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Socio-Economic Development and Eco-Education for Urban Planning Committed to Sustainability

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Abstract: The rapid pace of technological advancement presents cities with emerging socio-economic and environmental challenges. Drastic climate change threatens the viability of biologically comfortable environments, compelling urban areas to adapt to new conditions. This adaptation necessitates the implementation of various strategies to maintain the population's well-being, including mitigating climate change effects, which are characterized by rising average temperatures and prolonged droughts. Addressing critical issues such as water scarcity and extreme temperatures—particularly in Mediterranean regions, where summer temperatures can reach 48–50 °C—requires substantial energy consumption, which must be met through clean energy sources to reduce carbon emissions. Decarbonization efforts must be accompanied by the restructuring of urban green spaces, the expansion of peri-urban parks, and large-scale reforestation to enhance carbon sequestration. These measures, combined with the adoption of clean energy, would mitigate the impact of elevated CO_2 concentrations. In urban areas, the restructuring of green spaces should prioritize biodiversity through the use of native, water-efficient species while avoiding non-native, potentially invasive plants. Furthermore, societal engagement is essential in achieving these objectives, with the education system playing a pivotal role in fostering environmental awareness and promoting collective action.

Keywords: learning; education; management; knowledge; societies; agriculture; natural spaces

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1. Introduction

In the face of the pressing challenge of climate change and the unchecked expansion of urbanization fueled by an excessive reliance on fossil fuels, cities that once provided conditions of biological comfort are now experiencing the opposite scenario. Increased population density has elevated pollution levels, adversely impacting public health [1–3].

Moreover, climatic irregularities further disrupt biological comfort, manifesting in torrential rains, extreme droughts, and rising temperatures. According to the IPCC, by 2035, global temperatures are expected to exceed 1.5 °C, a scenario with potentially catastrophic consequences for urban areas [4]. Current bioclimatic studies indicate a rise in thermal conditions and a decrease in precipitation in Mediterranean regions [5]. Consequently, urban areas must implement effective measures to mitigate the effects of climate change.

Water scarcity poses a critical challenge to sustaining current agricultural, forestry, and urban development. Addressing this issue requires not only controlling water and energy consumption, but also fostering education and raising societal awareness. To meet humanity's emerging challenges, the education system must adapt accordingly.

A comparative analysis of water resources in Spanish river basins demonstrated that Mediterranean basins exhibit the lowest water availability, particularly in the Southern, Segura, Júcar, and Catalonia basins, which aligns with regional precipitation patterns. However, the highest water availability per capita is found in the Segura and Júcar basins due to external water contributions, hydraulic infrastructure, and the use of groundwater. These Mediterranean areas, characterized by high population density, exhibit greater water demand as they are highly industrialized and require significant irrigation for agricultural activities.

The irregular precipitation patterns induced by climate change have led to a decline in groundwater resources, threatening industry, agriculture, and domestic water supply. In contrast, these water resource anomalies are mitigated in the Atlantic and Cantabrian basins. This scenario underscores the necessity of implementing a rational and sustainable water consumption strategy at all levels.

The severe environmental conditions affecting the Mediterranean basin—marked by prolonged droughts that impact floral, faunal, and human populations—necessitate urgent environmental actions to mitigate these phenomena. This urgency prompted the Government of Spain to enact Law 7/2021, of 20 May, on Climate Change and Energy Transition [6], outlining measures to address these challenges. Climatic irregularities result in low agricultural yields and subsequent food shortages, severely affecting populations, as evidenced by the DANA (Isolated Depression at High Levels) that devastated much of the Valencian Community [7]. The 2024 DANA floods in Spain, which began on 29 October, were an environmental catastrophe caused by a cold drop, demonstrating the destructive impact of such phenomena. These irregularities are also among the primary drivers of strong south-to-north migration flows.

Furthermore, extreme heatwaves, reaching up to 48 °C in Spain, intensify energy consumption as populations attempt to maintain biological comfort. Outdated climatic perspectives and economic interests continue to hinder efforts to reverse climate change. The only effective way to mitigate its effects is through a deep understanding of these phenomena and the promotion of social awareness, both of which should be fundamental pillars of the education system [3,5].

In today's society, fostering the development of social competencies centered on environmental knowledge and appreciation has become imperative. Educational institutions play a crucial role in this process, embedding environmental education within their curricula as a cornerstone for cultivating an eco-responsible social consciousness.

The translation of scientific knowledge into actionable understanding must be achieved through scientific literacy. Classrooms need to adopt innovative educational strategies that promote participatory learning, enabling students to engage with real-world scientific contexts. This experiential approach ensures that learning is both meaningful and directly connected to their daily lives.

Promoting an understanding of interdisciplinary knowledge is essential for addressing educational work with commitment and responsibility. This fosters cooperation, coexistence, and reciprocity within the educational context, contributing to public awareness. Therefore, guiding teaching activities toward a significant improvement in knowledge acquisition and the development of scientific competencies is crucial, as these competencies can, subsequently, be transmitted to society as a whole [8].

In schools, a noticeable lack of interest in science persists, one of the primary causes being the traditional teaching model, which relies predominantly on the theoretical transmission of knowledge. This approach fails to motivate students to engage in learning.

The mere theoretical dissemination of knowledge detaches students from practical reality, relegating them to a passive role as observers. This factor significantly contributes to the growing disinterest in science among students [9].

Scientific competencies can only be fully assimilated by students through active knowledge acquisition. Therefore, it is preferable to promote practical teaching methodologies conducted by educators and environmental managers outside the classroom. This approach serves as a motivational tool in the cognitive learning process. The training of specialized personnel in environmental issues enables the dissemination of knowledge to society, fostering a collective awareness of nature, since one can only value and protect what one truly understands.

This evident lack of interest in learning leads to poor academic performance, highlighting the need to revitalize educational processes by redirecting them toward the pursuit of sustainability [10] and incorporating educational innovation into classrooms alongside the teaching of entrepreneurship [11].

The didactic strategies implemented must address this issue from the earliest educational levels. To achieve this, educators must integrate new methodologies into their teaching practices, shifting away from traditional instruction toward active learning approaches. These methods aim not only to enhance scientific literacy, but also to significantly improve student motivation. Byrne et al. [12] argue that the shift to online learning during the pandemic demonstrated the greater benefits of in-person education.

The urgent need to adopt new active learning strategies enables the integration of relevant resources into student training across multiple educational levels, including primary, secondary, and higher education. This approach fosters direct interaction with both natural and urban environments, supporting the development of various educational disciplines [13]. By engaging with their surroundings, students gain a deeper understanding of environmental challenges, linking theoretical knowledge to real-world issues [14].

School gardens, botanical gardens, urban parks, and peri-urban areas serve as valuable educational resources that promote cooperative and active learning, fostering the development of attitudes and values focused on environmental conservation and respect [15–17].

According to Palacios [18], the school garden promotes active teaching and brings students closer to the natural environment, serving as a tool to strengthen teaching–learning activities. It also functions as a platform for establishing and developing a more dynamic and participatory form of education.

Similarly, school gardens, botanical gardens, urban parks, and peri-urban areas serve as environments that foster cooperation, collaboration, and student participation, enabling the application of theoretical knowledge through practice in these semi-natural spaces. In this context, as stated by Cano-Ortiz et al. [16], peri-urban agricultural areas provide excellent laboratories for environmental education.

The presence of school gardens, urban parks, and green spaces within educational institutions necessitates the integration of innovative methodologies into teaching strategies to promote sustainability education. In this regard, educational institutions in urban areas should function as drivers of sustainable development.

The school garden is a widely endorsed didactic resource, supported by numerous researchers, as it is accessible to the educational community and serves as an effective medium for transmitting knowledge across all academic levels. Incorporating school gardens into educational infrastructure ensures the creation of spaces conducive to experiential learning, fostering behaviors and values associated with environmental responsibility among students. School gardens and urban parks, as well as green and peri-urban areas in cities, serve as laboratories for practical learning [19,20].

Botanical gardens were originally established to protect and preserve plant species of interest, particularly endemic and rare species, and to facilitate biodiversity research [21–25]. Given the severe environmental changes caused by human activities and climate change, promoting this type of education has become increasingly urgent [26–28].

These learning spaces not only serve an educational function but also represent essential infrastructures [29] for research on ecosystem services, species conservation, and the eradication of invasive exotic species, which pose a significant threat to native flora [30,31], as exemplified by *Swietenia macrophylla* and noted by Coracero [32].

A similar situation occurs in the southern Iberian Peninsula, where Dana et al. [33] identified 66 invasive species in Andalusia (Spain), some of which, such as *Oxalis pes-caprae*, severely impact grasslands and agricultural systems. These invasive species frequently escape from urban gardens [34].

Law 42/2007, of December 13 [35], on Natural Heritage and Biodiversity, exclusively addresses the protection of biodiversity in non-urban natural areas. Neither this law nor municipal regulations provide guidelines on the selection of plant species for city gardens and parks. As a result, exotic species are frequently introduced, some of which escape from these managed spaces and become invasive.

These urban areas, including gardens and parks, lack specific national regulations, leaving their management entirely to the discretion of local governments. With appropriate classification, these spaces—given their semi-natural characteristics—could be restructured to include carefully selected cultivated species, transforming them into outdoor educational laboratories.

Such semi-natural spaces facilitate experiential learning, allowing students to acquire knowledge through direct interaction with their environment. Moreover, they help develop practical skills and foster attitudes of responsibility and respect for nature [18].

Educational gardens, urban green spaces, botanical gardens, and peripheral city areas function as valuable environmental resources [36], bringing students closer to their immediate surroundings. These spaces not only provide hands-on learning opportunities but also serve as interdisciplinary platforms, integrating themes such as sustainability, food security, health, values education, and civic engagement within the framework of ecosystem services [3,37].

The incorporation of gardens and parks into educational programs enhances knowledge retention by grounding learning in experimentation. Additionally, this educational approach fosters the development of competencies beyond environmental awareness, such as the ability to establish eco-industries within the scope of ecosystem services [38], thereby contributing to business sustainability.

This sustainability is reinforced through an action–research methodology focused on the training of educators and researchers. As highlighted by da Silva Siltori [39], this approach equips professionals with the necessary skills to generate sustainability reports and effectively integrate these concepts into educational curricula. To support this, it is essential to systematize, collect, and disseminate sustainability research [40], while fostering competencies related to climate change mitigation [41] and the development of effective mitigation methodologies [42–46].

These strategies may include expanding urban forested areas and increasing herbaceous plant cover in peri-urban agricultural systems, which serve as indicators of soil nutrient status and function as CO_2 sinks. Achieving these objectives requires enhancing students' ability to interpret environmental conditions, integrate new knowledge into their cognitive frameworks, and cultivate key competencies such as perseverance, personal development, teamwork, initiative, and collaborative problem-solving [47].

The reviewed literature emphasizes the promotion of environmental knowledge as a key to achieving sustainable development that enhances societal well-being. This is made possible through the understanding of ecosystem services. Cities with natural or semi-natural environments must play a pivotal role in driving economic and social transformation, with the educational system being a fundamental factor in this process.

This research aims to promote a teaching–learning system that connects its goals to the use of the natural environment as an educational resource. These spaces function as laboratories for teaching practices and research.

The didactic strategy proposed seeks to foster and improve the assimilation of knowledge related to social, cultural, health, agricultural, forestry, and sustainable development activities. It outlines strategies for implementing responsible and environmentally respectful agricultural practices, enabling agricultural practices that do not deplete the natural resources on which they depend. A critical aspect of this approach is addressing the demand for sustainable resources within the food chain to ensure food security [48], thus avoiding food stress not only for international students [49], but also for local Spanish students, while preventing food contamination.

The objectives of this study are as follows: to educate students on the conservation of native biological diversity, the sustainable use of its components, and the fair and equitable distribution of the benefits derived from the natural environment. Additionally, this study seeks to empower local governments to manage urban gardens and parks sustainably, and to equip managers with practical strategies that can be applied to natural and semi-natural spaces. Another objective is the training of teachers to effectively communicate these principles to students at various educational levels, preparing them to become future educators.

Furthermore, this study aims to design, develop, and implement didactic strategies that promote actions encouraging environmentally responsible development. This includes the design of sustainable cities and the integration of sustainable energy sources [50]. This research also seeks to cultivate individual responsibility among students by encouraging direct interaction with the natural environment as a foundational approach.

Furthermore, this study aims to integrate the learning of plant-related content with the development of skills that foster the achievement of specific competencies. Ultimately, this research seeks to evaluate the effectiveness of the aforementioned spaces in enhancing the assimilation of key concepts in botany and sustainability.

This study also aims to identify the low levels of social participation in urban environments. We intend to raise social awareness through knowledge and education by utilizing city gardens and parks, as well as forest and agricultural peri-urban areas. Educational institutions should implement the practical teaching methods that the majority of students demand.

However, the intervention of social organizations and the state alone is not sufficient; family involvement from the earliest stages of life is essential. As Perea Quesada [51] states, the family constitutes the fundamental unit of society, responsible for transmitting both positive and negative behaviors and values to children. When the family's influence is negative, it is often due to precarious socio-economic conditions or family disintegration. In such circumstances, school absenteeism tends to increase [52], and these families often exhibit limited engagement with educational institutions. This is concerning, as both family and educational centers serve as essential pillars for the holistic development of children [53,54].

The social changes experienced throughout history have contributed to environments that are not always conducive to education, further highlighting the need to strengthen family–school relationships as a key factor in fostering the harmonious social development of children and adolescents [55,56]. Strengthening these relationships enhances students' motivation for learning, particularly in environmental subjects, ultimately leading to improved academic performance [57,58].

2. Materials and Methods

This strategy, which utilizes the natural and semi-natural environment as an educational resource, aims to energize the teaching approach by establishing a teaching–learning process that integrates curricular content within an environment conducive to experiential learning, thereby sparking students' interest. It creates a space for interaction, reflection, and experimentation.

The contents published in the Official State Bulletin (BOE) were reviewed to determine whether the current teaching in educational institutions aligns with societal realities [59–61].

The legislation reviewed pertains to the Government of Spain, and the three laws published in the BOE do not reflect the updated curricula necessary to meet the demands of a significant portion of the population.

Tacca [62] suggests that the teaching of Natural Sciences requires the implementation of creative strategies that foster and motivate the development of critical-reflective thinking, while also taking into account the student's developmental progression. This approach leads to an appropriate pedagogical intervention.

This line of research focuses on using school gardens, parks, and other green spaces as educational tools, with students taking an active role in constructing their own knowledge through observation and experimentation. In this process, students not only interact with their environment, but also become directly involved in the development of their own thinking [63].

The unit of analysis for this study consists of undergraduate students and future teachers enrolled in the Knowledge of the Natural Environment course at the Faculty of Education, Complutense University of Madrid.

The present study was divided into several sections within the structured interview. Once the proposed didactic activity was implemented, such as determining microorganisms in soil, seed and seedling planting techniques, composting processes, creating a mini-ecosystem, applying sustainable agricultural techniques, and utilizing energy, the efficiency of the teaching–learning process and content assimilation was evaluated through a structured interview. A workshop was also organized to connect activities across various spaces with foundational knowledge for teachers. Data collection and analysis were conducted accordingly.

To collect the information, visits were conducted to the school garden, city parks and gardens, botanical gardens, peri-urban environments, and various other environmental spaces in general. The structured interview method defined by Grawitz [64] was utilized, which is described as an oral interaction between two or more individuals in a specific space, through which information about a particular topic is gathered.

While immersive on-site learning is crucial for gathering environmental information that enhances academic performance, it is also recognized that the use of artificial intelligence (AI) can provide information about academic performance. However, studies in Latin America have shown that AI does not necessarily improve academic performance [65].

The structured interview used in the data collection and testing process consisted of 16 questions divided into 4 thematic groups: (A) questions P1 to P5 were related to agronomy; (B) questions 6, 7, 9, 10, and 11 were related to gardens, parks, and orchards; (C) questions 13 to 15 were related to energy use; and (D) questions 8, 12, and 16 were focused on environmental aspects. The responses were evaluated according to a Likert scale ranging from 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = neutral (neither agree nor disagree), 4 = agree, and 5 = strongly agree.

This study did not require endorsement from the ethics committee due to the irreversible anonymization of the data used. In accordance with the basic guidelines for anonymization published by the Spanish Data Protection Agency and Organic Law 3/2018 of December 5 on the Protection of Personal Data and the Guarantee of Digital Rights [66,67], the necessary precautions were taken. The questions formulated for the students are listed in Table A1 (Appendix A). The questions were grouped for further analysis into groups A (1–5), B (6, 7, 9, 10, 11), C (13, 14, 15, 16), and D (8, 12). These questions were reviewed by subject matter experts with over 20 years of experience. These questions were evaluated by three experts in the Didactics of Experimental Sciences, who recommended certain modifications, which were subsequently approved.

The structured interview was conducted both before and after the practical activities in the garden, parks, botanical gardens, and peri-urban spaces. This process involved direct oral interaction between the student and the teacher to ensure the proper execution and understanding of the questions included in the interview, as well as to address any doubts that arose.

Once the survey data were collected, statistical analysis was performed using the Past.exe program.

The responses from 106 students (86.75% women and 13.25% men) were entered into an Excel table, which was then subjected to statistical analysis using the Past.exe program. The linear correlation for each item was calculated, and the average correlation was determined to apply Cronbach's alpha coefficient to assess internal consistency and evaluate the reliability level [68]. The formula used was

$$\alpha = n \times p/1 + p\ (n - 1) \quad (1)$$

where α represents Cronbach's alpha coefficient, n is the number of items, and p is the average of all correlations.

According to the analysis of Cronbach's alpha coefficient, a sample of 80 students was statistically significant. However, in our study, the original sample size consisted of 106 students. A larger sample size is often considered inadequate for ensuring the reliability and internal consistency of the dataset. Nevertheless, it was necessary to validate the Likert scale used; therefore, we reduced the sample to 80 students, as Cronbach's alpha coefficient does not accommodate larger samples.

According to Oviedo and Campos-Arias, for the scale to be valid, the Cronbach's alpha coefficient must range between 0.7 and 0.9. Consequently, in the initial analysis, we did not use the full sample. However, when applying Cronbach's analysis to the 106 students, the coefficient decreased but remained slightly above 0.7. As a result, we decided to include the entire sample. When utilizing all surveyed students, the Cronbach's alpha coefficient logically decreases, leading to a subsequent reduction in reliability and internal consistency.

To further corroborate this, we applied Spearman's correlation coefficient to examine whether there were strong positive (+1) or negative (−1) correlations.

In the learning framework provided by the aforementioned spaces, the teaching–learning process was designed with the teacher assuming a guiding role, while the student actively participated in the construction of their own knowledge. To achieve this, didactic strategies were established through experimentation and manipulation, enabling direct interaction with the natural environment. This approach fostered observation, allowing students to formulate questions and resolve them in real time within the space itself.

An inquiry-based and experimental methodology was employed to facilitate the teaching process. Natural spaces played a key role in understanding soil structure, fertility, sowing methods, the incompatibility between native and exotic species, the use of living and inert covers to protect the soil, composting processes, and the creation of mini-worlds.

Additionally, students explored energy consumption and examined the potential transition from fossil fuels to clean energy, aiming to propose methods for achieving sustainable and healthy cities.

In the process of determining soil fertility, students experimentally tested the presence of organic matter in the soil structure, particularly in the A horizon, by using hydrogen peroxide. The presence of organic matter was confirmed when effervescence occurred upon contact with hydrogen peroxide, indicating its presence and, by extension, the soil's fertility. pH levels were measured by adding hydrochloric acid to the soil to identify carbonates, with effervescence signaling their presence.

The seed and seedling planting process, as well as the compatibility between species based on their nutritional needs, sunlight exposure, and space utilization, was studied through field observations of already planted crops and the invasive species within the agricultural, aquatic, and forest environments. Students also engaged in direct sowing of both seeds and seedlings.

The incompatibility between native and exotic species was assessed by studying the origin of each species and analyzing their frequency of occurrence in natural plant communities.

Regarding the use of living and inert covers, this agricultural technique was directly observed in the garden and peri-urban spaces to evaluate how such covers protect the soil.

The composting process was conducted on-site using recycled materials. This involved producing ecological and sustainable fertilizer from organic plant matter, such as food waste and garden debris. The learning process was experimental, beginning with the construction of a homemade composter.

Mini-worlds represent unstructured, symbolic play. In this context, a real-life scenario, specifically a school garden or small-scale garden, was recreated using a variety of materials, both structured and unstructured. Natural materials collected from the visited spaces were used to replicate a school garden or botanical garden (models), incorporating all the essential elements involved in it.

3. Results

The group of students involved in the didactic proposal consisted of 106 participants, of which 86.75% were female and 13.25% were male.

The analysis of the responses to the formulated items revealed significant discrepancies in the answers provided by the students, with certain question groups being rated with a 1 on the scale, while others were rated with a 5. Specifically, question P11, which addressed native and exotic species, showed a high percentage of responses rated 1, indicating that the students were unable to distinguish between these two categories (Appendix A, Table A2).

In light of this, a bibliographical study was conducted to identify exotic species present in urban gardens and parks, some of which have become invasive. The study collected data regarding the origin of the species, their drought resistance, and the type of impact they have on the environment.

The linear correlation analysis, denoted as r, yielded a result of 0.173 When applying Cronbach's alpha coefficient, the formula is as follows:

$$\alpha = 16 \times 0.173/1 + 0.173\ (16 - 1) = 0.7699 \quad (2)$$

However, the Shapiro–Wilk normality test presented a p-value > 0.05, meaning that the null hypothesis could not be rejected and the data did not follow a normal distribution.

Principal Component Analysis (PCA) is a predictive model we performed, and Figure 1 shows that, as observed on the right side of the image, 75% of the students responded positively to all the questions posed, except for questions P4 and P3, which focused on vegetative covers. Due to the heterogeneity of the sample, there was a percentage of students who possess some knowledge of the topics presented, while others lacked this understanding. This heterogeneity in the responses indicates that there are two groups of students coming from different sociological backgrounds. The PCA analysis demonstrates the consistency between each of the groups and the questions asked.

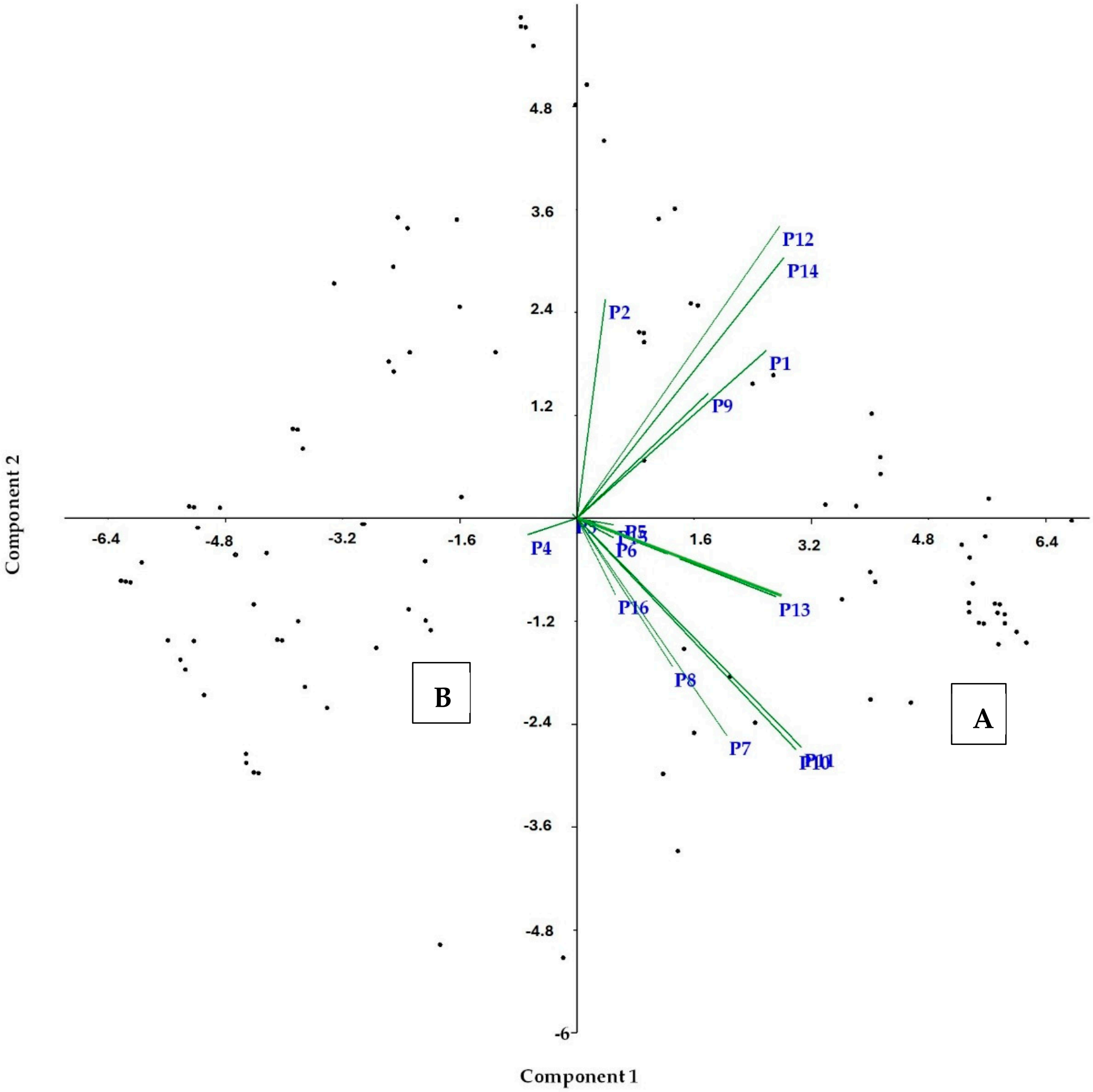

Figure 1. Principal Component Analysis (PCA) with the 16 questions posed to the 80 students. Two groups of students were identified: Group A, which was in agreement with most of the questions asked, and Group B, which was only in agreement with questions P3 and P4.

Questions 1–5 (A) were related to agriculture, yielding an average value of 3.12; questions 6, 7, 9, 10, and 11 (B) addressed aspects related to urban gardens, parks, and botanical gardens, with an average value of 3.67; questions 13, 14, and 15 (C) pertained to energy topics, with an average value of 3.45; and finally, questions 8, 12, and 16 (D) concerned environmental issues, with an average value of 3.64 (Figure 2).

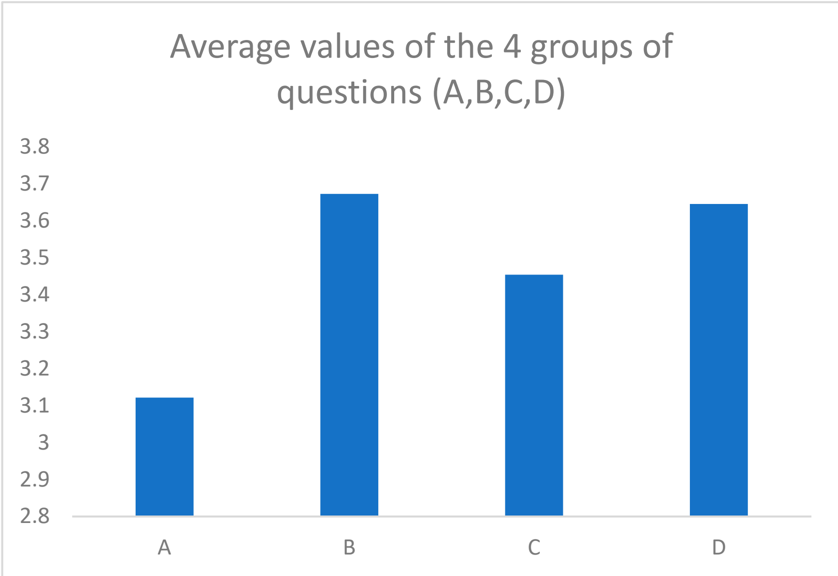

Figure 2. Average values of the four groups of questions established from the 16 questions posed to the 80 students.

In the Spearman's rank correlation analysis (rs) for the four groups of questions, values ranging from −1 to +1 were observed, with some cases showing values close to zero (Table 1).

Table 1. Spearman's rank correlation (rs) analysis, with values close to +1 for groups B and D, and negative values near zero for groups B and C.

	A	**B**	**C**	**D**
A	0	0.00738	0.02043	4.30×10^{-5}
B	0.29740	0	0.00010	3.37×10^{-19}
C	0.25883	0.41990	0	0.90088
D	0.44065	0.80284	−0.01414	0

From a total of 1407 responses to the 16 items, we obtained 592 (42.07%) responses with values of 4 and 5 on the Likert scale, indicating a high percentage of agreement and strong agreement. On the opposite end of the scale, a significant group of 561 responses (39.87%) was rated with a 1, indicating total disagreement.

The third group was the smallest, with 127 responses rated 2 and 3, representing students who either disagreed or remained neutral, i.e., they did not express a definitive opinion. This group corresponds with the answers to questions P15 and P16, which, along with P13 and P14, were included in group C, and were primarily related to energy topics. For this reason, negative Spearman values close to zero appear, indicating a negative correlation in group C. This suggests a certain association between the ranges, but the values are very close to zero, indicating a very weak association.

This analysis revealed that energy-related environmental issues are the least considered by the students. However, the responses to questions P3 and P4 show agreement or total agreement, with percentages of 98.7% and 77.5%, indicating an interest in the knowledge of green covers in agriculture. On the other hand, there was total disagreement regarding questions P5 and P6, with disagreement percentages of 91.2% and 93.7%, concerning the use of peri-urban agricultural areas and school gardens as pedagogical sites.

The responses to questions P7, P8, and P9, with agreement percentages of 70% and 73%, supported the promotion of parks and urban gardens as teaching laboratories (Figure 3).

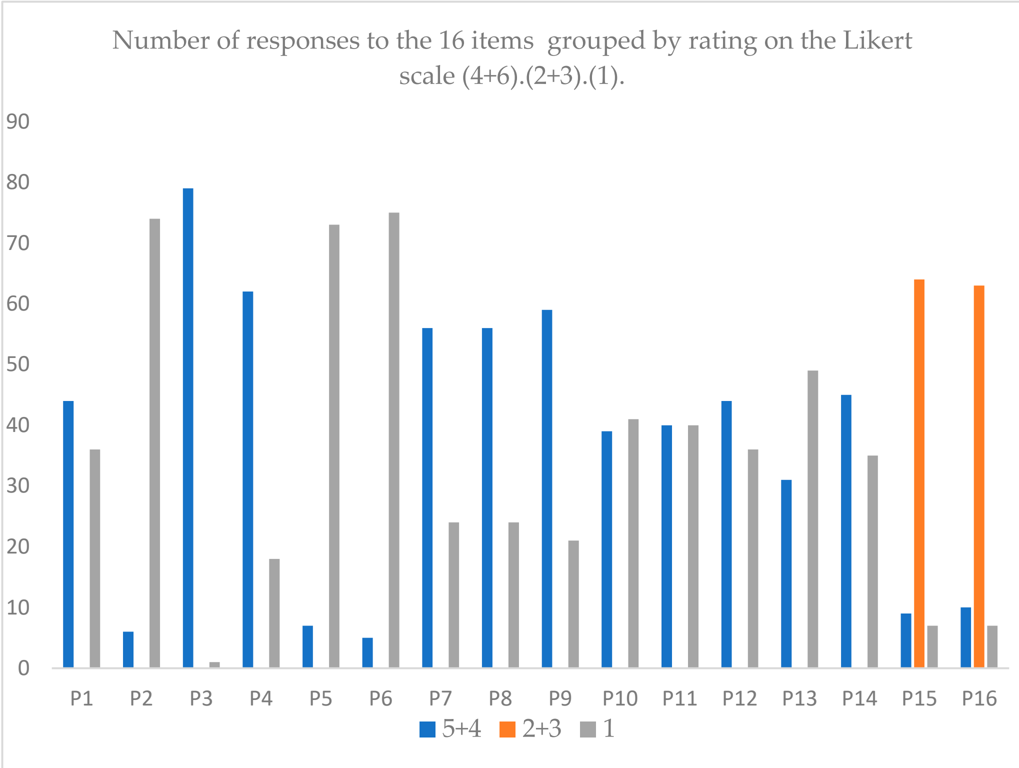

Figure 3. Number of total responses for each item distributed according to three groups of values on the Likert scale: (5+4) = strongly agree and agree, (2+3) = neutral and disagree, (1) = strongly disagree.

Among the noteworthy results, the existence of two distinct groups of students with different levels of knowledge stands out, which were likely influenced by their rural or urban background. This factor conditions their responses to the formulated items, revealing that students from rural environments show a stronger preference for vegetative cover compared to their urban counterparts, while their interest in energy-related topics remains moderate. However, both groups demonstrate a shared interest in utilizing parks and gardens as educational learning spaces.

4. Discussion

The reliability measure of the scale used, determined through Cronbach's alpha coefficient, yielded a value of 0.7699. Since this value falls between 0.7 and 0.9, it confirmed the internal consistency of the scale. The Cronbach's alpha index value of $\alpha = 0.7699$ approached the minimum threshold of 0.7, which still allowed us to affirm the internal consistency and reliability of the survey. When applying the full sample of surveyed students (106), the gender bias observed in previous trials was mitigated, with the distribution consisting of 86.75% women and 13.25% men. However, we did not find arguments either in favor of or against using balanced samples for men and women.

Various authors support the effectiveness of practical teaching methods, such as the inquiry-based approach embedded in the constructivist education model. Cantó Domenech [47], in his work on scientific education beyond the classroom, highlights this perspective, along with other scholars such as Mueller et al. [48], Samper and Ramírez [69], and Montaner et al. [70].

In the Spearman's rank correlation analysis (rs), cases approaching +1 and −1 indicated strong positive and negative correlations, respectively. However, some cases exhibited correlations close to zero (Table 1). This variability allowed us to predict a didactic model of an inquiry-based and experiential nature (active learning), which could help standardize knowledge and social awareness among all students.

From the analysis of the overall responses to the 16 items, it can be inferred that the group showed an interest in learning about the vegetation cover in peri-urban agricultural areas, but they did not demonstrate interest in using these spaces as teaching laboratories, as indicated in previous studies by Cano Ortiz et al. [16]. However, there was some interest in using urban spaces, gardens, and city parks as teaching environments, aligning with the proposals of several authors, such as Bechert, D'Antracoli et al., and Wani et al. [27,29,30], who advocate for education as a means of enhancing conservation efforts; this approach necessitates raising awareness and fostering knowledge about species of conservation interest.

Authors, such as Samper and Ramírez [69], argue that experiential learning allows students to directly participate in the construction of their knowledge, engaging with new content within the same context. In this teaching–learning process, it is essential to understand the prior knowledge that the student has acquired in order to develop the competencies necessary to address current needs.

This methodology enhances the learning process by focusing on practice and experiencing stimuli through the senses, which fosters the development of skills [70,71]. In this regard, complex and controversial actions, such as those related to environmental and multidisciplinary issues, require immersive learning that is predominantly practical and conducted in situ.

The teaching process should not merely involve the transmission and overload of knowledge, leading to saturation. Instead, it should utilize didactic strategies that help learners construct their knowledge through experiences, ultimately resulting in a restructuring of their mental framework based on real-world contexts [72].

The results obtained through this experimental process, using gardens, botanical gardens, and diverse environments as educational tools, reveal significant differences in the level of knowledge and awareness regarding the use of these spaces as learning laboratories. Through these environments, students learn to distinguish between local native species and introduced species. Additionally, by utilizing these different spaces in their learning, they gain knowledge and awareness about the importance of vegetative covers as CO_2 sinks and as elements that reduce evapotranspiration, consequently decreasing water loss.

For instance, *Oxalis pes-caprae*, native to Southern Africa, invades much of the grasslands and woody crops in the southern Iberian Peninsula, while *Eichhornia crassipes* (water hyacinth), an ornamental plant that escaped from gardens, has spread along the Guadiana River [73]. This species, which thrives in stagnant water, has already appeared in the Guadalquivir River [33,34]. The origin of the invasive species studied is primarily from America and Africa, due to strong historical and commercial ties. There is concern over the uncontrolled sale of ornamental exotic plants by nurseries, which underscores the need for stricter regulations regarding the sale of these species. Although most of the species used are drought-resistant, they should not be used due to their highly invasive nature (Appendix A, Table A3).

Therefore, it is proposed to replace invasive alien species with native species, taking into account the ecological niche of each species. Among the native species that could replace the invasive alien species mentioned in Table A3 are the following:

- For subhumid-humid environments: *Acer granatense*, *Acer campestre*, *Quercus faginea*, *Quercus suber*, *Ceratonia siliqua*, *Arbutus unedo*.
- For dry environments: *Quercus rotundifolia*, *Quercus coccifera*, *Retama sphaerocarpa*, *Pinus halepensis*, *Pinus pinea*, *Pistacia lentiscus*, various species of *Cistus* spp., *Genista umbellata*,

Genista spartioides, Ulex parviflorus, various species of *Cytisus* spp., *Lygeum spartum, Stipa tenacissima*.

- For riparian environments: *Nerium oleander, Populus alba*, various species of *Salix* spp. and *Tamarix* spp.

In all cases, it is essential to consider the ecological niche in terms of the species' thermal and edaphic characteristics.

Once the experimental activities were carried out, the results showed that for question one, 50% of students considered the use of plant cover as favorable. However, nuances were observed and documented in the structured interview, with educated individuals noting that this benefit depends on the type of plant cover and its management.

Regarding questions P7, 8, 9, 10, 11, 12, and 14, an increase of up to 88% was observed in the students' knowledge related to these topics. Concerning the use of plant cover, and up to 98–100% for the question testing knowledge of its use in agriculture (P3, P4), both questions showed a significant increase, with 88% to 100% of the students acquiring competencies related to the use and functions of plant cover, the appreciation of native species in urban gardens and parks, and a certain motivation toward the use of clean energies.

In the workshop, clear and direct aspects of a binding nature are established between the activities developed in the spaces used for experiential learning and the basic knowledge outlined in the curricula. These practical proposals facilitate the exploration of various areas of knowledge and the establishment of interconnections between them and natural education.

The use of peri-urban spaces as laboratories emphasizes that knowledge of plant cover is essential for sustainable development, mitigating climate change by acting as CO_2 sinks [74]. This helps to reduce the excessive use of three contaminating agents in agriculture: herbicides, pesticides, and fungicides [2], which pollute the food chain. While in some cases the levels of these contaminants are within the WHO standards, these compounds can accumulate in the body or take time to be eliminated, thus increasing the risk of tumor formation.

The irresponsible contamination of soil, water, and biota by various chemical agents, such as organochlorine pesticides, has led to them entering the food chain and being detectable in chemical analyses of blood and breast milk from pregnant women, as well as being found in studies of young people, who showed an increase in genetic malformations, according to authors Torres and Capote [75]. These authors emphasize the need for greater educational efforts. Through direct on-site observation, students come to understand the necessity of plant cover and the avoidance of contaminating agents.

Policy Implications

Due to the low level of knowledge exhibited by students, as evidenced by their responses to the 16 items, the curricula published by the Spanish Government [59–61] were analyzed. It was found that there is no mention of teaching about exotic and native species or the use of urban spaces as teaching laboratories, which puts habitats at risk [76]. This gap has motivated students to become more engaged in learning about these spaces.

Pinto et al. [77] state that experiential learning encompasses a set of practices and techniques that facilitate the learner's acquisition of knowledge through their own experience. This was demonstrated in the results obtained from the present didactic proposal.

In response to the lack of knowledge and the disconnection between students, society, and the environment, authors such as Fytopoulou [78] proposed changes to curricula in order to strengthen students' involvement in environmental issues, a position with which we agree. In Spain, environmental topics (agriculture, forestry) are only lightly addressed in the educational system [59,60].

In light of this, it is crucial to stimulate both individual and collective awareness in schools about genetic anomalies [74,79]. It is evident that social awareness is insufficient, and the knowledge among graduates and licensed professionals remains limited. Therefore, we propose increasing training for teachers and managers.

Finally, after this experiential learning trial using the inquiry-based methodology, students acquired competencies in knowledge, motivation, and awareness regarding the integration and use of urban spaces in the educational process. For this reason, we suggest the collaborative participation of local governments by integrating urban spaces into the educational system. Additionally, we encourage the involvement of all public and private institutions with competencies in urban and agricultural spaces to collaborate with educational centers, transforming these spaces into hubs that radiate knowledge and social motivation for sustainable urban and agricultural development.

5. Conclusions

In conclusion, the effectiveness of using urban and peri-urban spaces as essential tools for education is emphasized. This approach fosters sustainability education and promotes eco-responsible awareness among future teachers. The goal is to integrate sustainability education into various areas of the teacher training curriculum, establishing a teaching and learning process within classrooms that utilizes these spaces. This will equip future educators with tools to address and understand the environmental challenges society faces, encouraging their inclusion in curricula through their future role as teachers.

The main conclusion drawn from this study is the revaluation of urban and peri-urban spaces as educational tools. These spaces serve as scaffolding between knowledge, practical skills, and existence, where direct contact with nature allows for the autonomous and respectful development of students' cognitive growth. As educational environments, they improve academic outcomes, particularly promoting the effective assimilation of knowledge by students.

In the case of school gardens and orchards, children are provided with direct contact with the natural environment, which connects them to life itself. This fosters a strong bond with the natural world and improves their perception of it.

The findings highlight how ignorance leads to a lack of appreciation for the functions and benefits that various natural elements provide to humans (such as plant cover). However, through the scaffolding of this knowledge, the recognition and appreciation of these benefits grow, leading to a respectful coexistence between nature and humankind.

Future educators are increasingly valuing urban and peri-urban spaces as pedagogical resources, recognizing them as essential tools for implementing future teaching strategies. These spaces serve as the driving force behind environmental education, where hands-on practice and the direct interaction between children and nature form the foundation for achieving a more sustainable future.

Finally, this active learning methodology demonstrates significant gains in environmental knowledge by students and heightened social awareness for improving the biological comfort of cities.

The contrasting analysis of environmental education, based on the literature reviewed, shows the educational success of practical teaching through green spaces. However, the learning model faces certain limitations, notably the scarcity of green spaces in cities that can serve as learning laboratories.

The current study revealed that green spaces should be enhanced by replacing exotic species in urban gardens and parks with native species. A large number of researchers argue that invasive plants are displacing indigenous ones, posing a risk to the local flora. Additionally, exotic plants are often harmful to health due to their allergenic nature. For these reasons, we propose promoting research on invasive species introduced into urban areas, which have, subsequently, escaped and damaged forest and agricultural ecosystems. To address this, it is necessary to implement teaching at all educational levels. New gardens and parks in cities could become genuine teaching laboratories, making it advisable to foster greater involvement from both public and private institutions.

The main conclusions of this research are as follows:

1. We propose that urban and peri-urban green spaces should be utilized as educational laboratories.
2. There should be widespread implementation of an active (practical) methodology in educational institutions, which necessitates teacher training.
3. Research on invasive flora should be enhanced to support its replacement with native plant species.
4. Curricula should be restructured to strengthen environmental education.

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Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

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

Appendix A

Table A1. Questions formulated to the students.

	These Questions Should Be Rated on a Likert Scale from 1 to 5.
P1	Do you have knowledge of the meaning of plant cover?
P2	Do you consider plant cover to be a harmful element in agriculture?
P3	Could you indicate the different functions of plant cover in agriculture?
P4	Do you know how inert covers are used in agriculture?
P5	Do you think peri-urban agricultural areas could serve as laboratories for teaching practices?
P6	Would you use school gardens as a pedagogical resource in early childhood education?
P7	Do you consider that city gardens and parks should be used as teaching spaces?
P8	Do you think it is important to improve sustainability and environmental respect education in schools?
P9	Is it possible to incorporate urban parks and gardens as environmental teaching spaces?
P10	Do you think it is necessary to have school gardens and botanical gardens in schools, and should these spaces be included in the design and construction of school buildings?
P11	In order to reduce water consumption in cities, which species do you consider more appropriate for gardens and parks: native or exotic species?
P12	Do you think water deficiency is caused by climate change?
P13	Is an energy transition from fossil fuels to clean energy possible?
P14	Can clean energy sources, such as wind and solar photovoltaic, replace fossil fuels?

Table A1. *Cont.*

	These Questions Should Be Rated on a Likert Scale from 1 to 5.
P15	Would a change in the energy model lead to sustainable development?
P16	What do you consider more beneficial for learning Natural Sciences: practical teaching, theoretical teaching, or both?

Table A2. Responses to the Formulated Questions Rated on the Likert Scale (1–5).

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
AL1	5	1	5	5	1	1	5	5	5	1	1	1	1	1	3	2
AL2	5	1	5	5	1	1	1	1	5	1	1	1	1	1	2	4
AL3	1	1	5	1	1	1	5	1	5	1	1	1	1	1	2	2
AL4	5	1	5	5	1	1	1	1	5	1	1		1	1	3	2
AL5	1	1	5	5	1	1	1	1	5	1	1	5	1	5	2	2
AL6	1	1	5	5	1	1	5	4	1	1	1	1	1	1	3	2
AL7	1	1	5	1	1	1	1	4	1	1	1	1	1	1	2	3
AL8	1	1	5	5	1	1	1	1	1	1	1	1	1	1	1	2
AL9	1	1	5	5	1	1	1	1	5	1	1	1	1	1	2	1
AL10	1	1	5	5	1	1	1	1	5	1	1	1	1	1	3	1
AL11	1	1	5	5	1	1	1	4	5	1	1	5	1	5	3	4
AL12	1	1	5	5	1	1	5	4	5	1	1	1	1	1	1	2
AL13	1	1	5	5	1	1	1	1	1	1	1	1	1	1	2	2
AL14	5	1	5	5	1	1	1	4	1	1	1	1	1	1	3	2
AL15	1	1	5	5	1	1	1	1	1	1	1	1	1	1	2	2
AL16	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1
AL17	5	1	5	5	1	1	5	5	5	1	1	1	1	1	3	3
AL18	1	1	5	5	1	1	5	4	1	1	1	1	1	1	2	3
AL19	1	1	5	5	1	1	1	5	1	1	1	1	1	1	3	2
AL20	1	1	5	5	1	1	5	4	1	1	1	1	1	1	2	3
AL21	1	1	5	5	1	1	5	1	5	1	1	5	1	5	3	3
AL22	1	1	5	5	1	1	5	1	5	1	1	1	1	1	2	3
AL23	1	1	5	5	1	1	1	5	5	1	1	1	1	1	3	3
AL24	1	1	5	5	1	1	1	5	1	1	1	1	1	1	3	3
AL25	5	1	5	5	5	1	5	4	5	1	1	5	5	5	5	4
AL26	1	1	5	5	1	1	1	4	1	1	1	1	1	1	3	2
AL27	1	1	5	5	1	1	5	1	1	1	1	1	1	1	2	2
AL28	1	1	5	5	1	1	5	5	1	1	1	1	1	5	4	3
AL29	1	1	5	1	1	1	1	5	1	1	1	5	1	5	2	1
AL30	1	1	5	5	1	1	5	5	5	1	1	1	1	1	3	2
AL31	5	1	5	5	1	1	5	5	5	1	1	5	5	5	4	3
AL32	1	1	5	5	1	1	1	4	1	1	1	5	5	1	1	2
AL33	1	1	5	5	1	1	1	1	5	1	1	1	1	1	3	3
AL34	5	1	5	5	1	1	5	5	5	1	1	5	1	5	4	2
AL35	1	1	5	5	1	1	5	5	1	1	1	1	1	1	2	2
AL36	1	1	5	5	1	1	5	5	1	1	1	1	1	1	3	2
AL37	1	1	5	5	1	1	1	1	1	1	1	1	1	1	3	2
AL38	5	5	5	5	1	1	5	5	5	5	5	5	5	5	3	2
AL39	5	1	5	5	1	1	5	5	5	5	5	5	5	5	3	1
AL40	5	1	5	5	1	1	5	5	5	5	5	5	5	5	3	3
AL41	5	4	5	5	1	1	5	5	5	5	5	5	5	5	2	3
AL42	5	1	5	5	5	5	5	1	5	5	5	5	5	5	2	2
AL43	5	1	5	5	1	1	5	5	5	5	5	1	1	5	1	2
AL44	5	1	5	5	1	1	5	4	5	1	1	1	1	1	1	3
AL45	1	1	5	5	1	1	5	1	1	5	5	1	1	1	2	3
AL46	5	1	5	5	1	1	5	1	5	5	5	1	1	5	3	5
AL47	5	1	5	5	1	1	5	5	5	5	5	5	5	5	5	5
AL48	1	1	5	1	1	1	5	1	1	5	5	5	1	5	3	3
AL49	5	1	5	1	1	1	5	5	5	1	5	5	5	5	3	1
AL50	5	1	5	5	1	1	5	5	5	5	5	5	1	5	3	2

Table A2. *Cont.*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
AL51	5	5	5	1	5	5	5	5	5	5	5	5	5	5	4	4
AL52	5	1	5	5	1	1	5	5	5	1	1	5	1	5	3	3
AL53	5	1	5	5	5	5	5	5	5	5	5	5	5	5	3	4
AL54	5	1	5	1	1	1	5	5	5	5	5	1	1	1	2	2
AL55	5	4	5	5	1	1	5	5	5	5	5	1	1	1	2	2
AL56	5	1	5	5	1	1	5	5	5	5	5	5	5	5	4	3
AL57	5	1	5	1	1	1	5	5	5	5	5	5	5	5	2	2
AL58	5	1	5	5	1	1	5	5	5	5	5	5	5	5	3	3
AL59	5	1	5	1	1	1	1	1	5	5	5	5	5	5	3	2
AL60	5	1	5	5	1	1	5	1	5	5	5	5	5	5	3	2
AL61	5	1	5	5	1	1	5	5	5	5	5	5	1	5	3	3
AL62	5	1	5	1	1	1	5	5	5	5	5	5	5	5	3	2
AL63	5	1	5	5	1	1	5	5	5	5	5	5	5	5	3	3
AL64	5	1	5	1	1	1	5	5	5	5	5	5	5	5	3	3
AL65	1	1	5	5	1	1	5	5	5	5	5	5	5	5	2	2
AL66	5	1	5	1	1	1	5	1	5	5	5	5	5	5	4	5
AL67	5	1	5	1	1	1	5	5	5	5	5	5	5	5	3	2
AL68	5	1	5	5	5	5	5	5	5	5	5	5	5	5	2	3
AL69	5	1	5	1	1	1	5	5	5	5	5	5	5	5	2	4
AL70	5	1	5	5	1	1	5	5	5	5	5	5	5	5	2	2
AL71	1	1	5	1	1	1	5	5	5	5	5	5	5	5	4	3
AL72	5	1	5	5	1	1	5	1	5	5	5	5	1	5	3	3
AL73	1	1	5	5	1	1	5	5	5	5	5	1	1	1	3	3
AL74	5	5	5	5	1	1	5	5	5	5	5	5	1	5	2	2
AL75	1	1	5	5	1	1	1	5	5	5	5	5	5	1	3	3
AL76	5	1	5	1	1	1	5	1	5	5	5	5	1	5	3	4
AL77	1	1	1	5	5	5	1	5	5	5	5	5	5	5	3	2
AL78	5	1	5	5	5	1	5	5	5	5	5	5	5	5	3	2
AL79	5	2	5	5	1	1	5	5	5	5	5	5	5	5	2	2
AL80	5	5	5	1	1	1	1	5	5	1	1	5	1	5	1	1
AL81	1	1	5	5	1	1	5	1	5	1	1	1	1	1	3	3
AL82	5	1	5	5	1	1	1	1	5	1	1	1	1	1	2	2
AL83	1	1	5	1	5	1	1	1	5	1	1	5	1	5	2	2
AL84	1	1	5	1	1	1	1	1	5	1	1	1	1	1	2	2
AL85	5	5	5	1	1	1	5	5	5	1	1	1	1	1	2	2
AL86	1	2	5	5	1	1	1	5	5	1	1	1	1	1	2	1
AL87	1	1	5	5	1	1	1	5	1	1	1	5	1	5	3	1
AL88	1	1	5	5	1	1	5	5	5	1	1	5	5	5	3	2
AL89	5	5	5	5	1	1	5	1	5	1	1	5	1	5	3	2
AL90	5	5	5	5	1	1	1	1	5	1	1	5	1	5	3	2
AL91	1	1	5	5	1	1	1	5	1	1	1	5	1	5	3	2
AL92	1	1	5	5	1	1	1	1	1	1	1	5	1	5	2	1
AL93	1	1	5	5	1	1	1	1	5	1	1	5	1	5	1	1
AL94	5	5	5	5	1	1	5	5	5	1	1	5	1	5	4	2
AL95	5	5	5	1	1	1	5	5	5	1	1	5	1	5	2	2
AL96	5	5	5	5	1	1	1	1	5	1	1	5	1	5	3	1
AL97	5	5	5	5	1	1	1	5	5	1	1	5	1	5	3	2
AL98	5	5	5	5	1	1	1	1	5	1	1	5	1	5	2	2
AL99	5	5	5	5	1	1	1	2	5	1	1	5	1	5	2	2
AL100	5	1	5	5	1	1	5	5	5	1	1	5	1	5	3	2
AL101	1	1	5	5	1	1	5	5	5	1	1	1	1	1	3	2
AL102	5	5	5	1	1	1	5	5	5	1	1	5	1	5	2	2
AL103	1	1	5	5	1	1	5	5	5	1	1	1	1	5	2	1
AL104	5	1	5	5	1	1	5	1	5	1	1	5	5	5	3	3
AL105	5	1	5	5	1	1	5	2	5	1	1	5	5	5	1	1
AL106	5	1	5	5	1	1	1	1	5	1	1	5	1	1	2	1

Table A3. Invasive species, origin, and agricultural, ecological, and social Impact.

Invasive Species	Origin	Introduction	Drought Resistance	Impact	Observations
Acacia dealbata Link.	SE Australia and Tasmania	Gardening, dune and slope fixation	Moderately resistant	Ecosystems	Damage to biodiversity
Acacia saligna (Labill.) H.L. Wendl.	SW Australia and Tasmania	Gardening, dune and slope fixation	Yes	Ecosystems	Damage to biodiversity
Acer negundo L.	North America	Gardening and riverbank restoration	No	Ecological	Damage to biodiversity
Agave americana	Central America	Ornamental and cultivated for textiles	Yes	Ecosystems, ecological, social	Damage to biodiversity
Ailanthus altissima (Mill.) Swingle	China	Gardening	Yes	Ecological and social	Damage to biodiversity
Amaranthus sp.	America	Ornamental	Yes	Agricultural	Various species cause crop damage
Arctotheca calendula (L.) Levyns	South Africa	Ornamental	Yes	Ecological	Can dominate coastal areas
Austrocylindropuntia subulata (Mühnlnpfordt) Backeb.	South America	Ornamental	Yes	Ecological, social	Similar requirements to Opuntia ficus-indica
Carpobrotus edulis (L.) N.E. Br.	South Africa	Gardening, dune and slope fixation	Yes	Ecological	Should be banned as a strong invader
Conyza bonariensis (L.) Cronq.	Tropical America	Accidentally introduced	Yes	Agricultural	Economic damage to agriculture
Conyza canadensis (L.) Cronq.	North America	Accidentally introduced	Yes	Agricultural	Economic damage to agriculture
Conyza sumatrensis (Retz.) E. Walker	South America	Accidentally introduced	Moderately resistant	Agricultural	Economic damage to agriculture
Cortaderia selloana (Schult. & Schult. f.) Asch. & Graebn.	South America (Argentina)	Ornamental	Yes	Ecological, social	Economic damage in urban areas
Eucalyptus camaldulensis Dehnh.	Australia	Intentionally introduced	Moderately	Ecosystems	Introduced for pulpwood and some forest restoration cultivation
Eucalyptus globulus Labill.	Australia	Intentionally introduced	No	Ecosystems	Introduced for pulpwood and some forest restoration cultivation
Gleditsia triacanthos L.	Central and Eastern North America	Ornamental	Yes	Ecological	Little known about its impact on ecosystems
Gomphocarpus fruticosus (L.) Ait. f.	South Africa	Ornamental in coastal gardens	Moderately	Ecological	Ecological damage to habitats of interest
Ipomoea acuminata (Vahl) Roemer & Schultes	Tropical America	Ornamental	Moderately	Ecological	Ecological damage to habitats of interest

Table A3. *Cont.*

Invasive Species	Origin	Introduction	Drought Resistance	Impact	Observations
Ipomoea purpurea Roth	Tropical America	Ornamental	No	Ecological	Ecological damage to habitats of interest
Mirabilis jalapa L.	Tropical America	Ornamental	Yes	Ecological	Little is known about potential damages it may cause
Opuntia dillenii (Ker-Gawler) Haw.	Tropical America	Ornamental	Yes	Ecological, social	Possible ecological damage to habitats of interest
Opuntia ficus-indica (L.) Mill.	Tropical America	Ornamental	Yes	Ecological, social	Species occupies large areas in southern Spain
Oxalis pes-caprae L.	South Africa	Accidentally introduced	No	Agricultural	Causes significant economic losses in agriculture and livestock
Parkinsonia aculeata L.	Tropical America	Ornamental	Yes	Ecological	Invasive potential still poorly understood
Pennisetum setaceum (Forssk.) Chiov.	NE Africa	Ornamental	Yes	Ecological	Introduced in parks and gardens, has escaped
Robinia pseudoacacia L.	North America	Ornamental, sometimes forestry	No	Ecosystems	Found in natural parks, affecting natural ecosystems
Stenotaphrum secundatum (Walter) O. Kuntze	Tropical South America	Gardening, as lawn	Moderately	Ecological	Ecological damage to habitats of interest, abundant along Granada's coast
Xanthium spinosum L.	South America	Accidentally introduced	Moderately	Agricultural	Causes damage to agriculture
Xanthium strumarium subsp. *italicum* (Moretti) D. Love.	North America	Accidentally introduced	No	Agricultural	Causes damage to agriculture
Zygophyllum fabago L.	SE Asia to SE Europe	Accidentally introduced	Yes	Ecological, social	Economic impact in disturbed and degraded areas

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