Linking Perceptions and Water Management: Reflections from Cyprus

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Abstract: The predicted effects of climate change on regions with fragile ecosystems and high dependency on natural resources, such as the Mediterranean basin, call for an improved and holistic resource management Such a holistic approach would be enriched by the inclusion of the perceptions of the appropriators and the decision makers. The aim of this study is to identify the linkage between perceptions and water management at individual level, focusing on the case of Cyprus, an island characterised by strict top-down hierarchies and intense water shortage problems. To realise the aim, 20 in-depth interviews were conducted with students of the University of Cyprus and locals of Panagia, a village adjacent to a protected area. Additionally, empirical results were obtained by experimental techniques employed by the authors. As such a policy experiment on irrigation in the above mentioned locations was conducted and used as a triangulation means. The preliminary results illustrate that the perceptions of the sample differ substantially. These differences shape to a large extend the way water is managed by individuals but also the notion of water management as a whole.

Key-Words: common pool resources, water resource, perceptions, water management, policy experiments, Cyprus

1 Introduction

The predicted effects of climate change on regions with fragile ecosystems call for a holistic approach to the management of natural resources and especially water, particularly in areas with fragile ecosystems and high dependency on natural resources. This is especially the case for the Mediterranean islands whose water stress is predicted to be intensified [1, 2] and who depend on water resources to sustain important economic sectors like agriculture and tourism [3].

According to literature focusing on the varieties of capitalism [4], there is a distinct *Mediterranean* model that stands between liberal market economies (like the U.S.A. and the UK) and coordinated market economies (like in Germany). This southern model is characterised by a weak state, inefficient bureaucracies [5] and poor level of corporate governance and a strong role for banks in key investment sectors. In recent years, there is an observed rapid liberalisation process of various sectors, which indicates a shift towards a more neo-liberal approach. However, according to the theory of neo-liberal approach natural resources (water included) are regarded as *any other good* and as such they can be substituted. In the context however of the Southern European Member States and especially the Mediterranean islands, and taken into consideration the predicted effects of climate change, the –scarce- natural resources are anything but "any other good".

There are numerous examples of overuse and depletion of natural resources under the above mentioned framework (like the North Sea fisheries, where cods are facing thread of extinction due to overexploitation). There are however many other examples where natural resources are managed in a more "sustainable" way [6].

The authors share the view of many scholars arguing that the management of natural resources depends on a plethora of factors, like the institutional settings, the incentives and values of the actors, the size of the appropriators (state/community) amongst others [6, 7]. However, a factor that has remained relatively blurry or untouched is the influence of the appropriator's perception regarding the resource under consideration. In the case of common pool resources the perception of the appropriator regarding the function of the resource has been rarely examined empirically in the Mediterranean, especially in relation to the decision-making process.

According to the rational choice model, a common pool resource appropriator would weight the costs and benefits to be derived from the extraction or use of the resource, and he/she would

then decide unbiased about the optimal management of the resource. But this assumption assumes a rational approach, in which the appropriator has full information and acts without biases and personal preferences. In reality the appropriator acts having incomplete knowledge about the costs and the benefits and holds some biases that influence decisions. The authors hold two working assumptions. According to the first one: in marginal regions with fragile ecosystems and high dependency on natural resources -and taking into consideration the weaknesses of the rational choice model- understanding perceptions can play a major role in water management. The second working assumption is that especially in the Mediterranean setting with the almost non existent participatory culture, tomorrow's decision-makers will come from today's students.

A very interesting case to study environmental perceptions is Cyprus, a country whose economy is based on tourism and partly on agriculture, two sectors that demand constant and reliable water supply. Cyprus presents additional interesting features since it is a traditional top-down hierarchy, in which civil society plays but a minor role in the decision-making process. Finally, being an Island, it constitutes by definition a closed system with limited resources.

In order to better understand the link between environmental perceptions and water-related decision making, the author conducted 20 in-depth semi-structured interviews in Cyprus, with ten university students and ten residents of a village adjacent to a protected area. Further, results obtained through a policy experiment on irrigation in the same locations were used in order to triangulate results for this study.

2 Water management and Perceptions – Theoretic considerations

This chapter links water as a common pool resource with considerations about its management, viewed under the prism of perceptions on environmental issues and their role.

2.1 Perceptions and their role

Tröndle argues that [8], "*observing, recognizing and constructing reality always relies on the system-specific differentiation of the observing system"*. According to this agreement, reality is therefore constructed and its construction relies on some factors presented by Robbins and Judge [9] (refer to Fig 1). These factors are accredited to the perceiver (e.g. experience, motives, expectations), to the target (e.g. size, novelty) and to the situation (e.g. time, social setting).

Bruner and Goodman (in [10] illustrated the influence of expectations on perceptions when rich and poor children were asked to illustrate the size of a coin. Poor children over-estimated the size of the coin to a larger extent than rich children.

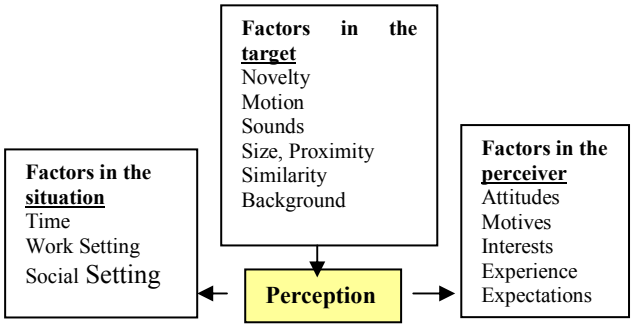

Fig. 1. Factors influencing individual perceptions (Source: [7])

For example the size of the object impacts the perception process because size influences attention and recognition in a very effective manner. This attribute (size) has been utilised in promoting strategies either in business (e.g. using a big advertisement) or in conservation efforts (e.g. using tigers as umbrella species). In regards to perceptions about the environment and subsequently natural resources, Sudarmadi *et al* [11] emphasise that the perceived world – or environment- differs for every individual, since it is subjectively constructed, based on memory and influenced by previous experiences. The notion of a constructed environment is supported by several empirical studies. For example, Filp *et al* [12] interviewed peasants and tourists in central Chile. Their results showed that the length of interaction with the environment and the type of activities carried out are related to environmental perception. Although most of the peasants had never attended school, as opposed with the tourists visiting the area, environmental perception of the former was richer than that of the latter group [13] because of their lengthy interaction with the natural environment of the area. Tourists seemed to perceive more the aesthetic value of the area compared to the locals, although other important values were recognised mainly by the locals (biological, economic, psychological). The study of Flip *et al* [12] illustrates effectively the relation between people's perceptions and the environment. Feijoo and Momo [14] introduce the socio-

economic aspect of environmental perception. In their study of the linkage between socio-economic characteristics and environmental perceptions in Argentina, they emphasize that *"[…] there exists a perceived world, which would be different for each individual and group, according to their socio-economic characteristics, and their particular story"* [15].

Individual perceptions have a strong influence on the decision-making process, which is not recognized in the rational decision-making model. The rational decision making model assumes that before any choice is made the decision maker (a) has full knowledge; (b) is aware of all the alternative solutions; (c) follows the process objectively; and (d) aims at maximizing economic gain or utility [7].

1. Definition of the problem
2. Identification of the criteria or objectives of the decision
3. Weighting or prioritization of the criteria or objectives of the decision
4. Generation of alternative courses of action to solve the problem
5. Evaluation of the alternatives against each criterion or objective
6. Computation of the optimal decision

Box 1. The Rational Choice Model

However, scholars and empirical research contradict these assumptions [136 17, 18]. Indeed, as the human brain can not formulate and solve complex problems with full rationality, we tend to reduce problems to a level at which they are easily comprehensible. Under this perspective, problem-solving and decision-making processes function within the context of bounded rationality. The assumptions, therefore, of full knowledge and awareness of all alternatives are not realistic. The assumption of objectivity has also been challenged. It has been shown that in complex situation with uncertainty and when strong beliefs are present, judgments are highly susceptible to biases. The beliefs of the decision-maker as well as his needs and values can influence and bias his perception of the situation and thus unavoidably lead to subjective decisions.

The last assumption of the rational decision making model (maximization of utility) has been challenged by many scholars. Empirical and theoretical work has shown that decision-makers in real life act before all the information is gathered, tolerate misinformation and lack of information, use complex, iterative decision processes or quick processes and rely heavily on their intuition over rational analysis to make a decision [16].It is within this context that stakeholders decide upon their actions or influence decisions concerning them. This context is of special interest in regards to *environmental issues*, as faulty decisions can have serious consequences for the affected individuals, society and the environment.

2.2 Water as a common pool resource

Water is a common pool resource. As such, it has some specific attributes that make it susceptible to depletion. *Excluding* (or limiting) individuals from using the common-pool resource is very difficult, because of its attributes (physical, legal, economic). While it is easy to fence private property to exclude others from using it, it is impossible to fence a fishery ground. In other cases, costs deriving from exclusion are much higher than costs of establishing a mechanism to control use [17]. *Substractability* of common-pool resources is also higher than that of toll and public goods (see Table 1, next page). The consumption of a public good by one individual does not reduce availability of the good for consumption by others. Examples of public goods are defense or the legal system etc. In common-pool resources, however, consuming -or using- the resource, reduces availability of the good for others. If, for example, a fisherman harvests a ton of fish, then those fish are no longer available for other fishermen [18]. The overexploitation of a common pool resource leads to the "Tragedy of the Commons" a situation first described by Hardin [19] in 1968.

Garret Hardin in his much influential paper titled "The Tragedy of the Commons" introduces the dilemma of individual versus collective interest [19]. He uses the example of herdsmen, taking their herds for grazing in a pasture (commons) that is open to all. It is in each herder's interest to put as many cattle as possible on the land. The herdsman will receive all the benefits from the additional cattle, while the entire group of herdsmen will share the damage inflicted upon the commons via overgrazing. However if this is the decision of all herdsmen, as individually rational as it might be, overgrazing will lead to the destruction of the commons and all herdsmen will equally suffer from it [19].

All in all, the combination of low excludability and of high substractability makes common pool resources (and water) very susceptible to depletion. And the issue of "how to govern natural resources used by many individuals in common" [20] becomes crucial, especially under the prism of climate change which will bring additional pressure to natural resources systems [21]. As Berge [22] notes: *"with a few notable exceptions environmental protection and management of common resources are not usually discussed together"*.

There is a plethora of theories outlining how common pool resources can be managed. What is common by all is the notion of collective action. The prisoners' dilemma is a game often used to illustrate how the pursuit of individual welfare results in a "collective strategy" [6].

Exclusion	Substractability	
	Low	High
Difficult	Public Goods	Common-Pool Resources
Easy	Toll Goods	Private Goods

Table 1. Typology of Goods (Source: [17])

In the prisoner's dilemma two suspects are arrested by the police but without sufficient evidence of their guilt. Both suspects are put in separated jails by the police and are both offered the same deal: If one testifies against the other and the other remains silent, the betrayer goes free and the silent accomplice receives a 10-year sentence. If both remain silent, they are both sentenced to the minimal six months in jail because of lack of evidence. If each betrays the other, then each prisoner receives a five-year sentence. Each prisoner has only two choices: to betray the other or to remain silent. In this dilemma the optimal group result is for both prisoners to remain silent and, cooperate, and thus accept the minimal sentence and obtain the best group result (one year total). But according to the rational choice theory both prisoners seek to maximize their individual profit (set free) without caring for the group result. As such, the individual prefers seeking his freedom, although this would result to a worse group sentence (group total of 10 years no matter if one is set free or each prisoner testify against the other).. In other words*, individual rationality leads to social irrationality*.

The theory of collective action, developed by Olson supports that "unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, *rational, self-interested individuals will not act to achieve their common or group interest*" [7]. Additionally Olson (*ibid.*) brings forth the possibility of free-riding. He argues that the largest the size of the group, the highest the possibility that somebody will free-ride. Olson (*ibid.*) however does not set a number according to which the group size is considered small.

Externalities are defined as the material consequences a stakeholder who did not undertake any actions will feel, due to the activities undertaken by others [22]. In the context of common pool resources externalities appear in the form of competition and distribution problems (*ibid.*). The first appropriator will utilise a certain amount of resource units, removing them from the pool and leaving less for the second. It is then a matter of management and organization to ensure an equal and environmentally sustainable distribution of the resource. The decision made on how to utilise a common pool resource is made individually. It is based –among others- on the institutional arrangements in place, the size of the appropriators (state/community) the incentives, values and perceptions of the actors [7]

Cardenas *et al* [23] tried to enhance the understanding of the effect of incentives and institutions on decisions about CPR's management, by employing policy experiments with students and non-students samples. Policy experiments, often taking the form of games, aim to address common biases of economic valuation. They examine how incentives and institutions affect decisions. Furthermore they study typical problems of group externalities or social dilemmas associated with CPR. In general, they involve a better understanding of the behavioural foundations of decision-making when facing environmental externalities and uncertainties, and a more careful understanding of how incentives and institutions affect such decisions and their environmental outcomes. [17]. It can be observed that although economic, social and behavioral patterns are discussed in CPR's management theories, there is minimum involvement of perceptions.

3 Methodology

In an attempt to bridge environmental perceptions and common pool resources, the following steps were made (*see Figure 2*):

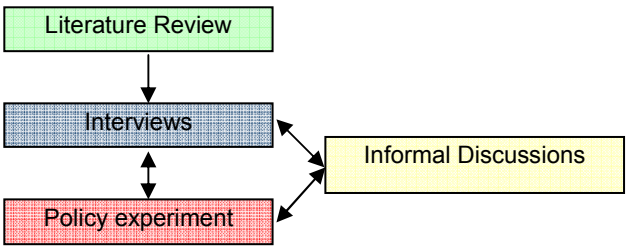

Fig. 2: The methodological steps of the research

a) A thorough literature review on common pool resources theory, on environmental perceptions and on the state of water resources and documented perceptions in Cyprus was conducted.

b) 20 semi-structured interviews were made, both with students and stakeholders participating or not in

c) a policy experiment on irrigation.

Furthermore a number of informal discussions and meetings contributed to the translation of the findings and uncovered many well-hidden beliefs and interesting stories.

More specifically, ten in-depth semi-structured interviews were conducted with students from the University of Cyprus and ten more with locals in Panagia, a mountainous village adjacent to a protected Natura 2000 site. Semi-structured interviews were conducted, with questions regarding the interviewees' conectiveness to nature, their perception about nature, common pool resources and particularly water and finally water management (*for sample questions, refer to Table 2*). All interviewees volunteered for the interview.

Sample Questions
-How would you characterise the state of the natural environment in Cyprus at the moment? -Which, according to your opinion, are the most important environmental problems in Cyprus? -What do you think about when you hear the word Nature? -How do you feel about water availability in Cyprus? -According to your view, which measures could be taken to improve water availability?

Table 2: Sample Questions posed to interviewees

Students study environment-related disciplines in the University of Cyprus and their programs vary from 4th year of BSc in Environmental Engineering to PhD candidates of environmental chemistry. Locals in Panagia had a bigger variation in regards to their formal educational level. Some had graduated from high school while some had finished their doctoral studies.

Half of the interviewees participated in a policy experiment (irrigation game –*see below*) in the form of games which aim at better understanding decision making when faced with environmental externalities and uncertainties, as it reveals attitudes, perceptions of players on CPR's based on the way they play [23].

	Numer of Interviewees/Panagia	Number of Participant/University
Irrigation game	5	5
No game	5	5
Total	10	10

Table 3: Interviewees' sample structure

The irrigation game is comprised of two set of 10-rounds and it is played by a group of 5 participants. In both sets of rounds participants are not allowed to communicate with each other. In the first round of the irrigation game the five players invest individually and privately monetary units from a limited amount available to each player to a public fund (common water works). According to this investment an amount of water units is produced. Following the participants can collect water. The more they invest, they more is made available to them for collection in a non-linear way. The players collect according to their position (upstream first, downstream last – *see figure 3 below*) and the winner is the player who at the end of the game has the more units (sum of units not invested and of units collected) [23].

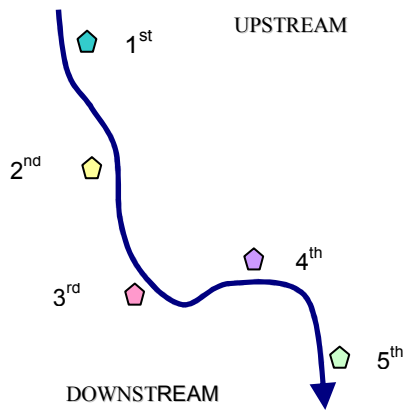

Fig. 3 Positioning and dynamics of players in the irrigation game

In the second set of rounds of the game, players are called to vote between three rules to be implemented. The first rule is *rotation* according to which two players (out of five) are allowed to collect water each turn, according to a fixed rotation system. In the second rule (called *lottery*) each round the order in which the participants can collect from the common pool is randomly drawn after everybody has made their decision how much to invest in the water provision. In the third rule each participant receives the right to use 20 percent of the water each turn [23]. The game is repeated (investment and then collection) and the players gather units within the range determined by voted Independently of which rule is voted though, participants have the right to cheat, i.e. to collect more or out of the order in which they are allowed to.

It should be noted that the participants of the policy experiment were reimbursed for their attendance by getting a "showing up fee" (the stakeholders) or a certificate for attending the game and the following-up workshop (the students). Furthermore, economic incentives were given: the total performance (units of water collected plus monetary units kept) of the participants was reimbursed by proportionally paying their total harvest at the end of the game

4 The case of Cyprus

As a case to empirically study the environmental perceptions through water management, the Republic of Cyprus was selected, because of its special attributes. Cyprus constitutes a new European Member State, where only few and contradicting studies on environmental perceptions have been carried out, even though water resources on the island are under severe stress [20]. Additionally Cyprus is considered a traditional top-down hierarchy where public participation plays but a minor role in decision-making [21, 24]. Being an Island, the area of the study also constitutes a closed system in terms of biophysical constraints and limitations.

Precipitation is the only conventional water in Cyprus. More than half of it is surface runoff and the rest is groundwater [21]. During summer months water provision for all uses is done through reservoirs (dams or groundwater), as water demand is much higher during summer, mainly because agricultural and tourist activities peak during that period. Agriculture is the biggest water consumer, with 70% of the total water supply being directed for agricultural uses [24]. Half of the groundwater being pumped in Cyprus is used for irrigation [*ibid.]*.

Until 1970 Cyprus could meet its water needs by using groundwater, a practice that lead to the depletion of groundwater levels and resulted to sea water intrusion [25].Since 1997 two desalination plants have being established, which now complement water flow from dams. Three more are to be completed by 2013. Water produced by these plants will be first directed to meet household demand and then irrigation [25, 26]. This way, the government of the Republic of Cyprus aims at the independency of agricultural water supply and gradually of domestic supply from precipitation by 2010 [26]. According to the Cypriot law, water resources can not be privatized, and are therefore considered as common pool resources. This distribution of property rights, combined with the lack of enforcement of existing laws leads to uncontrolled and extensive pumping which in turn has compromised the quality and quantity of water resources [24]. Tsiourtis [21] records the laws determining who has the right to extract and use water. According to the same source (*ibid.*), water users do not hold active role in the decision making process and their participation is restricted to either to the role of consumer (domestic users) or on purely technical aspects, distribution and use of water resources (industrial and agricultural users). With the implementation of the Water Framework Directive consumers' role might be enhanced, since one of aims of the WFD is to engage the public in participation processes [27, 29].

Cyprus has adopted a master plan for the management of water resources with special weight given on technical measures, a step that has failed to yield the desired results. The UNDP [28] accredits the failure to the way water management is being approached in the master plan. The UNDP argues that "rather than aiming to meet the demand for water resources as a first priority, water management should *focus on demand management*" [28, emphasis added]. The focus on demand management, however, entails the notion of recording environmental perceptions, understanding them and embedding them in a participatory procedure where both decision makers and consumers exchange perceptions, expectations and knowledge.

There is however a lack of pertinent research on environmental perceptions in Cyprus and their linkage with CPR's and especially water management. This is the gap this study aims to fill, by employing a case study and empirical methods of qualitative data collection in order to trace

environmental perceptions of two distinct, but equally important, groups in Cyprus; students of environmental disciplines and locals in a protected area.

5 Results

As mentioned in the methodology section, primary source of information was a three-folded process: formal interviews, informal discussions and direct observations of the authors during the policy experiment that was conducted.

The interviewees were asked about their connectiveness to nature, their knowledge about common pool resources; they were asked about the state of the natural environment and of water resources in Cyprus; Results show that there is a clear distinction between the rural and the urban sample. Locals interviewed had a much closer relationship with nature than students. Students regarded nature as something undisturbed and distant to them, while locals regarded nature as something familiar and alive.

Under this perspective, the two groups were further seen as belonging to urban and rural groups. Locals in Panagia held more "rural" perceptions about nature whereas students held "urban" ones.

In regards to water, interviewees of both groups recognized that Cyprus is facing a serious water shortage problem. Furthermore, three students believed that if and when water problems were eradicated from the island then the majority of environmental problems would disappear. According to one of the students, sufficient rain would moisture the soil and forests and thus would minimize the probability of forest fires occurring during summer, something that was mentioned as an important problem by some students. Additionally, the same students mentioned that water-cuts in the cities would also cease to exist. Surprisingly, water-cuts were perceived as an environmental problem by these students. Locals interviewed in Panagia admitted incomplete knowledge about Cyprus-wide problems and preferred talking about their region. According to them, the most severe problem related to water was the depletion and lowering of the groundwater table.

Every single interviewee clearly stated that water scarcity in Cyprus is a reality. However, each group understood and perceived it in a rather different way. Students felt water scarcity in the form of water-cuts in the cities. Locals saw the agricultural dimension (lower groundwater table) and some saw the implications of reduced rainfall for wildlife. It is worth noticing that all issues discussed by one group, were not mentioned by the other. Locals said they are facing serious irrigation problems, since the volume of groundwater made available by the water bores has been dramatically reduced, by more than 50% and students felt irritated by the lengthy cuts of water provision in the urban centers.

In regards to water usage (water consumption for household use was exempted), only stakeholders said that they were active in that field. All respondents in Panagia practice agriculture in different degrees. The majority is employed full time in various sectors and cultivates their privately-owned fields at their leisure time. Half of the interviewees in Panagia owned the irrigation installations they use, while the rest had been given the right to use the installations of neighbours, as long as they compensated for the water used by maintenance work on the canals and the bores. When asked to explain how this informal network works, especially given the reduced availability of water, they replied that *trust* is what keeps this informal agreement. A respondent illustrated the decisive role of trust in one of the following up informal discussions:

"Trust. My neighbour trust me that I will not use all his water and then leave him to do all the work alone".

Moreover, when about the question of common pool resources was posed to the interviewees, the dichotomy of the perceptions between the two groups was made clear. The majority of the students believed that common pool resources (and water) *belong to nobody*, while the majority of the locals believed that CPR's *belong to everybody*. This differentiation between the two groups was further verified by their behaviour during the policy experiment. Participants who in their interviews stated that "CPR's belong to everybody" were more "other-regarding". They did extract just a portion of the maximum allowed, allowing for more resources to be made available for the rest (downstream) players and surprisingly even leaving water to go wasted, thus flowing out of the "game" (this unexpected behaviour of actually leaving "money on the table" was also observed in the Cardenas *et al*. (*op.cit.*) experiments in Thailand and Colombia). On the other hand, students who perceived CPR's as "belonging to nobody" were more "self-regarding" and often extracted more resources than allowed. What is interesting and worth mentioning here is that in games where the majority of players were more "other-regarding", the produced resource was higher and more equally distributed. When the majority of players were more "self-regarding", the

last players would rarely receive any water, they would not invest in the public fund (preferring to keep their units "safe"). This would result in a smaller amount of water available for extraction and therefore the overall sum of collected water unit in the group would be much smaller than in the case that the last players contributed more.

Additionally, the issue of trust was also recognized by both locals and students crucial for the sustainability of the resources. For example students who knew each other and considered members of their team as friends had a much more equitable distribution of water amongst them and also the resource usually reached the last player. On the other hand, students who did not feel close to the members of their teams, behaved in a much more individualistic manner, collecting more than what was allowed. Trust popped up though even in groups that developed trust during the game, mainly by maintaining high investment and equal distribution of the resource. It is very characteristic that in those groups where trust was not apparent or diminished during the game, the fourth and the fifth players (the downstream players) usually received no water at all since the upstream players collected it all.

As mentioned previously, all interviewees were asked about the most important environmental and water-related problems of the island. When asked to propose measures for managing water in the island, the answers given by students and locals differ substantially. All students held a "technocratic" perspective, supporting technical measures for dealing with extreme water shortages. Four students proposed that more desalination plants should be established island-wide so as to increase water availability, whereas five gave the combined answer of water recycling and the installation of water saving technologies in households as a means to achieve decrease in water demand and consumption. Only one student emphasised the role of environmental education and awareness campaigns in water management.

On the other hand, interviewees in Panagia had a more holistic, although general, approach. Water recycling and desalination was also mentioned by two respondents. However, eight interviewees believed that only through education and awareness can water be managed in a manner as to allow future generations to use sufficient quality and quantity of water. They argued that only through environmental education and awareness campaigns can water consumption be reduced.

6 Discussion

A relationship between responses and behaviour in the game was made clear. Behaviours in the irrigation game could be explained through responses given during the interviews. Likewise, responses were verified by actions undertaken during the game. It can be safely assumed that when trust is present between the participants, water is managed in a more sustainable way. As it was observed by the author and confessed by the participants, when the players trusted each other, free-riding incidents were minimal and more equal distribution of the resource took place.

An additional aspect that came forth, combining the irrigation game with the interviews was the notion of *needs*. Whereas students perceived CPR's as belonging to *nobody*, locals perceived them as belonging to *everybody*. This differentiation might provide a justification as to why students were oriented more in a utility-maximization logic and why locals harvested much less resource units in the game. Discussions following the experiments showed that locals harvested according to their needs. What was interesting was the fact that, while playing the game, locals had an image of an existing water source in mind and every time they extracted water units from the pool, the imagined water source (a lake, dam or water bore) was diminishing. Thus, they rarely extracted more that what they thought exceeded their real needs in water. This was not the case with the students, which perceived the water units in the game as a means to win. As a combination of the above (trust, ownership of CPR's and relatability with reality) it was often the case that after the middle of the game, the water resource available to the students was dramatically reduced and in some cases eradicated before the end of the game. In contrast, in all the games where locals participated, the resource was maintained until the end.

Under the above, it can be observed that the students' group verified the game theory, according to which individual rationality (utility maximization) leads to social irrationality, since water was rarely sustained until the end of the game and that leads to a "tragedy of the commons. On the other hand, the locals' group verified that there can be other motives that guide water management, like social and ethical considerations, trust and a communal feeling.

The reasons behind this differentiation could vary and no safe assumptions can be drawn before further research is conducted. It is evident though that the setting in which each group is active influences their perceptions. Locals live in a rural

setting and they engage in farming activities to various degrees; students live in an urban setting and they feel detached from nature. Students, therefore, hold perceptions that are environmentally more neutral than locals'.

7 Conclusions

The overall aim of this study was to advance an understanding on the role of environmental perceptions in water management in the Republic of Cyprus. Interviews and a policy experiment (irrigation game) were conducted with students of environmental disciplines in the University of Cyprus and in Panagia, a mountainous village adjacent to a Natura 2000 site.

Overall, the results illustrate that environmental perceptions differ substantially between the urban and the rural sample. Educational level is not as a determinant factor in the formation of environmental perception as interaction with the natural environment is. Additionally the issue of trust (and hence networks) comes forth as an important factor for the sustainable appropriation of water resources. A need for a more thorough research on environmental perceptions and their role in the decision making process in Cyprus was identified.

The authors acknowledge that the small scale of the research limits the validity of the results and makes any generalization effort futile. However some preliminary conclusions can be drawn and further research on the linkages between water resource management and environmental perceptions might provide useful evidence for the effectiveness of relevant policies. However, the policy implications of the preliminary findings of this research might be proved important in the near future for the drought-hit Island.

An issue of particular importance is that although, both groups recognized dramatic water problems that most likely will be intensified in the future, they perceived the nature of the problem and the possible solutions quite differently.

As such, the preliminary findings provide evidence that there is a clear distinction between the environmental perceptions of the two groups, which can be attributed to the setting in which members of each group live. People in Panagia live by the forest and they all practice farming to some degree. Students live in the capital and have no day-to-day contact with nature. It can be safely assumed that educational level does not seem to be an important factor is shaping environmental perceptions, at least not as important as contact with nature is. It must be noted though that such differences do not in any way imply the existence of "ideal" perceptions. The authors do not suggest that one set of perceptions is better or able to contribute to all management efforts of the scarce water in Cyprus. On the contrary, the different ways that the sample of the research approaches such a vital resource may complement each other. This is an issue to be taken under serious consideration during the design and the implementation of water related policies.

As an overall, the paper empathically suggests that further research on the particular issue should be conducted and efforts to involve more local stakeholders to the management of natural resources should be made.

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