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# Conservation Reasoning and Proposed Actions for the Protection of Threatened Plant Species: Insights From a Sample of Rural and Urban Children of Cyprus

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*Investigating children's beliefs and values toward threatened biodiversity can contribute to their understanding about nature and to the prevention of sociopolitical issues that may emerge when nature policy is being implemented. This study investigates children's beliefs about threats to plants, the personal values associated with conservation, and actions children consider desirable regarding the conservation of three threatened plant species of Cyprus. Photos of threatened plants were used during interviews with 60 students (30 urban and 30 rural residents) aged 10–12 years. Results showed that participants deemphasized anthropogenic threats, while attitudes of individual responsibility were prevalent. Participants proposed actions of higher effectiveness mainly when they felt that they would be able to implement them. Findings suggest that an educational policy on threatened plant conservation should adopt a social character, focusing on attitudinal development and participatory learning approaches that will enhance children's sense of ownership and efficacy.*

**Keywords** biodiversity conservation, Cyprus, environmental values, rural–urban children, threatened plants

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A focus on people's beliefs, values, and behavioral intentions toward nature and environmental protection is of great importance for the success of managerial measures that directly affect the people holding those positions (Hovardas and Korfiatis 2008). A better understanding of people's conceptions and values, and their genesis, will allow for better prediction of the acceptability of biodiversity management measures and facilitate the development of suitable ways of communicating them, thus increasing the likelihood of biodiversity management success (Fischer and Van der Wal 2007).

Within this line of reasoning, a number of studies have emphasized the need to focus on young people's beliefs, attitudes, and intentions (Barrat-Hacking et al. 2007; Evans et al. 2007). There is some evidence that young people's ideas of the world, including their relationships with nature, develop at an early stage of their lives and may influence lifelong dispositions, attitudes, and behavior (Korfiatis et al. 2009; Panelli and Robertson 2006).

This study focuses on the beliefs, values, and potential actions toward conservation of adolescents 10 to 12 years old. This age period is important to study because is considered a turning point between childhood and adulthood (Crain 1985). Children at this age not only start to take account of "the bigger picture"; they also develop a capacity to reason and work things out (Berk 1994; Vosniadou 2002). They are able to solve concrete (hands-on) problems in a logical fashion. They can talk about concepts and possibilities, form hypotheses and conclusions, and use rules to solve abstract problems. Consequently, children at this age have the necessary cognitive apparatus to cope with environmental protection tasks (Evans et al. 2007). Moreover, the age between 10 and 12 years old is considered by some the developmental stage where attitudes, values, and emotional motives begin to be formed (Wray-Lake et al. 2010).

We used, for the purpose of our study, photos of three threatened plant species of European Community priority (Annex II Directive 92/43/EEC). The specific research questions were: (1) What is participants' knowledge of threats to threatened plant species, (2) which values influence participants' conservation decisions, and (3) which are the potential management practices they propose regarding threatened plant conservation?

### **Children's Knowledge of Threats to Plant Biodiversity**

Concerning children's knowledge about the threats to biodiversity (research question 1), it has been reported that children from the age of 10 are able to distinguish between different kinds of environmental problems and understand the negative impact of misusing the environment (Huang and Yore 2003; Kahn and Lourenco 2002). However, other researchers have argued that adolescents often underestimate the anthropogenic pressures that constitute threats for biodiversity, associating the dangers that many species face with natural patterns and processes (Grace 2008; Myers et al. 2003). In another study, adolescents referred more to animal species when asked about possible threats to ecosystems, while threats to plant species were hardly mentioned (Jimenez Aleixandre and Pereiro Munoz 2002). However, despite the significance of investigating children's knowledge on aspects of environmental conservation, such as the threats to biodiversity, relevant research is considered scarce and inconclusive (Elsley 2004). Thus, we anticipate that the findings of the present research will shed some light to the issue.

### **Children's Conservation Values**

Concerning the second research question, conservation—like other types of individual and collective action—is influenced by value judgments (Matsuda 1997), and the criteria that underlie management decisions and policymaking in nature conservation can be considered realizations of values (Fischer and Van der Wal 2007). Lindemann-Matthies (2006) reported that research on how children perceive and value wildlife has shown that children aged 8 to 16 years judge the value of organisms based on their beauty, visual attractiveness, usefulness, or rarity. Similarly, Alerby (2000) found that primary and secondary students in Sweden thought about nature in aesthetic terms. In their longitudinal studies with diverse samples of children, Kahn and his colleagues concluded that biocentric reasoning is well developed at the age of 11 (Kahn 1999; Kahn and Lourenco 2002). Another study with sixth graders in the United States agreed that by middle school, youths understand basic ecological principles, and an appreciation for the potential intrinsic value of nature has emerged (Eagles and Demare 1999). Severson and Kahn (2010) more recently argued that biocentric reasoning develops in children as young as 7 years old. Accordingly, we expect that the 10- to 12-year-old participants in our research would express moderate interest for protecting biodiversity, characterized by a biocentric view, and an aesthetic appreciation of nature.

### **Children's Potential Actions**

Concerning children's potential actions, Hicks and Holden (2007) reported that when they asked the 11-year-old participants in their survey what they could do to make their local community or the world "a better place," the responses fell into three broad categories: (1) stop certain actions (e.g., dropping litter) and adopt environmental friendly behavior (e.g., recycling), (2) organize actions and campaigns toward awareness, and (3) improve relationships within community. Prohibition measures, awareness campaigns, and use of technology were the main categories of responses of participating children in Kahn and Lourenco's (2002) survey when they asked their participants for suggestions to reduce air pollution. In a comparative study among 10- to 13-year-old participants from Turkey, Bulgaria, Romania, and the United States on endangered animal conservation, participants emphasized awareness actions as well as establishing laws to protect the endangered species, such as fining people who harm biodiversity (Erdoğan et al. 2008). To our knowledge there is no published study concerning children's potential actions toward plant conservation specifically.

### **Rural–Urban Differences**

We paid special attention to differences between urban and rural participants because where a child grows up has been, in some studies, a correlated factor in children's opinions and dispositions toward nature (Panelli and Robertson 2006). It was suggested, for instance, that urban residents are more concerned about the environment than rural residents (Van Liere and Dunlap 1980). This concern was attributed to the fact that urban residents are assumed to be more exposed to environmentally degraded conditions, such as atmospheric pollution, noise pollution, or lack of recreational areas. The economic dependence of rural residents on the extraction of

natural resources was also reported to be a main reason for rural residents' valuing of economic growth over environmental protection (Jones et al. 2003). These differences apply even when the research concerned children exclusively (Ward 1988). However, other studies argued that standardized education, the impact of mass media, and the increased convergence of educational level, economic income, and lifestyles between rural and urban areas have resulted in minimizing the differences in environmental concern between rural and urban participants (Saphores et al. 2006). A nationwide survey in 1994, with 4th- to 12th-grade children from the United States, revealed that urban and rural students from disadvantaged areas were similar in placing a priority on helping the environment (21% and 26%, respectively). However, participants from rural non-disadvantaged areas were markedly higher than participants from urban non-disadvantaged ones (38% vs. 28%) in wanting to protect the environment (NEETF 1994). Another survey on a large adult sample (51,664 participants) in Canada revealed few differences between rural and urban residents on indicators of environmental concern, while rural residents ranked the importance of protecting the environment higher than the urban residents (Huddart-Kennedy et al. 2009).

In sum, existing studies on urban/rural differences on environmental concern give ambivalent results, rendering it important to continue including this variable in studies of this nature.

## Methods

### *Sample*

A convenience sample of 60 fifth- and sixth-grade students (10–12 years old) from four elementary schools was used. Thirty students came from an urban school located in the city of Limassol, Cyprus, and 30 students came from three rural schools located in the mountainous area of Troodos in the Limassol province.

The Troodos area is a predominantly rural and sparsely populated area. Its inhabitants subsist primarily on pastoralism and agriculture (Philippides and Papayiannis 1993). Our sample was drawn from three primary schools (out of the six schools serving the mountainous region of the Limassol province), with 120 total students and 6 to 10 students in each class. The schools were located in three villages—Platres, Omodos, and Paxna—with 250, 310, and 967 inhabitants, respectively. Five students from the fifth grade and five students from the sixth grade of each school participated in the study.

The urban children who participated in the study were students in the largest school of Limassol city, with a total of 560 students. Limassol is the second largest city of Cyprus. The Limassol municipal area has 94,000 inhabitants and the greater metropolitan area has 152,000 inhabitants. Although tourism is an important part of the local economy, the city has a diverse economic base, including public and private services, a commercial port, wineries, and a range of other small industries. The participating students came from a middle-class urban neighborhood, 15 students from the fifth grade and 15 students from the sixth grade.

The purpose of the research was explained and a written request was sent to the parents for consent. Participating children returned the signed parental consent form and agreed to participate in the study. Boys and girls were equally represented.

The Cypriot educational system is based on a centralized educational model, with the same curriculum and textbooks for all schools across the country. Thus,

all participants had been exposed to the same teaching material. Specifically, in Cypriot elementary level, environmental issues are taught within the course of Science. The course is offered for two school periods per week (each school period lasts 40 minutes) from the first until the last (sixth) grade of the elementary school. Content on plants, animals, and the environment constitutes 40% of the content of the course (58 school periods in total), distributed relatively evenly from the first to the fifth grade (there is no environmental content in the textbook of the sixth grade). Lesson units on plants cover 30 school periods. Emphasis is given to plant morphology, plant physiology (germination, growth, nutrition and reproduction), ecology (food chains, food webs, habitat characteristics), and plant biogeography (distribution of species across different types of habitats). The concept of threatened plants is examined only in one school period during the fourth grade, emphasizing the identification of some local threatened plants (the species we discussed during the interviews), as well as the habitats in which these plants can be found. The factors mentioned in the textbook as threats to these plants include cutting and uprooting of flowers, wildfires, and overuse of herbicides. There is an emphasis on the utilitarian values of plants (three textbook chapters in the third and fourth grade), while there is no reference to other values of plants. Finally, there are five school periods dedicated to environmental problems (atmospheric pollution, hunting, and water pollution) and possible ways to solve them (with an emphasis on technological solutions, e.g., wastewater treatment). Teaching is based on the textbook material, occasionally accompanied by the study of real specimens in the classroom. The respondents in our survey did not participate in any after-school environmental activity.

### **Data Collection**

Data were obtained through structured, individual interviews lasting approximately 30 minutes each. When conducting the interviews, we used photos as visual aids since they have proven most useful in minimizing semantic problems and serve as a common reference for the interviewer and the child (Korfiatis et al. 2009; Palmer and Suggate 2004). Pictures of three threatened plants, included in the Red Data Book of Cyprus Flora as species of Community priority (Annex II Directive 92/43/EEC), were shown to each student. The species were Cyprus tulip (*Tulipa cypria*), Kotschy's ophrys (*Ophrys kotschyi*), and Hartman's crocus (*Crocus hartmanianus*). The three species had similar physical characteristics, in order to avoid differentiation of students' responses due to the special appearance of a plant. Interviews were conducted by the first author of this article.

At the beginning of the interviews, students were asked whether they recognized each of the specific species. The majority of the children (58%) were familiar with all three plants; one-third (29%) recognised two of the three plants, 10% recognized only one plant, and 3% were not able to recognize any of the plants. In all cases the name of each plant and its conservation status, that is, "threatened endemic plant of Cyprus Flora," was explained by the researcher. The concept of "threatened species" was also clarified, when necessary, in order to avoid any misunderstandings during the interviews.

Each participating student was asked the following three questions:

- a. "What are, according to your opinion, the factors leading to this plant becoming threatened?" The question aimed at exploring children's knowledge about the vulnerability of the specific plant species.

- b. “Do you have any reasons to protect a threatened plant? What are they?” This question attempted to encourage students to clarify their values for plant conservation. This type of question is recommended in humanities education (Slater 1982) as well as in conservation education (Grace 2008) to help students explore and justify their opinions and become more aware of the values underlying their choices.
- c. “What would you do to protect the plant you see in the picture if you were acting a) as a student or b) as a mayor?” This question aimed at describing children’s ideas about possible actions in situations of different social status.

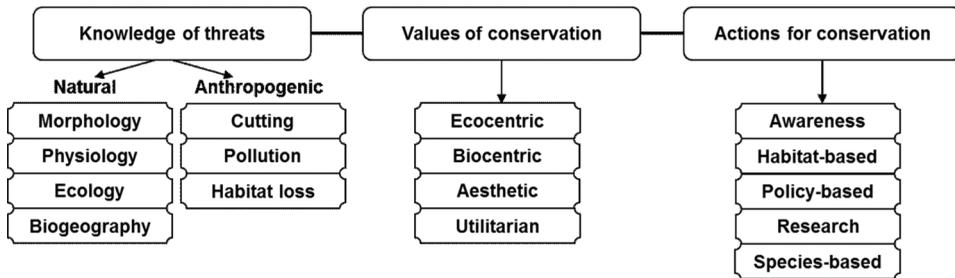
In order to avoid any bias (such as desire to please the interviewer, or, on the contrary, lack of confidence or lack of interest), the interviewer followed tactics recommended in the literature. Such tactics included proper body gestures, explanation of the purpose and the process of the interview, nonjudgmental style of asking the questions, and use of appropriate language (Lewis and Lindsay 2000; Littledyke 2004). Interviews were tape-recorded and transcribed.

### ***Data Analysis***

The interviews were transcribed verbatim and the analysis was carried out in an iterative manner to identify themes (categorical and classification). The content of interviews was classified in categories responding to the research questions of the study. Specifically, most of the categories were created by the authors before looking at the data (i.e., findings expected according to literature). They were modified, when necessary, to fit with the empirical data (e.g., the introduction of a category including respondents who mentioned both anthropogenic and natural threats). Other categories, though, emerged after examining the data (e.g., the division of anthropogenic threats into three subcategories—cutting and uprooting, pollution, and habitat loss). Upon coding, incidents were given the value 1. These values were then summed by individual and across groups; analysis was conducted using SPSS with these incidents as discreet data points for the purpose of statistical analysis.

Content analysis and classification within categories were executed by the first two authors of this article. Coders first discussed the categories of analysis and then worked independently, processing the whole body of data. Intercoder reliability between the first two authors was 95%. Inconsistencies were resolved through discussion between the authors. The categories constructed were the following (Figure 1):

1. Description of the causes of threat: Participants’ responses to the question regarding the causes of threat were classified as anthropogenic or natural. The category of natural threats was further divided in the following subcategories: (a) threats attributed to the morphological characteristics of a species; (b) threats related to the physiology of a species, especially germination and reproduction; (c) threats related to the ecology of a species, primarily regarding population dynamics, abiotic and biotic factors, and interactions between species and their environment; and (d) threats related to plant geography and distribution. Anthropogenic threats included subcategories related to (a) cutting and uprooting, (b) pollution, and (c) habitat loss.
2. Clarification of conservation values: Values toward nature are often classified on a continuum ranging from anthropocentric to ecocentric. We approached anthropocentrism in the sense of Thompson and Barton (1994), in which the protection



**Figure 1.** Conceptual framework of main categories that emerged from the classification of children's views on threatened plants.

of nature is important because of the services that nature provides, namely, life-support, recreational, and restorative benefits. We divided anthropocentric values into aesthetic, which focus on recreational and scenic values of nature, and utilitarian, which are related to the human use of existing or potential biological resources.

The terms "ecocentric" and "biocentric" values are both used in environmental psychology to refer to a notion of an intrinsic value in nature, that is, a value independent of any other entity (Kaltenborn and Bjerke 2002; Schultz 2001). In the present study we use "biocentric" in the sense of Lockwood (1999) and Oksanen (1997) to refer to beliefs regarding intrinsic values of nature associated with individual life forms and especially threatened species. In contrast, "ecocentric" refers to a wider conception, including ecosystems, the biosphere, or the processes that promote and maintain those entities.

3. Possible conservation actions: Participants' ideas for conservation action were divided into five categories similar to the categories of conservation actions proposed by the International Union for the Conservation of Nature (IUCN) that should be undertaken for the preservation of threatened species (IUCN 2006): (a) awareness and education; (b) habitat and site-based actions, such as maintenance, restoration, and establishment of protected areas; (c) policy-based actions, referring to management plans, legislation, and community management; (d) research actions related to taxonomy, population, ecology, threats, and conservation measures; and (e) species-focused actions, including reintroductions, sustainable use, recovery and ex situ conservation actions directed at the species themselves.

Chi-squared tests were conducted to examine differences among subcategories of the "description of threats" category, the "clarification of values" category, and the "possible conservation actions" category. We also conducted cross-tabulations analyses to examine the effect between sex and place of residence on children's responses. The likelihood ratio chi-squared for categorical data was used, while Cramer's V measure provided the effect strength for significant relationships.

## Results

Students responded in a similar manner to the interview questions, regardless of the species discussed. Therefore, we present the average percentage for each question for the three species. Additionally, we should note that the analysis did not reveal any important differences in responses of boys and girls.

### Children's Knowledge of Threats

In response to the question "What are, in your opinion, the factors leading this plant to become threatened?," 88% of the students mentioned natural threats, while 47% mentioned anthropogenic ones (Table 1). Moreover, 8% of the respondents attributed threats to human actions exclusively, while 39% mentioned both natural and anthropogenic factors and 50% mentioned only natural ones.

Ecological factors constituted the most common category of threats mentioned by the children (Table 1). Comments referred mainly to abiotic factors, for example, "this plant is threatened because the soil is not good and does not help it to survive" (rural boy), "the weather and the climate of the area is not good, I mean there is drought and there is not enough rain and nobody goes on the mountain to water this plant" (rural girl), and "sun cannot reach this plant and therefore it dies" (urban boy). Other responses referred to competition or predation as threats: "there are many plants around this small beautiful flower, they eat all food from the soil and drink all water, therefore nothing is left for this in order to survive" (rural girl); "this plant is a food for some animals, so it is eaten, that's why it is threatened" (urban girl).

Students also emphasized habitat specialization as a reason for danger: "this plant has been adapted to live only in mountains. It cannot survive anywhere else and because in Cyprus there are not many mountains there are only few of them" (rural boy); "it is very sensitive in the place where it lives, only in this place can survive" (rural girl); "it appears only on rocks or cliff" (urban girl).

Other statements relevant to natural threats included comments on the physiology of the species. These included germination ("these plants are threatened because they have problems and germinate every ten years" [rural boy]) and morphological characteristics ("the plant looks like a bee and this appearance may harm it" [urban girl]). They also included geographical distribution: "threatened plants are not distributed in many areas and therefore are few" (urban boy), "these plants are endemic that's why they are threatened" (rural girl).

**Table 1.** Children's knowledge of threats contributing to the vulnerability of threatened plants

Knowledge categories	Urban students		Rural students		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Natural	25	83	28	93	53	88
Morphology	13	43	11	37	24	40
Physiology	11	37	10	33	21	35
Ecology	12	40	19	63	31	52
Biogeography	2	7	6	20	8	13
Anthropogenic	17	57	11	37	28	47
Cutting	14	47	7	24	21	35
Pollution	5	17	1	3	6	10
Habitat destruction	0	0	3	10	3	5
No answer	1	3	1	3	2	3

*Note.* The total percentage exceeds 100% since many students gave more than one response.

Concerning anthropogenic threats, respondents focused mainly on actions such as cutting and uprooting: “children and other people cut these plants for decoration, placing them in a vase” (urban girl); “many people uproot such plants from the place they live and replant them in their gardens, therefore only few have been left” (urban boy); “in some mountains people cut these plants and use them as wood for the fire-place” (rural boy). A number of children (10%) mentioned pollution as a threat, as with “these plants are sensitive to air pollution and therefore they die” (urban girl), “industry pollutes the place and the plants become threatened” (urban girl), “there is waste from the neighboring houses which destroys the plants” (urban boy), and “there are pesticides from agricultural fields” (rural boy), as well as habitat destruction: “the owner of the land wanted to cultivate his field and remove anything in order to plant his crops” (urban boy).

The analysis revealed differences between students from urban and rural schools. More children from urban schools (57%) mentioned anthropogenic threats than rural children (37%) (although the statistical difference was not significant: Cramer’s  $V=0.20$ ,  $p=.121$ ). Responses from urban children mentioned modern society’s activities as threats (e.g., “car and factory pollution,” “consumption and trade”), while rural children exclusively mentioned individual habits as anthropogenic reason of threats (e.g., “cutting and uprooting,” “lack of care,” or “trampling”).

### *Children’s Conservation Values*

In response to the question “Do you have any reasons to protect a threatened plant? What are they?,” all students expressed positive reasons to protect each plant. Children focused on the aesthetic value of conservation (Table 2). A number of children referred to how the individual plant contributes aesthetically to its surroundings: “this plant is very beautiful and I want it to be protected” (urban girl), “these plants have very beautiful flowers we should protect them” (urban boy), “it’s a rare beauty, very unusual to see a plant on a rock” (rural boy). Some even described plants’ aesthetic value to the whole island of Cyprus: “these plants make all the landscape beautiful” (rural girl), “this plant is very important for Cyprus and should be protected because it makes our island very nice” (urban boy). The second most common category included biocentric values, focusing on the well-being of individual specimens or single species population, instead of more complex units, such as biocommunities or ecosystems. This was mainly expressed in comments about the right of organisms to exist (“it should not be destroyed, has a right to exist” [rural girl]) and on the importance of endemism to local and global biodiversity: “this plant is endemic and it is very important to be conserved” (urban girl).

Ecocentric arguments, that is, arguments referring to the importance of the quality and integrity of the ecosystem as a whole, were expressed by seven (12%) participants. They mainly referred to the interdependence of organisms: “if this plant goes extinct then a whole food chain will be destroyed, since the animals which feed on will disappear and so on” (rural boy); “if this plant disappears the habitat will gradually lose its composition and then collapse as a domino” (urban boy). Children also mentioned the importance of large populations for the survival of a whole species (“I want to protect them because its not good to be only few, I want them to have big populations, in order to survive in a big ecosystem” [urban girl]), the intrinsic value of nature (“the ecosystem should be as it was” [urban girl]), and the emotional value of protection: “I feel sorry for this plant to be extinct from

**Table 2.** Children's values for the conservation of threatened plants

Value categories	Urban students		Rural students		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Ecocentric	2	7	5	17	7	12
Biocentric	10	33	7	23	17	28
Aesthetic	17	57	15	50	32	53
Utilitarian	1	3	3	10	4	7
No answer	0	0	0	0	0	0

the ecosystem, I am afraid that if this species goes extinct then the whole ecosystem will be disturbed" (rural girl).

Comments referring to utilitarian values were rare in children's reasoning. Such comments included "if we have such beautiful flowers then tourists will come to visit Cyprus in order to see it" (rural boy), "maybe this plant has a medicinal use and we can cut and trade it" (rural girl), and "this plant may be edible and people need it for their food" (rural girl).

Rural students focused more on ecosystem-centered (ecocentric) and utilitarian reasons for protection (Cramer's  $V = 0.33$ ,  $p < .05$ ) and less on biocentric and aesthetic reasons than the respondents from urban schools. However, although statistically different, the actual differences were only 10% and therefore are not considered large.

### *Children's Proposed Actions for the Conservation of Threatened Plant Species*

In response to the question "Acting as a student, what would you do in order to protect this plant?," the majority of children suggested species-based actions, followed by awareness actions (Table 3). Species-focused actions included: "I would water it by myself regularly" (rural boy), "I will plant more plants to help pollination by the bees" (rural girl), or "I would love it" (urban boy). Almost two-thirds of the participants who mentioned species-focused actions (31.6% of the total sample) referred to uprooting and replacing the threatened species: "I would uproot it and place it in a pot to take care of it" (rural boy), "I would place it in a greenhouse" (urban boy), "I would uproot it and place it in my garden" (urban girl).

Proposed awareness actions primarily involved information campaigns or measures: "I would place informative labels about the plants" (urban boy), "I will write articles in the local newspaper" (rural boy), or "I will write posters and leaflets to distribute them in my neighborhood" (urban girl). Children also mentioned actions of political pressure, for example, "I would ask the mayor to announce conservation actions" (urban boy).

The habitat-based actions included maintenance (e.g., fire regimes, water management) and restoration of the habitat (e.g., removal of invasive species) or the establishment of a new protected area.

Acting as students, few children (7%) proposed policy-based actions: "I will go to see Cyprus' president and ask him to prepare legislation to punish the people who cut the threatened plants" (urban boy), or "I will find the distribution of the threatened plant and forbid people to go there by law" (rural boy). Similarly, few students (5%) mentioned research actions. Urban students' proposals focused on minimizing

**Table 3.** Children's suggested actions for the conservation of threatened plants

Conservation action categories	Urban students		Rural students		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<b>As student</b>						
Awareness (e.g., place signs such as "protect flowers")	11	37	12	40	23	38
Habitat (e.g., make irrigation system)	4	13	6	20	10	17
Policy (e.g., forbid access to the area by law)	1	3	3	10	4	7
Research (e.g., find germination conditions)	2	7	1	3	3	5
Species (e.g., replanting in a domestic garden)	16	53	15	30	31	52
No answer	3	10	2	7	5	8
<b>As mayor</b>						
Awareness (e.g., organize events for public information)	10	33	9	30	19	32
Habitat (e.g., establishment of a protected area)	14	47	12	40	26	43
Policy (e.g., fine people who cut them)	10	33	14	47	24	40
Research (e.g., scientists find the techniques of seed germination)	3	10	2	7	5	8
Species (e.g., introduce small plants in the field)	9	30	10	34	19	32
No answer	0	0	0	0	0	0

*Note.* Students were given the opportunity to respond both as a student and as a mayor. The total percentage exceeds 100% since many students gave more than one response.

human impacts on habitats ("I will stop trampling," "stop throwing waste," "stop throwing matches," "stop throwing cigarettes"), while rural children preferred to adopt actions for habitat improvement ("I would remove stones and place fluffy soil instead," "I would make a watering system") and reduction of interspecific competition ("I would cut all the surrounding plants because they hide the sun").

Acting as mayors, a majority of children proposed habitat-based actions: "establishment of a protected area and creation of a nature trail for people to see it without harming it" (rural girl), or "designate a protected area" (urban boy). They also proposed policy-based actions: "fine people who cut them" (urban boy), or "a sentence of 100 years in jail for people who cut a protected plant" (rural boy). Awareness-focused actions ("organize events for public information about threatened plants" [urban girl], "put informative labels to protect this threatened species" [rural girl]) and species-based actions ("I would take seeds and plant them" [rural girl], "I would build a special place like its home" [Urban girl], "I would uproot and place it in a museum to be protected" [urban boy]) were each proposed by approximately one-third of the students. Urban students' proposals focused on preserving habitats by the establishment of protected areas, while rural children preferred to "fine people who cut threatened plants" by proposing policy-based actions.

## Discussion

Participants in the present study expressed concern for the protection of the specific threatened species. However, they tend to deemphasize societal reasons for the

decline of plant populations. A minority of the respondents attributed threats to human actions exclusively (pollution, habitat destruction, cutting and uprooting). Rural participants focused less than urban participants on anthropogenic threats. However, the analysis of their answers indicated that rural children, relying apparently on their personal experience with agricultural activities, confused the needs of wild species with the needs of cultivated species (e.g., irrigation, use of fertilizers). A role of future education could be one that encourages a more interdisciplinary and comprehensive view of the environment, including human actions and their possible effect on the environment, as well as human–nature relationships. Protection of biodiversity requires attention to the interaction of ecological and social issues (Menzel and Bögeholz 2009) and requires the learner to take into account different perspectives to arrive at a balanced decision (Gayford 2000).

Aesthetic values dominated children's responses concerning reasons for protecting threatened plants, confirming previous studies reporting that children judge the value of nature mainly in aesthetic terms (Lindemann-Matthies 2006; Alerby 2000). In the course of aesthetic appreciation, nature provides pleasure to humans and is thus of instrumental value to them, but it is not altered or destroyed in the process (Billmann-Mahecha and Gebhard 2009). Thus aesthetic appreciation of nature represents a mild form of anthropocentrism reflecting a relationship toward nature that is intermediate between the extreme positions of regarding nature as something to be exploited and assigning intrinsic value to it (Norton 1987).

Biocentric arguments, that is, arguments giving value to individual forms of life, constituted the second largest category of reasons for protecting threatened species. This finding agrees with other studies arguing that children at early adolescence tend to ascribe value to living, concrete elements of nature (such as individual organisms or species), rather than more complex constructs, such as ecosystems or biomes (Kahn and Lourenco 2002). It should be pointed out that although school curriculum emphasizes utilitarian values of plants, the children's reasoning distinctly deviated from utilitarian arguments, showing that school was not necessarily a major factor shaping their environmental values. The slight preference of rural participants for utilitarian values could be indicative of differences of value reasoning between urban and rural respondents; however, the magnitude of the difference and the size of the sample do not allow for the extraction of firm conclusions.

In the present survey, participants proposed a wide range of actions for the protection of threatened plants. It appeared that when children are responding as someone having power (mayor), they proposed actions of a more inclusive character, compared with the ones they proposed as single individuals (e.g., policy-based and habitat-based actions instead of single-species actions). It is also noteworthy that emphasis on legislation-based suggested actions, commonly reported in other studies (Erdoğan et al. 2008; Hicks and Holden 2007), was expressed in our study mainly when children were supposed to act as mayors. This finding strengthens the argument that people propose certain actions when they feel that will be able to implement them. Consequently, it is pointed out that it is important to know not only the beliefs or knowledge that may result in a certain (potential) action, but also participants' belief about the possibility of implementing the potential action. Therefore, the improvement of children's sense of efficacy of their own actions is an important goal for environmental and conservation education (Meinhold and Malkus 2005).

The proposed action of uprooting and keeping a threatened specimen at home, or at a domestic garden, deserves attention: These types of actions, though improper

from a scientific point of view, most probably express an attitude of individual responsibility and caring that could be of great importance from an educational perspective. It has been proposed that between 10 and 12 years children develop a sense ownership and responsibility that could take the form of taking a threatened creature home and protecting it (Chawla 2009). This implies that, instead of (or together with) trying to teach children the correct scientific concepts and managerial practices, it would be more appropriate to emphasize the development of caring attitudes and the sense of ownership (Gebhard et al. 2003).

What are missing in children's proposed actions in our study, as well as in similar reports in the literature (Erdoğan et al. 2008; Kahn and Lourenco 2002), are community-based initiatives (e.g., resource stewardship, livelihood alternatives). Young people need opportunities to acquire the sense held by members of a group that they can coordinate their actions effectively and accomplish shared goals through unified efforts (Chawla and Flanders Cushing 2007).

Understanding children's beliefs and values toward threatened biodiversity is especially relevant to two challenges faced by nature policy and management, namely, the democratic need to understand public views on nature in order to incorporate these views into policy and management, and the pragmatic need to understand and prevent sociopolitical issues that may emerge when nature policy is being implemented at the local level (Bujis 2009). Although the present study should be considered a case study, based on limited, nonrepresentative samples of urban and rural children of Cyprus, and generalizations from the results should be avoided, it nevertheless reveals some important aspects of children's views on biodiversity and raises issues deserving attention. More especially, the deemphasizing of societal factors for the decline of plant populations and the expression of caring attitudes, together with the finding that respondents proposed certain actions when they felt that they will be able to implement them, suggest that an information and educational policy on threatened plant conservation should not be restricted in transmitting scientific content, but should adopt a social character, focusing more on community-based initiatives and participatory learning approaches that will enhance children's sense of ownership and efficacy.

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