), worldwide urban waste and water management still needs to be greatly improved. In 2021, while 82% of worldwide urban waste was collected, only 55% of it was treated in controlled facilities. Moreover, only 22.8% of worldwide electronic waste was safely and correctly managed (recycling of components and safe treatment of hazardous parts), and 17 million metric tons of plastic were dumped into the world's oceans. On the other hand, 1.2 billion people lacked stable access to basic water services in 2020 and worldwide water withdrawal rates approached stress levels in 2019. All these facts expose a slowdown in the progress towards achieving said goals by 2030.

Focusing our attention on the EU area, and Spain in particular, the figures are also worrying. Recycling rates for municipal waste, packaging waste, and electrical and electronic equipment waste have increased significantly in the EU area over the past decades. In 2004, the average EU-27 municipal waste recycling rate was 31.8%, while in 2020 this increased to 48.6%[1]. However, the level and evolution of these figures have been substantially heterogeneous across countries and over the years. In 2004, Spain registered a municipal waste recycling rate of 30.9%, which rose to 36.4% in 2020; however, this figure is still well below the EU-27 average (48.6%). Moreover, according to the latest report on Water Resources Across Europe (EEA, 2021), 20% of the European territory and 30% of the European population suffer from water stress, with the cost of economic damages due to drought measured between 2 and 9 billion euros annually.

In sum, there is still a long road towards achieving the SDGs. In this context, individual green behaviours play a significant role in improving sustainability. In that sense, it is important to identify groups of individuals that display the best pro-environmental habits and analyse their socio-demographic profiles. In this respect, our paper focuses on analysing the crossover between water-saving habits and waste sorting and recycling activities at the household level, observing best practices and their main determinants.

To empirically assess these issues, we considered a microdata database consisting of a sample of households in the municipality of Gijón. The database itself is a significant contribution of this paper, since it merges information of a personal questionnaire with real data on water consumption. Regarding the survey, households were asked about several issues related to recycling and water-use habits, as well as environmental attitudes, their knowledge of environmental campaign, or the understanding of water billing.

Assessing pro-environmental behaviours in Gijón is relevant for three reasons: first, this municipality is located in Spain, a highly-exposed country to climate change and environmental risks, such as water stress or increasing temperatures (Pausas and Millán 2019). In this context, the achievement of more rational patterns of water consumption

[1] For further information, check https://www.eea.europa.eu/ims/waste-recycling-in-europe.

and waste sorting and recycling can mitigate the impact of droughts and pollution production.

Second, urban water supply managers in Gijón are very concerned about water consumption reductions. Although local authorities have carried out different actions to promote water savings, per capita water consumption in Gijón is significantly higher than the 100 l/p/d optimal levels proposed by the World Health Organization (Howard et al., 2020) and the 80 l/p/d target purposed for Europe by Dworak et al. (2007). Thus, Gijón has a huge water-saving potential.

Third, waste sorting for recycling purposes has stagnated in Gijón after several years of sustained growth (EMULSA, 2023). To reverse this situation and thus be able to meet the objectives established in Law 7/2022 on waste and contaminated soils for a circular economy (Official State Gazette, 2022), as well as in the European Directive 2018/851 amending Directive 2008/98/EC on waste (European Union, 2018), it is crucial to identify those users who are most likely to get involved in waste sorting.

Our empirical approach attempts to address previous shortcomings in the literature. In contrast to previous works, which use factor analysis to classify households into different behavioural groups (i.e., Barr et al., 2005 and Gilg and Barr, 2006), we carry out a latent class analysis which groups households according to their socio-economic and attitudinal variables. Although this methodology has been used in several works focused on single pro-environmental behaviours such as water use (Pérez-Urdiales and García-Valiñas, 2016; Thiam et al., 2021; Maier et al., 2022) or waste sorting (Yuan et al., 2015; Beaumais and Brunetti, 2018; Masarutto et al., 2019; Nainggolan et al., 2019), to the best of our knowledge, it has not been applied to empirical studies that address pro-environmental behaviour from a multi-dimensional perspective.

The outline of the paper is as follows. Section 2 presents a literature review of papers focused on the determinants of pro-environmental behaviours, paying special attention to waste recycling and water conservation synergies. Section 3 describes the context where this study takes place: the city of Gijón, and the characteristics and possibilities of waste collection and water supply in said area. The methodology is briefly reported in Section 4, while Section 5 describes the database and main variables used in the analysis. Section 6 discusses the results and Section 7 summarizes the results and public policy implications.

2. LITERATURE REVIEW

Although the complementarity between energy and water conservation behaviours has been widely analysed in the literature (Dieu-Hang et al., 2017; Jin et al., 2017; Antunes and Gihisi, 2020; Casazza et al., 2021; Costa et al. 2011; Liobikienè & Minelgaitè, 2021; Liu et al., 2021; Kheirinejad et al. , 2022; Sanguinetti et al., 2022), most of the empirical literature on environmental attitudes and behaviours has focused on specific activities like recycling (Hornik et al., 1995; Oskamp et al. 1998; Czajkowski et al, 2017), waste sorting (Arbués and Villanúa, 2016 and 2022; Aprille and Fiorillo, 2019; Massarutto et al., 2019), water saving (Pérez-Urdiales and García-Valiñas, 2016; Alvarado et al., 2021; Zhu et al.,

2021) or energy conservation (Gillingham and Tsvetanov, 2018; Fiorillo and Sapio, 2019; Kumar et al., 2022).

However, “pro-environmental behaviours” must be regarded as a multi-dimensional concept that includes a wide range of interconnected attitudes and actions (Barr et al., 2001a; Pirani and Secondi, 2011; Royne et al, 2011). While the literature analysing the links between different eco-sustainable behaviours is increasing, works addressing this issue are still scarce[2]. Barr et al. (2005) expanded on the analysis of waste management behaviours carried out by Barr et al. (2001a; 2001b). They grouped households into four behavioural clusters with different socio-economic characteristics based on diverse pro-environmental actions, some of which were associated with water saving. Along this line, Gilg and Barr (2006) carried out the same analysis as Barr et al. (2005), focusing on water saving attitudes. Pirani and Secondi (2011), as well as Yang and Arhonditsis (2022), used a hierarchical modelling framework to analyse the demographic and socio-economic covariates of pro-environmental behaviours of households. They considered a number of dimensions related to activism, lifestyle, and multiple household practices concerning air quality, sorting waste for recycling, energy conservation, and water saving. Furthermore, Smiley et al. (2022) analysed the propensity of people to adopt pro-environmental actions to combat climate change, based on the influence of a set of socio-demographical and attitudinal variables. According to them, environmentally friendly actions can be proxied by four registered habits: renewable energy use, water saving, restricted overall consumption, and use of greener and alternative transportation methods compared to personal cars.

Empirical works have been carried out in various countries, addressing different issues, meaning the list of explanatory variables considered to be drivers of environmentally friendly attitudes varies greatly. In the attempt to capture the socio-economic profiles of individuals, the most common variables are gender (Gilg et al., 2002; Gilg and Barr, 2006; Pirani and Secondi, 2011; Royne et al., 2011), income, education, and age (Yang and Arhonditsis, 2022; Gilg et al., 2002; Gilg and Barr, 2006; Pirani and Secondi, 2011). Results show there is a significant and positive correlation between education level and income and pro-environmental behaviour (Barr et al., 2005; Gilg and Barr, 2006; Pirani and Secondi, 2011; Yang and Arhonditsis, 2022). Regarding gender, most papers found that women tend to behave in an eco-friendlier way (Smiley et al., 2022). In terms of age, Yang and Arhonditsis (2022) showed that the effect of this variable depends on the pro-environmental behaviour in question (waste disposal, water saving, air quality, etc.). However, previous works generally found that people with an older mean age are more committed to waste disposal practices and water saving actions than younger people (Barr et al., 2005; Gilg and Barr, 2006; Pirani and Secondi, 2011). Only in the case of actions related to conservation and protection of wildlife and health and safety were younger people more engaged than older people.

Other socio-economic variables that have been considered include political ideology (Barr et al., 2005; Gilg and Barr, 2006; Yang and Arhonditsis, 2022), ethnicity (Royne et al., 2011), religiosity (Kaplan and Iyer, 2021), relationship with the economic activity (Pirani and Secondi, 2011), marital status (Pirani and Secondi, 2011; Smiley et al., 2022),

[2] Along these lines, Han et al. (2020) carried out an empirical study to identify the drivers that affect eco-friendly behaviours in terms of waste reduction and water saving intention focused on hotel customers instead of households.

house type (Barr et al., 2005; Gilg and Barr, 2006), household size (Gilg and Barr, 2006; Yang and Arhonditsis, 2022), and area of residence (Pirani and Secondi, 2011; Yang and Arhonditsis, 2022). However, the results obtained for some of these variables have been inconclusive. For example, while Pirani and Secondi (2011) found a positive correlation between living in a large, urban city and eco-friendly behaviours, Yang and Arhonditsis (2022) reported there were no relevant differences between urban and rural areas with respect to pro-environmental attitudes. Similarly, Gilg and Barr (2005) and Barr et al. (2006) showed that Labour voters tend to have fewer pro-environmental attitudes, whilst Yang and Arhonditsis (2022) indicated that political ideologies have no influence on the environmental concerns of households. In a similar way, while Smiley et al. (2022) found that religiosity is not a statistically significant predictor of pro-environmental behaviours, Kaplan and Iyer (2021) observed a significant influence of this factor on sustainable attitudes.

In light of previous literature, our main contributions are: first, the adoption of a multi-dimensional approach to analyse several pro-environmental behaviours related to water usage, as well as waste disposal and recycling; and second, with the aim of identifying different environmental profiles, the application of a flexible methodology (the latent class analysis) that has not been considered in previous literature. This methodology is more thoroughly described in Section 4.

3. CONTEXT

3.1. The municipality of Gijón

Gijón is a medium-sized municipality located on the northern coast of Spain, within the Autonomous Community of the Principality of Asturias. It is the largest city in the region, with 271,843 inhabitants in 2021, and a surface area of 181.7 km2 (City Council of Gijon, 2022). The municipality has nine beaches, a sports marina, an industrial port, commercial districts, as well as industrial and residential areas. The suburban area shifts into green rural space at low elevation, and accounts for more than 11% of the total population (31,641 inhabitants in 2021). The climate is characterized by average temperatures of 14 ºC. The winters are long, cold, wet and windy while the summers are short, comfortable, and dry.

The aforementioned characteristics make the city of Gijón an interesting destination for tourism activities. According to the available data prior to the COVID-19 pandemic, Gijón followed a positive trend for incoming tourists, reaching a peak of 1,599,050 accumulated visitors in 2019[3]. This represents almost six times the resident population of Gijón, which undoubtedly creates seasonal pressure on the available resources and services of the city. Moreover, the summer months present the highest levels of tourism activity, with the number of tourists reaching twice the number of regular residents. This may lead to future sustainability problems, either in terms of waste management or water scarcity.

[3]https://www.gijonturismoprofesional.es/files/shares/Corporativo/Datos_Turisticos/Informe_tco_gijon_2019.pdf

3.2. Waste collection in Gijón

Garbage collection is entirely provided by the public company EMULSA (Empresa Municipal de Servicios de Medio Ambiente Urbano de Gijón, S.A.). It is a limited liability company and the City Council owns 100% of its shares. In 2021, the public company had 105 employees and 79 vehicles for solid waste collection and maintenance. The entire provision of cleaning services (garbage collection, maintenance of containers, street cleaning, etc.) is partially funded by a bimonthly fixed fee charged to the citizens of Gijón.

Citizens can dispose their garbage in any of the 9,656 containers available across the municipality. The bulk of the waste container infrastructure is composed of high-capacity containers that are stationary and located at street level or underground. Recyclable waste can be dropped freely at any time with the exception of organic waste; containers for the latter require a citizen card to be opened[4]. The remaining fraction can only be disposed of between 20:00-23:00, Sunday to Friday.
The waste container infrastructure is organised as follows: 34.63% (3,295) is devoted to non-recyclable waste; 13.37% (1,272) to organic waste; 50.14% (4,770) to cardboard, paper, glass, non-ferrous metals, and plastic and packaging; and 0.609% (58) to pruning waste, with containers located in suburban or rural areas. Additionally, EMULSA fits out different containers and waste and recycling drop-off sites ("*puntos limpios"*, according to the Spanish name) for special waste disposal. Clothes can be disposed of in 67 special containers on specific streets (0.704% of the waste container infrastructure), batteries in 143 containers on and below street level (1.481%), and residential vegetable oils can be recycled in 51 special bins located at supermarkets (0.536%).

Waste and recycling drop-off centres also allow citizens to dispose of their day-to-day waste, as well as other items, including hazardous waste. Gijón has four waste and recycling drop-off centres, mainly located at the outskirts of the urban area (see Figure 1). They tend to be open most of the day from Monday to Saturday and can be used free of charge by individuals with a citizen card[5]. Users are restricted to dropping off a limited amount of each type of waste per day, which must be registered before accessing the centre. The following waste products can be dropped off at these centres[6]: automotive waste (synthetic oil, tyres, lead batteries, …), selective waste (paper/cardboard, packaging, glass, books, …), electrical waste (household appliances, fridges, televisions, batteries, cell phones, …), construction and large waste (debris, furniture, mattresses, natural wood, metals, plastic, …), and hazardous and toxic waste (paint, solvents, medicines, discs, packaging with hazardous materials, …).

In addition to waste and recycling drop-off centres, households can dispose of their furniture and medicines by other means. Regarding furniture, citizens must first evaluate whether it is in good condition or not. If so, social inclusion companies, such as EMAUS-RIQUIRRAQUE or CENTRO RETO provide free-of-charge pickup services. If it is in poor condition, EMULSA offers free-of-charge pickup services, as well as the aforementioned waste and recycling drop-off centres. As far as medicines, all pharmacies

[4] Citizen cards are issued free of charge and can be obtained by anyone. There is no need to be registered in the census.
[5] New users and those without a citizen card may access waste and recycling drop-off centres up to three times with just their ID card and car number plate before they need to acquire a citizen card.
[6] Appendix A1 displays a comprehensive description of admitted waste types and their daily limits.

Figure 1: Main areas of Gijón and distribution of waste and recycling drop-off centres

Source: Elaborated by the authors with data from the City Council of Gijón website[7] [8] [9]. Notes: The urban area has been subdivided into the city centre and the rest of the urban area.

have a special recycling bin, called a SIGRE point, where medicinal waste can be recycled. Furthermore, for electrical and electronic devices, as well as toys and playthings in good condition, EMULSA offers an exchange service among citizens through the free app REUSAPP. These devices and toys can be deposited and withdrawn from the Roces waste and recycling drop-off centre, with a maximum retrieval limit of five products.

In sum, more than 60% of the container infrastructure units are devoted to recycling. More precisely, rural areas present the highest number of available recycling points per capita (60 inhabitants per batch of recycling containers), though their spatial distribution is sparser compared to urban areas10. In contrast, the centre of the urban area (yellow area in Figure 1) presents the most congested part of the municipality, with 194 citizens per container batch, with most containers mainly located below ground. Nevertheless, the location of the waste and recycling drop-off centres within the urban area (blue points in Figure 1) may alleviate the pressures on waste disposal of such highly densely populated areas, as well as improve the pro-environmental patterns of the urban population in terms of correct disposal of hazardous waste.

3.3. Water supply in Gijón

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[7] For further information, check https://drupal.gijon.es/sites/default/files/2022-08/MEMORIA%2BEMULSA%2B2021%2BVERIFICADA.pdf

[8] Detailed information is available at https://gijon.opendatasoft.com/explore/dataset/contenedores-emulsa/map/?flg=es&disjunctive.t_entidad&location=12,43.50547,-5.69144

[9] For further clarification, check https://observa.gijon.es/explore/dataset/padron-de-habitantes-actual-poblacion-urbana-por-barrios-sexo-y-grupos-de-edad/table/?flg=es

[10] Containers are preferably located at main junction points between parishes (a district entity smaller than a municipality), such as crossroads between major and minor roads and high-density areas, taking into account the needs of neighborhood associations (other factors considered by EMULSA are the safety of citizens and waste collectors, or minimizing the impact of waste collection on traffic).

The water supply is entirely managed by the public company EMA (Empresa Municipal de Aguas de Gijón). The City Council owns 100% of its shares, and the EMA directly provides several services related to the water cycle in Gijón. The provision of water services is partially funded by a bimonthly fixed rate combined with a three-block increasing variable rate.

According to the last available EMA Annual Report (2020), the public company had over 158 employees, 5 water cycle management and supervision facilities, 27 water depots, 4 water sources, and more than 2000 km of pipework for water distribution and wastewater which reaches most rural areas. In terms of management and supervision facilities, the EMA has a drinking water and wastewater treatment plant, as well as two wastewater pre-treatment plants. Located in the rural part of the city, these plants also have laboratories to control the quality of the water cycle. As per the report, the quality of drinkable water met the general requirements and presented chlorine compliance levels superior to 96%, while the purification system managed to eliminate an average of 74% of pollutants.

Regarding the water supply, more than 94% of the distributed water is sourced from outside the municipality, though it is owned by the City Council (the Arrudos spring) or by the Consortium of Regional Water CADASA (the Nalón river). The remaining water is collected from the Somió-Deva-Cabueñes aquifer and the Llantones spring, which are located in the municipality of Gijón. The quality of these sources and EMA's infrastructure prevents against general episodes of water shortages in the area[11]. Furthermore, since 2004, EMA has steadily increased the efficiency of its services by reducing the amount of water collected by 24% with respect to 2020 (from 29 million m3 to 22 million).

However, this improvement in water efficiency can also be attributed to changes in consumer behaviour due to successful information campaigns implemented by EMA. Among the latest is the "Pee, poo and paper" campaign, which focuses on not using toilets as waste bins. Another campaign called "Water in your City" focuses on teaching children about responsible water use. Moreover, the public company is also present on social media (Facebook, Instagram), where it provides tips for water-saving attitudes, promotes its campaigns, and updates inhabitants about changes in water prices or supply.

4. METHODOLOGY

This paper aims to identify households by their behaviour towards the environment. To do so, we classified them into different categories of unobserved heterogeneity following a latent class analysis procedure (Aitken and Rubin, 1985; Wedel et al., 1993), studying the determinants and probabilities of belonging to each category.

A Latent Class Model (LCM) assumes that a sample of N individuals is randomly drawn from a population divided into J groups or categories (Cameron and Trivedi, 2005). Each observation i of the (NxT) $\boldsymbol{Y}$ vector of T environmental attitudes, extracted from subpopulation j, is characterized by the joint probability density function (*jpdf*) $f_j(\boldsymbol{Y_i}|\boldsymbol{\mu}_\mathbf{j})$,

[11] According to the data from our survey, more than 96% of the participants responded that they had never experienced a water shortage.

where $\boldsymbol{\mu}_{\mathbf{j}}$ is the vector of subpopulation means of the $\boldsymbol{Y_i}$ vector of environmental attitudes. Additionally, the probability p_j of vector $\boldsymbol{Y_i}$ being extracted from the j subpopulation is assumed to take the following fractional logit specification

$$p_j(\boldsymbol{X_i\beta}_j) = \frac{exp(\boldsymbol{X_i\beta}_j)}{\sum_{j=1}^{J} exp(\boldsymbol{X_i\beta}_j)} \qquad (1)$$

where $\boldsymbol{X_i}$ is a (NxK) vector of exogenous observable characteristics and self-reported valuations that may be considered proxies for the underlying utility preferences (Fernandez-Blanco et al. 2009); $\boldsymbol{\beta}_j$ is a $(Kx1)$ vector of exogenous parameters, and $\sum_{j=1}^{J} p_{jt}(\boldsymbol{X}_i\boldsymbol{\beta}_j) = 1$. Now, defining d_{ij} as a dummy variable identifying $\boldsymbol{Y_i}$ as extracted from subpopulation j, the joint multinomial density can be written as

$$g(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}}, \boldsymbol{X_i\beta}_j, d_{ij}) = \sum_{j=1}^{J} \left(p_j(\boldsymbol{X_i\beta}_j) f_j(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}})\right)^{d_{ij}} \qquad (2)$$

which consists of the sum of the J different *jpdf* of subpopulations or latent classes, weighted by the probability of being drawn from a given subpopulation p_j. From (2), the likelihood function to be maximized can be read as

$$\mathcal{L}(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}}, \boldsymbol{X_i\beta}_j, d_{ij}) = \prod_{\mathrm{i}=1}^{\mathrm{N}} \sum_{j=1}^{J} \left(p_j(\boldsymbol{X_i\beta}_j) f_j(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}})\right)^{d_{ij}} \qquad (3)$$

Since we did not impose *ad hoc* categories, we estimate models with increasing categories in a stepwise fashion and compared the results using the Akaike (AIC) and Bayesian Information Criteria (BIC). Finally, we computed the posterior probabilities of belonging to each latent class, according to the function below

$$Prob[\boldsymbol{Y_i} \in j\,] = \frac{p_j(\boldsymbol{X}_i\widehat{\boldsymbol{\beta}}_j) f_j(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}})}{\sum_{j=1}^{J} p_j(\boldsymbol{X}_i\widehat{\boldsymbol{\beta}}_j) f_j(\boldsymbol{Y_i}|\boldsymbol{\mu}_{\mathbf{j}})} \qquad (4)$$

5. DATA AND VARIABLES

The database used in this study is one of the main contributions to the work. Most of the information was obtained from a household survey conducted between December 2020 and April 2021 in Gijón. While its implementation was initially scheduled as a face-to-face survey, the Covid-19 crisis prevented this. Also due to the pandemic, the survey was conducted via a mixed collection system, in which a letter with the questionnaire was sent to the households, which could choose to fill in and submit the survey by post or online. A 100% online survey was ruled out since it would have excluded a large percentage of people from participating, specifically those unfamiliar with smart technologies. Gijón is one of the Spanish cities with the oldest population (by 26% in the latest municipal

Table 1.- Variables definition

Variable	**Definition**
iw_rhabit	Global waste recycling habit weighted (*) index
i_r3habit	Household goods recycling habit index
i_whabit	Water habit index
m3ph	Household water consumption in m3 (2 month-billing period)
highinc	Net family income higher than 2,700 euros/month
hsize	Number of people living in the residence
p_age18	Proportion of family members younger than 18
p_age29	Proportion of family members between 18 and 29
p_age65	Proportion of family members older than 65
homemaker	At least one household member is a homemaker
unemployed	At least one household member is unemployed
college	First and/or second household members have postsecondary degree
wbill	Water bill is sufficiently detailed
users	Number of apartments measured with the same meter
dev_effic	Water-saving devices installed
app_effic	Some electrical appliances have water-saving and/or efficient energy rating
camp_save	The respondent is aware of any campaigns to promote saving water
env_prog	The respondent is aware of the environmental general educational program
smhouse	House surface area is not larger than 60 m2
daysaway30	Household spends more than 30 days away from residence
rural	Household lives in a rural area

Notes: (*) weights: 0.4 non-hazardous waste; 0.6 hazardous waste. Source: Own elaboration.

Census)[12]. Data from the survey were merged with information on actual water consumption provided by EMA. Initially, around 6,800 households were contacted, with a response rate of 30%. After dropping some observations from the database and choosing/building the variables (some of them registered a high number of missing values), 1,351 households were included in the final sample.

Regarding the dependent variables, four variables were built. On the one hand, two are related to declared recycling habits. These two indices were calculated using the information obtained from two of the survey questions, which are displayed in Table A1 (Appendix). The first (*iw_rhabit*) is a global waste recycling weighted habit index. We distinguished between non-hazardous waste (glass, plastics and packaging, paper and cardboard, and organic waste) and hazardous waste (used oil, batteries, and medicines/drugs)[13]. We calculated two subindices corresponding to each kind of waste, assigning the value 1 if the household recycles each product and 0 otherwise, summing up all values and dividing the total sum by the total number of items in each category. Then we calculated a weighted average of those subindices using 0.4 for non-hazardous waste and 0.6 for hazardous waste. This approach would give a higher weight if those products which are more harmful to the environment are recycled. If nothing is recycled, this variable takes the value 0. The second index is related to the correct disposal of small electric appliances, electronic devices, and furniture. Similarly, the value 1 was assigned

[12] For further information, see https://observa.gijon.es/pages/inicio

[13] This classification was proposed by the European Commission. For further details, see https://ec.europa.eu/eurostat/

Table 2.- Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
iw_rhabit	1,741	.821367	.2288968	0	1
i_r3habit	1,437	.7974948	.2934125	0	1
i_whabit	1,773	.6504404	.1349007	0	1
m3ph	1,773	16.1972	10.7535	0	166
highinc	1,556	.2512853	.4338917	0	1
hsize	1,773	2.4078	1.05122	1	6
p_age18	1,773	.1025287	.1813008	0	.67
p_age29	1,773	.0855236	.1737068	0	1
p_age65	1,773	.3020023	.4174705	0	1
homemaker	1,773	.1618725	.3684378	0	1
unemployed	1,773	.1460801	.3532861	0	1
college	1,773	.4782854	.4996692	0	1
wbill	1,729	.4441874	.4970189	0	1
users	1,773	9.1664	13.7605	1	93
dev_effic	1,725	.5130435	.4999748	0	1
app_effic	1,710	.1842105	.3877692	0	1
camp_save	1,763	.4163358	.4930905	0	1
env_prog	1,773	.1601805	.3668768	0	1
smhouse	1,680	.1380952	.3451026	0	1
daysaway30	1,773	.1979695	.3985815	0	1
rural	1,773	.1607445	.3673987	0	1

Source: Own elaboration.

if a household recycled each product and 0 otherwise, aggregating all the habits and dividing the sum by the total number of items.

On the other hand, two indices related to the water sector were defined. The first was based on another survey question (see Table A2 in the Appendix) and was built in a similar fashion to the previous indices. Households were asked if they had adopted several habits related to water use. A value of 1 was assigned when the household adopted the habit, or 0 otherwise. The values were summed up and the total amount divided by the number of habits. Finally, the last dependent variable was household water consumption corresponding to the second billing period of 2021. Contrary to previous indices, this variable is representative of an observable behaviour.

With regard to independent variables, we considered several groups of factors based on the previous literature. Firstly, certain socioeconomic household features were included: household income higher than 2,700 euros per month (*highinc*), family size (*hsize*), household age composition, with the percentage of family members in different age brackets (*p_age18, p_age29, p_age65*), if at least one household member is a homemaker and/or is unemployed (*homemaker; unemployed*) and if the first and/or second household members have a postsecondary degree (*college*).

Information on public services was another important factor and was captured through the variable *wbill*. As in other Spanish cities, the water bill reports information on both water and waste collection services, offers data on fees/prices, water consumption, and other notifications related to these services. Therefore, the water bill stands out as a crucial information channel between the public sector and citizens, as it contains key information that can impact behaviours and attitudes. As shown in Table 2, for a significant percentage of households, for several reasons, their water bill does not provide sufficient information on key water and waste collection concerns. The survey asked households if the water bill is sufficiently detailed. The available responses were 1) Yes; 2) No; 3) I do not receive a bill at this residence; and 4) I receive a bill but I do not remember. We transformed the original variable into a dummy variable to capture the effect of households receiving sufficient information on water and waste collection services through the bill[14]. With this variable, it is also assumed that inattentive households or those that do not receive the bill are not well-informed about these issues.

Another group of variables is related to house equipment. The number of flats measured with the same water meter was included as an explanatory variable (*users*). This variable can show if there is a collective meter and, subsequently, the different water tariffs and the difficulties in assigning responsibilities for water consumption. Additionally, two variables related to water efficient technologies were included (*dev_effic*, *app_effic*), distinguishing between devices that do not use energy (devices to control water pressure, efficient toilets) and appliances that do (washing machines and dishwashers).

Moreover, three additional variables captured the respondents' environmental attitudes: if the respondent is aware of campaigns to promote water savings (*camp_save*), and familiar with the environmental program organized by the water company (*env_prog*). It was expected that people who are more aware of environmental problems would be more likely to display more environmentally friendly behaviours.

Lastly, three extra variables related to space or time availability were included in the estimates: if the household lives in a small house (*smhouse*) no larger than 60 m^2, if the household spends more than 30 days away from the residence (*daysaway30*), and if the household lives in a rural area (*rural*). The first and second variables represent space constraints (people living in small houses in urban areas are expected to consume less water but have less room to recycle at home). Additionally, it is more likely that people who travel do not recycle frequently but it also is probable that they consume less water.

Table 2 presents the main descriptive statistics. On average, households reported having better waste recycling habits than water use habits. The representative household from the sample consumes 16 m^3 per billing period (around 267 litres per household per day) and has 2.4 members[15]. As mentioned before, it is quite an aged population, as seen in the percentage of family members older than 65. A relatively high percentage of households (around 15% and 16% respectively) has an unemployed member or a homemaker. In 48% of households, at least one of the main members has postsecondary studies.

Concerning information issues, 44% of households reported receiving useful information about water and waste collection services via the bill. Regarding house equipment, the average number of flats measured by a single meter is around 9 (a significant presence of collective meters was detected). Moreover, 51% of households have water efficient devices installed, but only 18% have energy and/or water efficient appliances. Around

[14] Dummy takes a value of 1 when respondents firmly state that the water bill is sufficiently detailed and, as such, a source of valuable information.

[15] This figure is in line with the results published by the Spanish National Statistics Institute (INE, 2020), reporting an average household size of 2.2 in the region (Principado de Asturias).

37% of respondents are very concerned about environmental problems, while 42% are aware of campaigns to encourage saving water. However, not many people (16%) are aware of the environmental programs organized by the water company. Finally, around 20% of households spend more than 30 days away from home, 14% of households live in small flats, and 16% are located in rural neighbourhoods.

6. EMPIRICAL RESULTS

Latent class models were estimated using the *gsem* Stata command. Models with different numbers of classes were also assessed. In order to select the best option, several information criteria have been provided. Table 3 displays the results of AIC and BIC for each model. Both criteria clearly decrease from 2 to 4 classes and increase again for the 5-class case. Based on these results, we focus our study on the four-class model.

Table 3.- Information criteria in LCM estimates: AIC and BIC

Model	N	AIC	BIC
2-Class	1,358	6761.436	6917.849
3-Class	1,358	6385.755	6656.871
4-Class	1,358	4675.853	5061.672
5-Class	1,358	5298.965	5799.486

. Source: Own elaboration.

Tables 4 to 6 present the results of the four-class model. Looking at Table 4, it is possible to observe the main features of these groups in terms of their reported environmental habits and behaviours. Furthermore, Table 5 captures the main determinants of class membership. Finally, Table 4 shows some figures related to class membership based on posterior probabilities predicted for each household[16].

According to the LCM estimates, the households were classified into four groups. Strong differences regarding efficient environmental indices were detected, except in the case of declared water habits, where values were similar across the 4 classes considered. A description of each group is provided below, connecting the class characteristics with the key drivers for belonging to each class.

Individuals in Class 1 exhibited the worst self-reported habits in terms of recycling and water use. However, their observed water consumption is the lowest level recorded. As mentioned in both Tables 4 and 5, Class 1 is the benchmark group of the LCM estimates. Posterior probabilities showed that 17.53% of households in the sample would be classified into this group.

Class 2 comprises the households with the best declared environmental habits and the second lowest water consumption level. Based on posterior probabilities, this is the largest group, with 56.33% of the households. It is noteworthy that these households present strong recycling behaviours related to all kinds of waste. Regarding the

[16] Probabilities were predicted after estimating LCM and households were allocated into the group with the highest probability.

Table 4.- Estimated class characteristics and class membership based on posterior probabilities

	iw_rhabit	***i_r3habit***	***i_whabit***	***m3ph***	**Freq.**	**Percent**
Class 1	0.435***	0.2393***	0.608***	14.425***	238	17.53
Class 2	0.973***	1***	0.666***	14.618***	765	56.33
Class 3	0.950***	0.992***	0.638***	42.196***	49	3.61
Class 4	0.732***	0.666***	0.655***	15.323***	306	22.53
log-likelihood	-2263.9265				1,358	100.00

Notes: Class 1 is the benchmark of the Fractional Logit Model. *p<0.10, **p<0.05, ***p<0.01. Source: Own elaboration.

Table 5.- Determinants of class membership

	Class 2	**Class 3**	**Class 4**
highinc	0.175	0.61	0.670***
hsize	-0.239**	0.582**	-0.165
p_age18	0.219	0.394	0.964
p_age29	0.950*	2.225	0.507
p_age65	0.467**	1.929**	0.311
homemaker	0.670**	0.58	0.574*
unemployed	-0.111	0.856*	0.131
college	0.416**	1.185**	0.135
wbill	0.574***	-0.144	0.162
users	-0.006	-0.125**	-0.012*
dev_effic	0.579***	-0.055	0.460**
app_effic	-0.081	0.395	-0.042
camp_save	0.159	0.524	0.27
env_prog	0.964***	-2.576	0.258
smhouse	-0.188	-0.509	-0.236
daysaway30	-0.064	-1.092	0.079
rural	-0.248	1.918***	-0.448
constant	0.599**	-5.345***	-0.164

Notes: Fractional Multinomial Logit Model results after LCM with four classes. Class 1 is the benchmark. *p<0.10, **p<0.05, ***p<0.01. Source: Own elaboration.

determinants of belonging to this group, the presence of a homemaker in the household, a higher proportion of members between 18 and 29 years, as well as older than 65, or having at least one member with a postsecondary degree increased the probability of belonging to this class with respect to the reference group (Class 1). Additionally, smaller-sized households, or those endowed with water-saving devices are more likely to be members of this group. A similar effect was detected when the respondent was aware of the environmental educational program or considered the water bill to be sufficiently detailed. Therefore, better informed households and those more concerned about water and waste collection services were more likely to perform better in terms of water and recycling services.

Households in Class 3 also exhibited very good recycling habits but presented the second worst index of water habits as well as much more higher consumption levels. In terms of predicted probabilities, this is the smallest group (3.61% of households). As seen in Table 5, they have different characteristics compared to Class 2. A unique feature is the significance of living in rural areas, which increases the probability of belonging to Class 3 with respect to the benchmark group. Similar to Class 2, households with large shares of elder members, or with high levels of education increase the likelihood of being included into Class 3 compared to Class 1. On the contrary, large families are more likely to be found in this class. Other significant determinants are the work status of the household members, or the number of users measured by the same water meter. In this sense, having at least one unemployed member increases the probability of being part of Class 3 with respect to Class 1, while sharing the water meter reduces the probability of being part. Therefore, the high consumption levels exhibited by this group are basically explained in terms of larger family sizes and the presence of gardens or other features which are present in rural areas.

Lastly, households in Class 4 did not report having the best recycling habits, and their water indices were similar to the households in Class 2. Households with high income levels, a homemaker or stay-at-home parent, or with efficient devices installed are more likely to belong to this group with respect to the benchmark group. On the other hand, being part of a building with many users sharing the water meter reduces the likelihood of belonging to this group with respect to the reference group.

7. DISCUSSION

To frame the discussion of the results, the average marginal effects corresponding to the four groups are displayed in Table 6. These figures help us understand the relative average weight of each variable when it comes to explaining pertaining to each class.

The empirical study shows an overview of the crossovers of pro-environmental attitudes of households regarding water saving and proper waste management. One of the most relevant findings is the lack of differences in water saving behaviours between households who have or have not invested in some efficient appliances (dishwasher, washing machine, etc.). On the contrary, investing in water-saving devices (*dev_effic*), such as efficient taps or toilet flushes, increases the likeliness to be a member of the environmentally-friendly Class 2 by 0.077 points, at the same time decreases the likeliness to be part of the environmentally-harmful Class 1 by 0.071. The non-significant effect of efficient appliances can be explained by the composition of these households. In this sense, Class-2 households present large shares of elder members, who often face strong barriers to operate these devices at their full water-saving potential (Cabanillas-García et al., 2022). Furthermore, the so-called ‘rebound effect’, where part of the efficient savings associated with the technology could be absorbed by behavioural changes (Fielding et al. 2012).

Regarding the attitudinal variables, the obtained results are heterogeneous. First, the variable (*env_prog*) that captures the influence of educational program organized by the water company shows that awareness of this program increases the likelihood of belonging to Class 2 with respect to the reference class, that is, of having good pro-environmental behaviour. Furthermore, the marginal effects show that if the household is

Table 6.- Average marginal effects by class

Determinants	Class 1	Class 2	Class 3	Class 4
highinc	-0.046*	-0.050	0.009	0.087***
	(-1.66)	(-1.41)	(0.67)	(3.04)
hsize	0.025*	-0.043**	0.020***	-0.002
	(1.75)	(-2.16)	(2.86)	(-0.16)
p_age18	-0.061	-0.072	0.001	0.132
	(-0.84)	(-0.74)	(0.03)	(1.62)
p_age29	-0.120	0.121	0.043	-0.044
	(-1.63)	(1.27)	(1.17)	(-0.54)
p_age65	-0.066**	0.039	0.044**	-0.017
	(-2.16)	(0.99)	(2.32)	(-0.5)
homemaker	-0.088**	0.074*	0.001	0.011
	(-2.52)	(1.75)	(0.11)	(0.32)
unemployed	0.0002	-0.054	0.024*	0.029
	(0.01)	(-1.38)	(1.71)	(0.89)
college	-0.050**	0.060*	0.025*	-0.035
	(-2.07)	(1.86)	(1.76)	(-1.3)
wbill	-0.058**	0.114***	-0.014	-0.041
	(-2.49)	(3.78)	(-1.26)	(-1.58)
users	0.001**	0.002	-0.003*	-0.0004
	(2.07)	(1.36)	(-1.85)	(-0.4)
dev_effic	-0.071***	0.077***	-0.013	0.007
	(-3.35)	(2.74)	(-1.1)	(0.31)
app_effic	0.006	-0.019	0.012	0.0001
	(0.25)	(-0.49)	(0.67)	(0)
camp_save	-0.028	-0.004	0.010	0.022
	(-1.29)	(-0.16)	(0.84)	(0.93)
env_prog	-0.085**	0.229***	-0.088	-0.056
	(-2.07)	(2.99)	(-0.75)	(-1.3)
smhouse	0.029	-0.006	-0.009	-0.013
	(1)	(-0.15)	(-0.36)	(-0.37)
daysaway30	0.008	-0.007	-0.029	0.028
	(0.33)	(-0.2)	(-1.38)	(1)
rural	0.030	-0.032	0.060***	-0.058
	(0.96)	(-0.71)	(3.71)	(-1.57)

Notes: *t* statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

aware of this educational program, the probability of belonging to Class 1 decreases by 0.085 while simultaneously the probability of belonging to Class 2 increases by 0.229.

On the other hand, with regard to the variable *camp_save*, the econometric estimation did not show a significant correlation with the pro-environmental behaviour of the households nor are the marginal effects significant. It should be noted that this result may be because, at least in Spain, it is quite common that water saving campaigns are focused on habits, such as taking showers instead of baths, that people have already internalised (March et al., 2015).

Therefore, these results point to the general environmental awareness programs as a powerful tool for promoting eco-friendly attitudes in the households, much more effective than programs focused on specific environmental issues. Thus, it will be very important to develop programs focused on SDG promotion in order to create high levels of environmental commitment. In addition, emphasis will need to be placed on teaching environmental values across all levels of education to promote greater environmental awareness.

Focusing on the socio-economic variables included in the analysis, our estimation in Table 5 shows that some eco-friendly behaviours tend to be related to the spatial location. It seems that good recycling habits alongside elevated levels of water consumption can be found in rural areas. The marginal effects show that the probability of rural households belonging to Class 3 (which register the highest level of water consumption and the second-best recycling indexes) increases by 0.06. Some papers have supported the idea that there are differences in pro-environmental behaviours among different countries (Pirani and Secondi, 2011) or regions (Lee and Khan, 2020). Furthermore, it should be noted that although the most commonly used criterion to establish the urban/rural division is population density, in practice there are different contextual factors (e.g., type of dwelling, housing equipment installed, etc.) that may be relevant to explaining the differences in pro-environmental behaviours among households in these areas (Anderson and Krettenauer, 2021).

Regarding education level, we observed that this increases the probability of adopting eco-friendly attitudes (the probability of being in Classes 2 and 3 and not in Class 1 was positively linked to this variable). This result is similar to that observed in previous works, such as Barr et al. (2005), Gilg and Barr (2006) or Yang and Arhonditsis (2022). Nevertheless, the relationship between education level and the water saving dimension of pro-environmental behaviour is, in part, unclear because households in Class 3 showed high water consumption levels. Since the marginal effect of increasing average education levels in Class 2 more than double that of Class 3, we can expect a positive net effect of education. Furthermore, this effect is reinforced by the negative marginal effect of education on the likelihood of belonging to Class 1. This finding reinforces the importance of education to promote changes in behaviour patterns, encouraging people to adopt more eco-friendly habits. Similarly, information issues also play a significant role, as seen in the marginal effects estimated for *wbill*. Thus, for those households that reported the water bill is sufficiently detailed, the probability of belonging to Class 2 increased by 0.114 while the likelihood of belonging to Class 1 decreased by 0.058.

On the other hand, the positive relation observed between the average age of households and pro-environmental behaviours is parallel to previous research (Steel 1996; Barr et al., 2005; Gilg and Barr, 2006; Pirani and Secondi, 2011). Specifically, our estimation indicates that the presence of a high proportion of people older than 65 increases the likelihood of being in Class 2 and not in Class 1, showing positive environmental habits in the two dimensions under consideration (water saving and proper waste management). However, the positive relationship between this variable and water saving attitudes is not entirely clear because the marginal effects for Class 2 is non-significant, but it is for Class 3 (0.044), which leads to better recycling habits at the expense of high water consumption.

Additionally, the non-significant coefficients estimated for the marginal effects corresponding to *p_age18* and *p_age29* indicate that the presence of young people in the household does not influence the adoption of pro-environmental habits. This is a result that previous empirical works adopting a multidimensional approach of pro-environmental behaviour have not found. The explanation for this pattern is that, as Calculli et al. (2021) noted, young people are increasingly committed to environmental issues, adopting eco-friendly practices and getting involved in pro-environmental activism (e.g., the protest movement called “Fridays for Future”) typically focused on mitigating climate change. Furthermore, as Dietz et al. (2009) and Wallis and Loy (2021) indicated, young people face many barriers to adopting eco-friendly lifestyles, especially when actions require high expenditure (e.g., investment in water saving technologies). As Kollmuss and Agyeman (2002) noted, people who have positive environmental awareness (i.e., young people) are often involved in low-cost eco-friendly activities (i.e., proper waste management), but are not always engaged in more expensive activities.

Therefore, the scope of pro-environmental action among young people is reduced to certain activities that include avoiding and sorting waste, using public transportation, or buying organic products (Calculli et al., 2021; Shutaleva et al., 2022). In this way, while young people are aware of the efficacy of waste reduction to help mitigate climate change, they consider water scarcity a consequence of climate change rather than a problem in itself. In this regard, we can see that, as the number of people living in a household decreases, the likelihood of having very good environmental habits (belonging in Class 2) increases. Note that this result is consistent with previous works such as those by Barr et al. (2005) and Gilg and Barr (2006).

Lastly, we determined that those households where one member is a homemaker tend to adopt better environmental attitudes. The marginal effects show that the probability of being in Class 1 diminishes by 0.088 when there is no homemaker while the probability of being in Class 2 increases by 0.074 when there is a homemaker. This result is consistent with the fact that these household members have enough time to perform household chores, including sorting waste and water-related tasks (cleaning, washing, etc.). It is noteworthy that this variable has not been analysed in any previous empirical work with a multidimensional approach to environmental behaviour.

8. CONCLUSIONS

Water consumption management and waste recycling are key behavioural dimensions that should not be overlooked. According to the United Nations, there is still a long path ahead towards achieving specific Sustainable Development Goals (UN, 2022). The challenges presented in the 2030 ASD framework will require significant support in terms of behavioural patterns. Understanding how households in a city similar to Gijón, highly involved in promoting eco-friendly behaviours among its citizens, may be a good benchmark for other cities seeking to build a more sustainable urban environment.

This research made it possible to identify groups of individuals with the best pro-environmental behavioural profiles regarding water use and waste recycling at the residential level. Moreover, some key drivers for those best practices were found, providing valuable information for designing more efficient and useful public policies. Together with non-controllable factors (i.e., sociodemographic and geographical features), we identified some significant policy tools where efforts could be focused in order to improve natural resource management and the circular economy. This issue is of great importance for understanding to which extent people are well prepared to tackle the environmental challenges which are to come (droughts, soil and water pollution by the accumulation of depleted batteries, etc.).

On the one hand, small families with homemakers have a higher probability of belonging to the most environmentally friendly group. Lower requirements and coordination efforts and more potential time devoted to these activities back up those findings. However, the results related to the age composition of household members did not return clear profiles. Being located in rural areas is also significant since it affects water consumption (housing features such as swimming pools or gardens), but also space availability and better recycling habits.

On the other hand, some strategies emerged as very valuable instruments to promote pro-environmental behaviours. Informational and educational programs were identified as powerful tools to generate good environmental attitudes and habits. For instance, misinformation in the water sector could generate inefficient behavioural responses (Binet et al., 2014), thus it is crucial to improve knowledge around water consumption and prices in the sector. Moreover, the promotion of educational programs that address several environmental dimensions is also recommended for raising awareness about environmental problems.

In sum, the LCM methodology applied in this study allows us to sort households according to their degree of pro-environmental behaviour. Our results could be very useful for decision-makers in designing effective pro-environmental measures. Implementing public policies based on the characteristics of individuals will help to achieve long-term changes in their environmentally-friendly habits.

Finally, we should remark several limitations of our study that yield interesting ways for further research. First, this research is obviously limited in both spatial and temporal dimensions. The findings could not be generally extended to other highly different geographical areas and do not capture the dynamics of behavioural profiles. However, we found similar results as the previous literature, though we adopted a fairly innovative multidimensional empirical and methodological approach which contributes to improve the state of the art. Therefore, an obvious next step for this analysis would be to replicate our methodology in other cities with different population characteristics and environmental challenges. Secondly, our study has been carried out focusing on two dimensions of pro-environmental behaviours (proper waste management and water saving). Because pro-environmental behaviours contain many other dimensions (i.e. energy saving, purchasing organic food, mobility or transportation patterns, among others), a next step of our research could be to replicate our methodological purpose including more dimensions in the analysis. In this way we would be able to have a much more comprehensive overview of pro-environmental behaviours that would allow decision makers to design much more effective measures.

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APPENDIX

Table A1.- Questions related to recycling habits

P.43 Which of the following do you recycle (you can choose several answers):	P.44 Have you made use of designated waste collection points or household collection services for disposing of the following (you can choose several answers):
1) Glass 2) Plastics and packaging 3) Paper and cardboard 4) Organic waste (to produce compost and biogas) 5) Used oil 6) Batteries 7) Medication/drugs 8) I don't usually recycle	1) Small electric appliances (microwaves, irons, etc.) 2) Electronic devices (laptops, mobile phones, etc.) 3) Furniture 4) I have not needed to dispose of anything 5) I'm not sure

Table A2.- Questions related to water habits

P.21. In general, has your household adopted any of the following habits to reduce water consumption?

	No	Yes
Recycling water. For example, making use of water from the shower while waiting for it to warm up		
Keeping a bottle of cold water in the fridge so as not to leave the cold water running from the tap		
Turning off the tap while applying soap to your hands		
Thawing food in advance instead of thawing it under the tap		
Filling the sink before washing the dishes		
Waiting until the dishwasher and the washing machine are full before running them		
Tightening the shut-off valve to decrease the flow from the tap		
Not using the toilet as a rubbish bin, avoiding throwing all types of waste into it		
Making use of the partial-flush system on the toilet tank to select the quantity of water		
Turning off the tap while brushing your teeth		
Taking showers instead of baths		
Turning off the shower while applying soap		
Avoiding washing your car with water from the drinking water supply		

Table A3: Type and quantity of waste admitted at waste and recycling drop-off centres

ADMITTED WASTE	MAX QUANTITY	ADMITTED WASTE	MAX QUANTITY
Mineral/synthetic oil	10 litres	Containers	No limit
Oil filters	5 units	Glass (bottles)	No limit
Tyres	4 units	Residential vegetal oil	No limit
Lead batteries	2 units	Clothes and textiles	No limit
Empty oil/gasoline containers	5 units	Paints/solvents	20 litres

Absorbents/contaminated material/rags	10 litres	Solvents and aerosols	10 units
Hydraulic oil	1 litre	Radiographies	10 units
Appliances	2 units	Toner/printer cartridges	10 units
Fridges	2 units	Drugs	50 units
Electronic scrap	5 units	Mercury thermometers	2 units
Televisions	2 units	Discs, DVDs, cassettes, VHS	50 units
Low consumption lamps	5 units	Packages with hazardous remnants	5 units
Neon	5 units	Photographic liquids	10 litres
Standard batteries	50 units	Natural wood	20 units
Button cell	50 units	Chipboard	20 units
Mobile phones	No limit	Metals	No limit
Mixed debris	120 litres	Aluminium and copper	No limit
Selected debris	120 litres	Plastic/EPS/Packages	No limit
Furniture	20 units	Plant waste	1 m3/day and 4 m3/month
Mattresses	5 units		
Coffee containers	No limit	Paper/cardboard	No limit

Source: Elaborated by the authors with data from EMULSA.

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