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Improving Environmental Literacy In Teacher Education

By

Quasim Al Shannag
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Improving Teacher Education At Jordanian Universities Project

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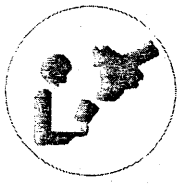


Improving Teacher Education at Jordanian Universities Project

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Editors:

Quasim Al Shannag

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National Center for Human Resources Development

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THE RELIGIOUS CONTEXT

Foreword

In 1998, environmental education was integrated into efforts of improving teacher education at Jordanian universities (ITEJU). The project was funded by the Jordanian Government and the European Union, and organized through the services of the National Center for Human Resources Development (NCHRD) and the German Gesellschaft für technische Zusammenarbeit (GTZ). ITEJU brought a sizeable number of experts from abroad to the four participating universities (University of Jordan, Hashemite University, Mu'tah University, Yarmouk University), each representing various disciplines and specialties. While that exchange was phased out in 2001, the project has contributed to a change of structure in teacher education. The project's focus was the link between theory and practice, crucial for the success of teacher education in each cultural setting, and, indeed, a point of constant challenge to teacher education worldwide. At Jordanian universities, a group of supervisors was established through ITEJU to provide a link and a means of coupling between the theoretical part of teacher education as represented by university courses, and the practice teaching in schools. These supervisors helped facilitate the integration of both aspects in accord with circumstances, providing easy access to a range of laboratory schools for the theoretician and making practical teaching a securely established element of teacher education at Jordanian universities. Within that context, environmental concerns were one section of the discourse.

Environmental education is not one specific discipline, but involves a spectrum of disciplines in the solution of problems related to the environment. ITEJU's initiators felt that this internationally driven and problem-oriented field was well worth being included into the project. During the three years of the project's duration, between scholars and practitioners from Jordanian universities and from Germany, a discourse began on the possibilities and the ramifications of environmental education in teacher education.

The document at hand may be seen as the product of that continuous exchange. The contributors to this book agreed on the label of "Environmental Literacy" in order to signify a fresh approach with interesting new points of view that apply to both developed and developing countries. As such, this book is characterized by two features, one its applicability to both worlds in teacher education, theory and practice, the other its attempt at finding common ground for various approaches of environmental education, so that a more meaningful and a more powerful structure can be developed.

The book's editors express their gratitude to the representatives of the agencies and the associations that have made this publication possible, the Jordanian Government, the European Union, the National Center for Human Resources Development, and the Gesellschaft für Technische Zusammenarbeit.

Amman and Hamburg, April 2001

Qasim AlShannag

Helmut Schreier

INTRODUCTION

Helmut Schreier

What is Environmental Literacy?

Definitions

Literacy as ability to read (just as arithmetic, the ability to use numbers), is not a self-explanatory term. It seems to give a hint rather than an explanation. As the German writer Johann Wolfgang Goethe observed in his old age, he had spent his whole life trying to learn how to read. He was referring to the endless scope and fathomless depth of the discipline of reading, which extends from a mere recognition of marks on paper to their significance as letters and words to the realization of deeper meanings in a given text, such as its underlying assumptions and the philosophy it represents, on to the process of making a text actively meaningful within the reader's own life.

Analogously, Environmental Literacy (EL) is the attempt to read the environment and to understand environment as a process affecting peoples' lives. EL as a program seeks to provide people with the conceptual knowledge and the skills necessary to cope with concerns and problems brought about in transactions between society and nature.

EL fosters cognition, attitudes and behavior of people to help them clarify complex situations and to overcome what is perceived as the problematic in a given situation.

EL must be understood as an extension of the human right to a healthy environment – an environment that is not detrimental to people's physical and mental health, but contributes to their wellbeing.

EL – put into the wider context of a country's culture – is also an attempt to liberate discourse from the ramifications of goals and ideals defined from outside and "above", as it were. The relationship between wealthier countries of the developed world and poorer countries of what is called the developing world appears sometimes to be marred by the imposition of expertise that is not altogether appropriate to the situation at hand. Since goals that were formulated elsewhere are representative of concepts identified apart from the processes of learning and living in the situation at hand, they are removed from people's needs. Such needs have to be identified by the people themselves after close inspection of the problems of concern within the given situation. EL may be seen from this international perspective, therefore, as a plan to provide people the means necessary for tackling problems and for application to the specifics of their country, their culture, their traditions, their concerns.

Our primary concern here, however, is with the possibilities of schools rather than of societies. The learners – pupils, teachers, teacher-students – are invited through the EL approach to engage in studies that are related to their own circumstances. While EL results in the promotion of relevant factual knowledge and skills acquired, it is not set up as a canon of basic concepts or a hierarchical list of skills. Based upon the insight that learning is not the direct transmission of facts or skills, but rather the indirect acquisition of these in a process that centers on the active mediation by learners themselves, EL focuses upon issues and concerns that are part of and inherent to the situation in which the learners are participating. EL seeks to ensure learners' participation in the process of learning by investigating problematic (and thereby, interesting) aspects of the relationship between people and the things that make up the environment.

An Example to Illustrate the EL Approach

The B.S.E. crisis current at the time of this writing in Europe is a good example of a learning process that is taking place among the wider population. Peoples' concern for their health and for the good health of their families is actualized by alarming news, spread by the media, about horrendous and fatal effects of the Creutzfeldt-Jacob syndrome on people, and the possible link to mad-cow-disease, which in turn is traced to cattlefodder that consists of protein-rich substances processed from carcasses and calculated to increase yield of milk- and beef-production. Clear indicators of concern among the population are a dramatic decline in consumption of beef, the promotion of shocking pictures and alarming news by the mass-media, and the number of attempts at clarification and exchange of information among groups of citizens. In an atmosphere that seems rife with suspicion, people are not only exchanging information that ranges from facts to rumors, they are engaging in a learning process that touches upon a grasp of the basic ecological concept of food-chain and includes a discourse about the ethical: Is it right to feed animals the way we do, to keep animals the way we do, to mass-butcher animals the way we do?

These learning features are never without regard to human well-being. Human welfare, the possible dangers to human health are foremost on people's minds. This concern provides the prime motif for the population in general, as it has done throughout the history of Environmental Education. It has been pointed out frequently that the environmental movement, while traceable far back into the history of civilization, in the sense of a broadly supported movement began in 1962 with the publication of Rachel Carson's "Silent Spring". That best-selling book, it may well be argued, drew both the general public's attention and the ire of the powerful chemical industry because it did

not limit the effects of pesticides such as DDT to birds and other animals, but because it went so far, indeed, as to include people, to demonstrate the harmful, possibly cancerogenous effects of said substances on human health.

This perspective has been called "anthropocentric" in recent literature on environmental education, and has been opposed to a "pathocentric" or "holistic" view of the natural universe. This represents a curious dualism, as if people were enemies of something both alien and precious, wild nature. It is to be hoped that incidents such as the B.S.E. scandal serve as a reminder of the close, intimate, and, indeed, unbreakable connectedness of people and their natural environment. The question is not, How can nature be saved from humans?, but, How can people learn to live healthy lives in a healthy natural environment?[1]

Perhaps, as a global civilization, or at least as people living in various areas of this planet, we learn to cope with threats to our wellbeing only under circumstances of disaster and catastrophe, as Botkin/ Elmandjira/ Malitza have pointed out in their well known study "No Limits to Learning" (1979). It may even be shown that, arguably, the ecological concept of food-chain is a recurring topic from Rachel Carson's time on: It was at the center of the mercury poisoning incident at Minamata Bay, has been repeatedly brought up in affairs involving agriculture and fishery, and has recently reached a new point of culmination in the mad-cow-disaster.

It is an important feature of EL that it seeks to provide an understanding of the environment that goes beyond the incidental. Instead of involvement with catastrophes and the kind of learning these engender – a retrospective, reactive kind – EL aims at a more thorough, more systematic study of the environment, including long-term effects that may not be immediately visible , and at a preventive, precautionary approach.

Actually, the precautionary principle itself provides a good example for a typical EL topic. Since it is central to the political aspects of EL, one fairly recent statement of it (excerpt) might well be worth quoting from in this context:

"The release and use of toxic substances, the exploitation of resources, and physical alterations of the environment have had substantial unintended consequences affecting human

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1 In his essay "Reinhabiting Environmentalism" (*Orion*, summer 1999) Peter Sauer argues for the environmental movement's re-orientation. Instead of focusing upon the myth of wild nature, untouched by humans, environmentalism should promote the rights of people to lead healthy lives in a healthy environment. Some of the data he cites refer to the accumulation of cancer-causing substances in the atmosphere, in water, and in food that are one feature of a global development: "In the years since Rachel Carson (the author of *Silent Spring* which led to a campaign against DDT in the nineteen-sixties, H.S.) died, the use of chemical pesticides has more than doubled (to four pounds per person per year of chemicals for which toxic dosages most often begin at one-hundred-millionth of a pound). One hundred percent of the air in the Lower Forty-eight is now contaminated with eight cancer-causing industrial chemicals at levels that exceed safety standards" (35).

health and the environment. Some of these concerns are high rates of learning deficiencies, asthma, cancer, birth defects and species extinctions, along with global climate change, stratospheric ozone depletion and worldwide contamination with toxic substances and nuclear materials.

We believe existing environmental regulations and other decisions, particularly those based on risk assessment, have failed to protect adequately human health and the environment – the larger system of which humans are but a part..."

Therefore, it is necessary to implement the Precautionary Principle: When an activity raises threats of harm to human health and/ or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context, the proponent of an activity, rather than the public, should bear the burden of proof..." (Wingspread statement on the precautionary principle, Sauer 37).

The applicability of the precautionary principle to the B.S.E. incident should provide a most interesting topic for discussion in a seminar for teacher-students. That discourse, by bringing into view the perspective of human rights, opens the horizon to questions such as: If the current policy of risk-assessment and the discarded policy of the precautionary principle are seen as policy tools – whose interests are served by either tool?

Even closer to the B.S.E. disaster is the "Vancouver Statement on the Globalization and Industrialization of Agriculture". It is the result of the International Forum on Food and Agriculture of June 1998. The conference's participants voiced their concerns in powerful language that is likely to lead to a lively discussion in most teacher-training (both preservice and inservice) seminars that deal with the topic of food policies and human health. To quote the concluding paragraphs:

"We affirm, with the Universal Declaration of Human Rights, that the right to food is sacred. The right to food transcends basic nutrition and hunger and includes the right to produce one's own food. We also affirm that consumers have the right to know where their food comes from, what is in it, and how it was produced.

Furthermore, farmers and consumers have a right to maintain local control over food production, distribution and consumption.

Our bodies, our plants and animals, our air, water, land, and soil, are not commodities and are not patentable. When a food production system violates the rights of citizens and the natural order of the planet's ecosystems, it is essential that we the people make use of our inalienable freedom to correct those abuses."(Sauer)[2]

While this view indeed must be understood in a political way, it is not equivalent to party politics and prescribed or ready-made ideological "solutions" to the situation-at-hand. The human-rights angle must rather be seen as an orientation, a reminder of the direction politics should take. In this general

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2 For further study, see Raffensperger/ Tickner, and visit www.orionsociety.org/reinhabiting.html.

sense, there is a deep connection between the goal of EL and a policy of human rights.

It is worth pointing out in this context that there are no ideological precepts from an EL perspective as to the role of science and technology. While developments such as nuclear technology and genetic engineering may not be beneficial to the human rights issue central to EL – especially when put in the services of profit-seeking agencies – their potential for progress in science and technology remains among the most promising features of human civilization. When developed and used wisely, i.e. in accord with the needs of the community and the unfolding of potentialities of each of the community's members, science, indeed, might provide a model for the progressive development of human interaction and education.

It is an advantage of the classroom setting, in comparison with the retroactive, hectic learning that typically follows environmental disasters, that learning can be organized in a more systematic manner and be approached with a plan in mind. Schools transform learning from the haphazard to the organized, thereby becoming a laboratory for learning as the main instrument to bring about desirable change. With regards to instruction, careful lesson planning is at the core of the effort. While the lesson plan is the teacher's responsibility and the dignity of his or her profession, a good lesson plan will take into account as much of the situation as possible. This amounts to an involvement of the learners themselves in the planning process. Often, it is not enough for the teacher to just think of what might be of interest to her students. It is better to make provisions that give learners the chance for active involvement in the planning process itself. What does that mean in the context of EL?

Such a lesson plan might typically begin with a phase of clarification about the issue at hand: What is it that we have to know and understand in order to cope with the problem at hand or to get closer to a possible resolution of the problem? To look at the actual example of mad-cow-disease, students could first of all do a newspaper and/ or internet survey to gauge all relevant information available and to pool it with the knowledge previously shared among themselves. This should provide a host of materials that needs to be sifted through in order to identify problems and questions of major concern. Such questions could be, e.g., where else is there a risk of infection with B.S.E. other than in eating beef? (Would salmon be affected, since it obviously is fed slaughterhouse refuse, when raised on "farms", and would that be transmittable to the fish and further on in the food-chain to people? Other animals who are given the kind of protein-enriched fodder which is the source of the disease – is it dangerous to eat those, chicken etc.?) The identification of concerns in the form of questions articulated already touches upon and asks for the clarification of concepts such as the ecological one of "food-chain" in this context.

The role of the teacher is to secure and perhaps skillfully introduce that concept along the way.

In the course of studies that follow, questions identified might be pursued through techniques such as interviews with experts, investigations of the information accessible through internet services and sourcebooks, to be discussed and put into some form that possibly provides conclusions and results to a wider audience.

EL, while focusing on specific concerns, thus seeks to develop a wider and deeper understanding of the context. A concern, an issue, a problem – like the tip of an iceberg – more often than not surfaces as part of a larger situation that cannot be understood within the narrow scope of terms inherent to the problem-at-hand. Thus, EL begins with a typical or specific tangible and concrete concern, and remains devoted to the process of resolving the problem, which is part of that concern. But it transcends the immediate problem's scope by looking at the larger picture, seeking to reveal the hidden structures and patterns that have generated the problem in the first place. In the case of B.S.E., pressures for an increase of output in the cattle-business as well as the terms of trade for beef and the regulations for subsidies to cattle-breeders must all be taken into account.

The result of such exercises will not be the resolution of the complex problem – in case of B.S.E. of all of its legal, political, economic, and ethical facets – but an enhanced appreciation of the issue's multifaceted character and an understanding of the problem's background: of economic regulations and rules that have to be taken into account, of cultural and societal implications and conditions, of the kind of social life that has produced the issue-at-hand. In a word, what is learned is the application of intelligence to a situation of little certainty.

The example illustrates that there is a gradual difference, a difference of scope, but no vast difference in kind between society and school. The classroom may be seen as representing society, as a model society or an embryonic society. What takes place in the classroom is a kind of learning which is a systematic, planned, careful, circumspect approach to a problem-at-hand which seeks to uncover the circumstances, the conditions, as it were, the rules that the game is played by. And it is this same kind of learning that aims at increasing the application of intelligence to problematic situations in the general society. The long-range-goal is an influence on the process of promoting civilization through immediate connections between school and community, as well as indirectly by the application in later life of the tools students have acquired during their school years.

The Contributions

The first contribution to the book in hand considers ethical aspects of the relations between people and the environment. Such aspects are, of course, playing a significant role in each of the contributions. But to look at ethics as a special topic in this context opens doors, to an important new perspective: One that puts us in the position to speak of our relations directly, one that is traditionally linked to an ethical discourse encompassing such traditions as the ancient idea of a virtuous life, as well as those of a deontological (tied to principles of a-priori obligations) or of an effectual (utilitarian) ethics. In the light of texts from these traditions, we become aware, as philosopher Lewis Mumford has pointed out, that the seven deadly sins (as defined by Christianity) have been converted into economic virtues in the modern world. Thus, traits once considered wrong, such as pride, envy, sloth, greed, gluttony, avarice, and lust, appear to be supportive of a growing economy and hence, somehow virtuous. How did this strange metamorphosis come about? Can we link this change to consequences in terms of concerns and problems studied? (It should be of interest in a cross-cultural study to compare family structures in Jordan, representative of a clan-like society, with those in Germany, be they nuclear or extended, representative of the broken-up relationships as a typical result of the process of transformation into a modern industrialized society, and to take a look at some of the consequences, in order to compare and to discuss.) A more desirable scenario – would it be connected to a different kind of society? What ends-in-view can be identified as a step in that direction?

Imfadi Abu-Hola, after providing an overview of various issues and facets in the discourse on environmental ethics, turns to the application of ethical principles in the typical setting of a school, and proceeds to demonstrate the connection between ethical considerations and EL on the common ground of practice.

There is a rich tradition of environmental education which offers valuable approaches to EL, especially in the area of experiencing nature. This tradition was developed in the practical context of the work done by associations, which pursue the preservation and conservation of the natural environment. There is a very plausible argument to be made for the transfer and use of activities developed in that context to the context of formal instruction at school. It is this idea that Qasim Alshannag is promoting in his contribution. His text demonstrates through a series of activities the appropriateness of environmental education activities developed and used by the Royal Society for the Conservation of Nature in the Jordanian school system. Of course, this society is just one of a number of associations with similar, if specified, goals whose contribution to instruction deserves to be taken into account by the education establishment. The environmental clubs, established at many Jordanian schools, provide a

sound fundament for the school system's environmental program, with elements to be taken into curriculum, and the possible commitment of individual schools to become environmental model schools.

Field trips appear as an inherent element of EL methodology. Some of the polluted sites have to be seen to understand the destructive aspects of progress; likewise, some of the scenic sites have to be seen, especially by children and young adults who are deprived of proximity to nature, in order to understand the meaning of the word "paradise" and its relation to the beauty of nature: A dream to be shared by most, providing us with a compass when searching for utopia. One might expect, from that viewpoint, that field trips are a common feature of school life and part and parcel of the instruction provided by most schools. However, the brave soul of a teacher who plans for a field trip with her pupils usually has to overcome many obstacles: There is usually some lack of funding, and because parent's support is requested, the field trip has become a feature much more common at schools in wealthy areas than those in poor areas. Moreover, the hurdles set up by administration, the papers that have to be signed, the permissions that have to be granted by various authorities both inside and outside of the school building are not exactly encouraging. Zeid Al-Bashaireh in his contribution deals with some of these difficulties, emphasizing the educational value of outdoor activities and field trips. Indeed, his point of view is re-enforced by other contributors who all have included field trips in their suggested activities or given them a prominent place as central to their approach.

Imad Sa'di shares a sequence of well-organized activities centering on the topic of pollution to promote EL in the primary grades. It is important to remember that the foundation of an understanding of the relationship and the mutual dependency of society and the natural world should be laid as early as possible. Indeed, as even young children are brought in contact with many of the problems and health risks that are caused by a polluted environment, avoiding the topic seems more artificial than dealing with it in the classroom. The good teacher will remember that her job is not only to dispense information and make children become aware of the problematic in a given situation, but that she also has an educational obligation to maintain the integrity and the power of her pupils' spirits, sharing with them her belief in the possibility of finding solutions to the problems that our societies have to deal with.

One of the most pressing environmental problems faced by Jordan is water supply. As the contribution by Feryal Oweis reveals, this is indeed a complex problem with various aspects which seem to all boil down to the requirements of wise management of a scarce resource. In Jordan, two of the problem's features go to show a particularly dark side, over and above the scarcity of water which is a well-known fact to most educated people: the amount of water

lost due to leakage from a system of water pipes in bad repair – up to 50 % – and the concentration of pollution in the Zarqa river and an adjoining lake that was made into one of the world's largest organic water treatment plants. Ms. Oweis' contribution breaks the complex problem down into six aspects and gives relevant information on each one, so that an exhaustive overview of the situation is achieved. Describing a host of activities designed for the intermediate grades, she provides the classroom teacher with a wealth of modules for approaching EL about this most sensitive topic. These activities are designed to stress integration of nonwasteful ways into the pupils' own patterns of behavior. Moreover, they aim at an understanding of the problem as one that, while requiring the best efforts, may be resolved if people are committed to its resolution.

One of the services that this book seeks to provide is the facilitation of access to environmental resources in Jordan and to pertinent websites and handbooks dealing with the toxicity of substances in the environment. The chapter on "Environmental Resources" by Theodora D. Baz provides an overview of political efforts to increase environmental awareness among the general population, an account of the ten major agencies working in Jordan to promote solutions to environmental problems, and an enumeration of six nature reserves. This account characterizes the specific contributions by each agency and the specifics of each nature reserve. Addresses are included, so that the practitioner in the field of teacher education or in the classroom may easily contact these providers of experiences and further ideas for activities to be integrated into learning projects concerned with EL.

Another source that might help teachers find data and information about problems at hand, and also might help students to investigate into given problematic situations, is the collection of sources on toxic substances, accessible mainly via the internet, by Sonja Alberts. Some of the information, even if available to the public and meant to be used by the general population, still is of such a highly technical nature as to be difficult to understand. Perhaps, it is helpful to remember in this context that the resources cited are data-banks, not textbooks: We do not have to study and to learn them as if for an examination, but make use of them as tools that help us understand the problems we have to deal within the situation at hand.

One of the instructional tools to be used effectively with high school and university students is the construction of an ideal city, i.e. a city that represents students' ideas – utopian and realistic – as to a safe and sane urban environment. Hussein Baarah's account of such an exercise illustrates the point that the result is actually an extrapolation of existing technological tendencies, a sort of sum total of the state of the art as accessible to students. Thereby, such a case study helps gauge students' environmental understanding, and facilitates

their cooperation in a combined effort to develop a workable and elegant model for the conviviality of society and nature.

The case of pollution in Zarqa, while put into the chapter of "Case Studies", is a text that deals with an issue similar to the water problematic, and the topic of pollution illustrated earlier. Indeed, in the region of Zarqa there is such a concentration of pollution that the area might well classify to be among the world's most polluted ones. Ahmad Qablan describes the various sources of emission and some of the effects on the health of people who have to live in that region. It is a challenge to the classroom teacher to deal with environmental education in a school located in such an area: What do we have to offer people who are very well aware of the dismal state of their environment, and who suffer from the conditions that are put on them? It appears to be of necessity to share all information available so that a clear view of the situation is achieved, in order to then study influences and the decision making processes that led to the state of affairs, before one can begin to seek for possible solutions. It is along these lines that Ahmad Qablan offers suggestions for a project, studying air pollution as one aspect of environmental concerns in Zarqua.

With regards to the closing contribution on an Islamic perspective, it is important to remember that Jordan is an Arabic country with both Islamic and Christian components. To the European eye, the Arabic culture sometimes appears to be so deeply imbued with the Muslim faith that the Christian element is easily overlooked, even though it is older than the Muslim element, with roots reaching into the pre-Islamic era, and, moreover, that this Christian element is as Arabic as the rest of the society. This is to say, Muslims and Christians together share the same culture and try to cope with the same problems in their common environment. As for a comment and a brief exposition of the foundation of a Christian environmental movement in Jordan, Lytton John Musselman has provided an interesting account in the Royal Society for the Conservation of Nature's magazine "Al Reem" (No. 65, Autumn 1999, 8/9). In it, he points to some of the biblical references of God the Creator delighting in His creation, and to Jesus's love of nature. With regards to both the Islamic and the Christian perspectives on Environmental Literacy, may it suffice to say that there is no contradiction between them when it comes to the protection of environmental sources sustaining human life: Both foundations are firm enough to provide the effort for the understanding and safeguarding efforts that we call "Environmental Literacy" with a secure foothold in the spiritual realm.

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ETHICS

Imfadi Abu-Hola/ Mohammed Subbarini

Ethics and Environmental Literacy

It is important to develop the ability to "read" the environment. No one would argue that having a healthy environment is not a human right. The question remains, however, how do we create a safe, healthy environment for our and future generations? One of the major considerations in achieving this goal is a matter of ethics. How do ethics contribute to this goal?

What is Environmental Ethics?

Ethics is a branch of philosophy that primarily discusses issues dealing with human behavior and character. Ethics attempts to establish a basis for judging right from wrong and good from bad. Environmental ethics employs concepts from the entire field of philosophy with regards to aesthetics, metaphysics, epistemology, philosophy of science, and social and political philosophy (Gale Group).

Which role do these disciplines play in the promotion of EL and the protection of the environment? Each one of these fields deals with an important aspect of the environment as a whole. Aesthetics deals with perceptions of properties such as color, sound, smell, texture and taste. Who remembers what color, sound, smell, texture and taste our wild environment has had? Our grandparents' memories reveal the sad truth about the state of our environment.

Thirty to forty years ago, many more kinds of birds and animals existed. Wildflowers with bright colors and fragrances were scattered all over and many plant species could be found. But, sadly many of these have disappeared. Human actions must be held accountable. How can environmental ethics help to – at a minimum – slow down the speed of species decimation, if not halt it altogether?

Since environmental ethics is often involved with the protection of plants and animals, it appeals to aesthetic experiences of nature. Environmental ethics is also interconnected with political and social structures concerning the use of natural resources, so the field also touches the areas of social and political philosophy (Gale Group). Is it fair and just to use up all available natural resources and to disturb the balance of the environment in order to fulfill the growing needs of modern society? What will modern society leave behind for coming generations? If we continue to use up our natural resources and con-

tinue to pollute soil, water and air, then nothing will be left for our children but fear and tears for their difficult future. In the struggle to conserve the environment, environmental ethicists use the knowledge and theories of science in order to deal with issues such as global warming, desertification and air pollution.

Issues of the Environmental Ethics Discourse

Individual and Community Rights

Just as philosophers try to answer questions about life and reality, environmental ethicists attempt to answer the question of how human beings should relate to their environment, how to use the earth's resources, and how to treat other species, be they plant or animal. But is using the earth's resources possible without conflicts? The answer, shockingly, is negative. Some of the conflicts that arise from environmental policies deal with the rights of individuals versus those of the country or the world, and the rights of the private property owners versus those of a community. It is necessary to comment on this issue. Is it acceptable for individuals to satisfy their needs without consideration of the needs of others? Is it right to put your own needs first? It would seem to be fair and just that equal rights should be granted to others.

Protecting the Wild

Methods of dealing with environmental issues vary among the organizations that are devoted to the protection of the environment. An important milestone toward an international environmental movement was probably an event that first took place on many college campuses across the United States of America on April 22,1970. This was called Earth Day, and it used protest and demonstration as a way of raising awareness about environmental issues (Gale Group). Earth Day has since become an annual event across the world. Although there are many clubs and organizations that deal with environmental problems, more and more people seem to be contributing actively to the opposite. Environmental concerns are not universally supported. The conflicts between those who want to protect the natural environment, and those for whom this is of lesser concern, often center around economic issues. For example, environmentalists in the Pacific Northwest want to protect the habitat of the rare spotted owl, which inhabits old-growth forests. But the livelihood of the timber industry and families of loggers depends on these forests. In England, there was a strong movement to stop the addition of a new terminal to Heathrow airport as it would have necessitate the destruction of a large portion of the forest surrounding the airport. In Jordan, construction of new highways and buildings will destroy the forests, as well. There is much contro-

versy over who has the "right" to use this forest or that wild area. Those economically affected by the protection of the old growth forests in the American Northwest claim that spotted owls have become more "important" than the needs of people. Environmentalists, however, believe that both are important and have legitimate needs.

Environmental Ethics and the Law

Environmental issues are strongly tied to the laws of different countries, especially in the USA and Europe. There, lawsuits have been brought before the courts against developmental activities that threatened the environment. One of law's major functions is to review the environmental impact of highway projects, large-scale commercial and residential construction, power plants and other large undertakings involving different governmental agencies (Gale Group). For example, there are numerous accounts of lawsuits against tobacco companies because of tobacco's negative health effects. The plaintiffs believe that their lawsuits are of great value for the protection of the environment, particularly when a project is a potential threat to human health or to the natural environment.

Lawyers who deal with environmental issues are key players in the discussion of environmental ethics. They may bring court action against companies that, for example, leak toxic substances into the groundwater or emit harmful smoke from factories. Here, an attempt is made at measuring the amount of potential harm to humans. How much environmental damage is acceptable, and how much is not?

Environmental Discourse and Sustainable Development

One of the major shortcomings of mainstream development theories and models is their relative indifference toward environmental concerns. However, the increasing number of environmental catastrophes and the growing environmental consciousness led to the emergence of a new model of development known as "sustainable development."

The proponents of sustainable development tend to explore the environmental costs of developmental activities, prescribe environment-friendly policies, suggest institutional and legal measures for environmental protection, and publicize the principles of sustainability through international forums and publications. Despite this recognition, the model of sustainable development suffers from certain shortcomings that need to be addressed.

From the Brundtland Commission in 1983 to the United Nations conference on Environment and Development in 1992 and beyond, sustainable development has been one of the core issues facing environmental ethicists and policymakers. Their challenge has been to ascertain the proper formulation

and implementation of sustainable development practices either within the present global market economy or within a new more ecological paradigm.

Feminism and Environmental Ethics

Feminist literature has long claimed that women speak with a different voice. The literature argues that it is both possible and desirable to view ethics from a female point of view, and that the female point of view serves for a better understanding of the world than the male-dominated view, which traditionally has led to exploitation. The claim that women have a particular perspective on the relationship between humanity and nature and have a moral/political calling to reweave the world to heal the wounds of an ecologically destructive social order is central to ecofeminist politics. The claim that women per se have superior vision or a higher moral authority in these matters may or may not be appropriate. Yet an ethical viewpoint that does not take into account the gender-driven nature of society or its socio-economic structure, or the way in which that structure affects the relationship between humanity and nature, is certainly doomed to failure.

Environmental Antinomianism

In rejecting the ethical authority of social institutions that define and impose norms of belief and behavior, radical environmentalism has many parallels with antinomian protests of the past. It is characterized by a "hermeneutics of suspicion" directed towards the establishment and extending to all its attempts to "lay down the law." Nomothetic models, which represent environmentalists as either seeking to extend current legal/bureaucratic frameworks to "nature", or drawing moral conclusions from "natural laws", are ignoring radical environmentalism's antinomian ethos.

Environmental Ethics: A Common Background

Environmental ethics is a subject of applied ethics and examines the moral basis of environmental responsibility. In these environmentally conscious times, virtually everyone agrees that we need to be environmentally responsible. If we do not become responsible persons, our environment might be lost to us, and then we will face real tragedy. Toxic wastes are contaminating groundwater in the aquifers, oil spills are destroying shorelines killing sea life, fossil fuels are producing carbon dioxide, thereby adding to the greenhouse effect, and chlorofluorocarbon (CFC) gases are depleting the earth's protective ozone layer, thereby causing ultraviolet rays to reach the earth surface, which produce health problems. The goal of environmental ethics is not to convince us that we should be concerned about the environment – most of us already

are – but to focus on the moral foundation of environmental responsibility, and to investigate how far this responsibility extends.

There are three distinct approaches of moral responsibility to the environment. Although each supports environmental responsibility, their lines of departure are radically different. The first of these theories is anthropocentric, or human-centered. Environmental anthropocentrism is the view that all environmental responsibility derives from human interests alone. The assumption is that only human beings are morally significant persons and have a moral responsibility. Since the environment is crucial to human wellbeing and human survival, we have an indirect duty towards the environment. This involves the duty to assure that the earth remains environmentally hospitable for supporting human life, and that its beauty and resources are preserved so human life on earth continues to be pleasant. Is the pleasant life of another species of benefit for humans or not? Some have argued that our indirect environmental duties derive both from immediate benefit to current as well as to future generations. Critics maintain that since future generations do not yet exist, they cannot have any more rights than a dead person. This issue is comparable to the issue of the mother's "right" to an abortion. One is aware of the bearing of this upon one's own life: Where were we a hundred years ago? Nevertheless, both parties to this dispute acknowledge that environmental concerns derive solely from human interests.

The second approach to environmental responsibility is an extension of animal rights. If at least some animals qualify as morally significant, then our responsibility toward the environment also hinges on the environmental interests of these animals. Environmental responsibility is based on the interests of morally significant persons, including humans and higher animals. It is indirectly inherent in both the anthropocentric and the pathocentric (centered on the ability to experience pain, from which derived an interest to avoid pain) approaches.

The third approach to environmental responsibility is called ecocentrism and is the most radical among the three. This approach maintains that environmental responsibility should be a product of moral considerations rather than based on human and animal interests. This argument implies that the environment has rights, must be elevated to "personhood", and that it has inherent value. According to this approach, one may develop a proper ecological conscience that mirrors the interdependence of a food pyramid. From bottom to top, the basic layers of the pyramid are those of soil, plants, insects, insect-eating animals, omnivores, and carnivores. Where can we find humans in this pyramid? Humans are near and close to the top among the omnivores. In this pyramid there is a continuous and upward flow of energy starting from sun-

sunlight and soil. Any obstructions to the flow of energy in any one level will damage the chain.

A combination of the three approaches, the anthropocentric, the pathocentric, and the holistic or ecocentric, is possible only in practice. Surely the technology that produces weapons that can destroy all forms of life on this planet within a very short period of time, can easily find equally powerful procedures that help maintain a healthy and productive environment for all humans on this earth. Why does that not happen? Because political and economic structures are preventing an all-out-effort at development in this direction.

Environmental Ethics and Learning

One of the major goals of environmental education programs is to produce environmentally responsible students who are motivated to take environmental actions. Research studies suggest that attitudes and behaviors of individuals are frequently modeled after the attitudes and behaviors of others. Since most youth spent six to seven hours a day in school, a coordinated school environmental program that focuses on preventing and solving environmental problems at the school site can provide an excellent model of attitude and behavior for young people to emulate. Elements that should be included in the program include:

- A set of policies;
- procedures for identification of problems;
- action plans to prevent and alleviate problems;
- plans for monitoring habit patterns.

Developing and operating a school environmental plan can be an important part of a school curriculum. Many environmental concerns may be included in a school environmental program. Examples for a school environmental program are suggested. Does your school have environmental policies and a program regarding any of the following?

Purchase of Materials

An important aspect of any school environmental program is a purchasing policy. A purchasing policy provides guidelines for materials to be used in the school. An effective policy statement provides guidelines to reduce or eliminate the purchase of materials that are not safe or environmentally sound and also provides guidelines regarding amounts of materials to be purchased to reduce waste. The cafeteria, school and ground maintenance, science programs, art programs, general school supplies, and remodeling projects are areas that should be the focus of initial policies.

Study and discussion regarding what materials should and should not be used in a school provide excellent environmental education experiences.

These activities will provide both a good school environment and practice for students to model at home and in their consumer roles.

Wise Use of Materials In and Around the School

Students and staff should be involved in discussing and establishing guidelines for purchasing alternative materials, and the storage, use, and disposal of materials. Students should also be involved in monitoring activities to determine how effective the policies are and whether changes in policies are needed.

Some materials containing chemicals are hazardous and should not be used in schools or should be stored and used under carefully specified conditions. Science, art, and technology programs are curricular areas usually affected most by guidelines; materials used in these classes may be corrosive, flammable, or possibly carcinogenic and can present hazards to the students and the environment.

Buildings and ground maintenance materials may also present problems. Materials used for cleaning buildings, exterminating insects in building, such as pesticides on playgrounds and playing fields, are among problems frequently identified in school environmental studies.

Identification, Monitoring and Correction of Environmental Problems

A school environmental program should include identification and monitoring processes concerning environmental issues in the school. Since many of these issues may also exist in homes and the workplace, student involvement in the school program can develop knowledge, skills, and attitudes that are easily transferred to out-of-school settings.

A few of the more common problems found in schools are discussed as possible priorities.

Drinking Water

Drinking water in school can present several types of problems. The extent of lead contamination in some drinking water is considerable. Since children are particularly susceptible to the toxic effects of lead, schools should monitor drinking water periodically to identify possible problems. Lead-content may stem from the original water, lead solder used in plumbing, corroded plumbing, and lead-containing equipment such as water coolers. Student activities can be used to detect lead in water. Professional assistance should be consulted if any levels are identified because many of the simpler tests may vary in accuracy.

Small schools in rural sites often obtain drinking water from wells and cisterns. Such water may become contaminated and cause health problems.

Schools using well water need to be certain they are complying with state drinking water regulations.

Asbestos

From the 1940s to the 1970s, materials containing asbestos were used in many schools. While professionals should assess potential asbestos problems in schools, a school environmental program involving students can investigate the asbestos problem. Materials to test include sources of asbestos in floor tile, ceiling tile, roofing materials, pipe insulation, and fireproofing; effects of asbestos on health; asbestos removal problems; and controversy regarding the impact of the different types of asbestos on humans. Recommendations for school guidelines can be developed as a result of student investigations and deliberations.

"Sick" Buildings

Newspapers and magazines frequently have articles on "sick buildings", i.e. buildings that have generated unhealthy environments due to substances in the air. Schools in some cases may become "sick buildings" due to problems associated with heating and cooling systems and materials used in constructing and furnishing buildings. A school's environmental program should identify and monitor the most common problems associated with construction, equipment and furnishing used in the building.

Paints and Chemicals Used in Classrooms

Paints frequently contain metals that may be harmful to children. While few buildings will contain lead-based paint, buildings may have paint containing mercury, chromium or cadmium. Paints should be checked to determine if there are potential problems.

Classrooms may be furnished with materials containing hazardous chemicals. Some chemicals are very harmful; others could cause bad or even fatal effects.

Disposal of Wastes

A school environmental program should have waste disposal policies that consider conservation, waste reduction and pollution control. A school can provide an excellent model for families by developing procedures to reduce wastes and to recycle or compost as many materials as possible. Common materials used in schools that can be recycled include paper products, glass, plastic materials, and aluminum and mixed metallic cans. Materials that can be composted include yard wastes and food wastes from cafeterias.

Policies should also be established for the disposal of materials that can not be composted or recycled. Chemicals, paints, solvents, oil, batteries, and other items containing hazardous materials should be removed by approved meth-

ods. If a community does not have a program for handling hazardous wastes, a good school activity is to work with community officials to establish such a program.

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ACTIVITIES

Qasim AlShannag

Let's Go Outside and Learn*

Human health, well-being, and survival are ultimately dependent on the integrity of earth (Donatelle and Davis). Today the natural world is under attack from the pressures of people who live in it, and from the wide range of their activities. Unfortunately, our planet faces many serious environmental problems, such as ozone layer depletion, global warming, solid waste crisis, hazardous waste, noise pollution, water pollution, air pollution, population growth, world poverty, deforestation and the decline of biodiversity (Bernard and Richard; Donatelle and Davis; Subbarini).

The meaning of Environmental Literacy (EL) is to improve people's critical understanding of environmental problems. It aims at building capacities for dealing with problems related to health and well-being in an environmental context.

This chapter contributes to the improvement of EL among students of different grade levels. In order to achieve this goal, I asked a school teacher, Ms. Hally, to support me with some outdoor activities that promote environmental awareness among students. Ms. Hally also added a number of classroom activities. All these activities (indoor and outdoor) are intended to help students widen the horizons of their experiences within the environment, in order to help them understand their environment more thoroughly. Through their first-hand experiences with nature, students will be in a position to take better care of it and to work for its protection.

Subbarini pointed out that the environmental crisis is in fact a crisis of education. This crisis may be determined in two areas:

- Global environmental problems considered as breaches of ecological rules that organize and protect the natural balance;
- Environmental problems made apparent through the interaction between population, technology, and resources.

*Acknowledgements

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Public Concerns vs. the EPA's Top 11 Risks	
Top 11 Risks according to the EPA (random order)	*Concerns of the Public (ranked order)*
Ecological Risks	1. Active hazardous waste sites
	2. Abandoned hazardous waste sites
Global climate change	3. Water pollution from industrial wastes
Stratospheric ozone depletion	
Habitat alteration	4. Occupational exposure to toxic chemicals
Species extinction and biodiversity loss	
	5. Oil spills
Health Risks	6. Destruction of the ozone layer
	7. Nuclear power plant accidents
Criteria air pollutants (e.g., smog)	8. Industrial accidents releasing pollutants
Toxic air pollutants (e.g., benzene)	
Radon	9. Radiation from radioactive wastes
Indoor air pollution	10. Air pollution from factories
Drinking water contamination	11. Leaking underground storage tanks
Occupational exposure to chemicals	12. Coastal water contamination
Application of pesticides	13. Solid waste and litter
Stratospheric ozone depletion	14. Pesticide risks to farm workers
	15. Water pollution from agricultural runoff
	16. Water pollution from sewage plants
	17. Air pollution from vehicles
	18. Pesticide residues in foods
	19. Greenhouse effect
	20. Drinking water contamination
	21. Destruction of wetlands
	22. Acid rain
	23. Water pollution from city runoff
	24. Nonhazardous waste sites
	25. Biotechnology
	26. Indoor air pollution
	27. Radiation from X-rays
	28. Radon in homes

(Roberts)

According to Subbarini, these environmental problems can be resolved through environmental education. Thus, EL is an outcome of environmental education. EL can be built among students if they are provided appropriate opportunities to learn about the environment.

EL is a Multifaceted Educational Enterprise

With this in mind, environmental education aims to:

- provide opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
- encourage people to examine and interpret the environment from a variety of different perspectives – physics, geography, biology and ecology, aesthetics, ethics, and the spiritual;
- interest people in the environment and encourage their active participation in the resolution of environmental problems.

Viewed from another angle, through environmental education students will gain:

- a greater appreciation and enjoyment of the environment;
- a keener awareness of and sensitivity to their surroundings;
- a better understanding of the physical, biological, and social components of the environment and of their interaction to produce the state of the environment;
- a more thorough understanding of human dependency on the environment and of the importance of a wise use of its resources;
- an acquisition of skills to investigate environmental issues as well as to recognize actual or potential environmental problems and possibly contribute to their solution;
- a deeper concern for the quality of local and distant environments and for the quality of the lives of people living there;
- an acquisition of skills to evaluate options and to make choices between alternative ways of using the environment;
- a greater willingness to become personally involved in protecting the environment and resolving its problems.

In the process of learning, students will gain knowledge about their environment in such areas as

- the natural processes, which are part of the environment;
- the impact of human activities on the environment;
- the variety of environments, their past and present states and how these relate to each other;
- some of the key global and local environmental issues [in accord with the motto: think globally and act locally];
- the conflicts and controversies that arise around environmental issues;
- some of the local, national, and international legislative controls to protect and manage the environment;
- some of the local, national, and international policies and decision-making processes related to environmental concerns.

By engaging in outdoor environmental activities, students will inquire into some important concepts such as

- humans are physical beings (like animals) and depend on the environment for their well-being;
- working alongside nature (instead of against nature) can be beneficial to both people and the environment;
- everything affects everything else;
- resources must be used efficiently and for the benefit of all people;
- there are limits to the productivity of ecosystems;
- poverty and affluence can contribute to environmental degradation;
- development and conservation are inseparable if both are to be successful in the long run;
- global environmental issues are manmade and linked to other manmade issues, including world poverty, population growth, and the establishment of peaceful relationships;
- the environment can exist without humans, but humans can not manage without the environment.

Finally, through their environmental activities, it is hoped that students will gain values, beliefs and attitudes such as:

- an appreciation of and care and concern for the environment and for other living things;
- a habit for careful and independent thinking;
- some respect for the beliefs and opinions of others;
- some respect for rational argument and well-founded conclusions;
- an attitude of tolerance, openmindedness, and a willingness to consider compromise;
- an inclination to set a good example and to be involved in the solution of problems.

Ms. Hally offered many activities to help her students extend their experiences in the environment, thereby widening their horizons. By giving them the chance to know and understand their environment more closely, she motivated her students to take care of their environment and to raise their environmental awareness. She organized many experiences for her students to be followed in natural and rural settings, which include:

- the study of living things in their natural environment;
- adventure, recreation, and enjoyment;
- use of all senses - hearing, sight, smell, touch and taste;
- comparison of peace and quiet, noise and bustle;
- nature conservation activities;
- observations of the night environment and the night sky;
- exploration of emotional responses to different environments;

- encounters with nature to provoke a sense of wonder.

For the purposed of this chapter, I asked Ms. Holly to focus her teaching on activities that take place in Jordan's nature preservation areas.

Nature Reserves Provide Appropriate Starting Points for Environmental Studies

Awareness of the importance of the conservation effort that has led to the establishment of Jordan's nature reserves provides an appropriate key and a good starting point for environmental studies. This awareness has to be developed first in teachers and secondly in students in order to:

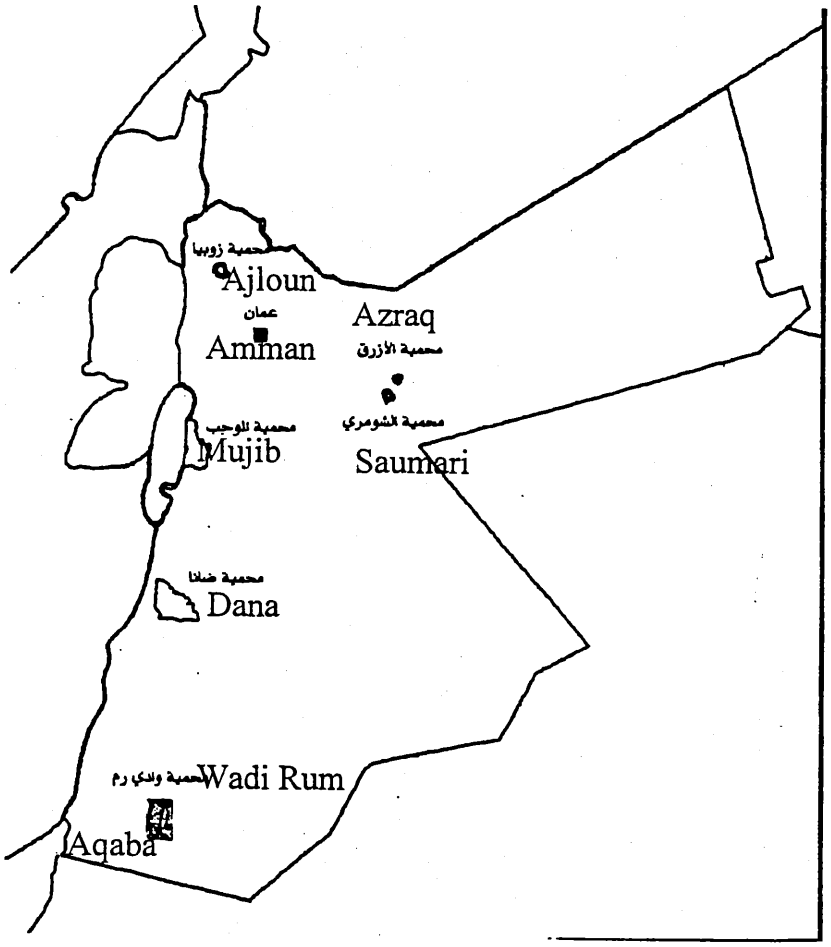
- improve and increase the teacher's knowledge of the environment and to make her familiar with some details about the reserves, their flora and fauna;
- provide both teachers and students with opportunities for greater appreciation and an enjoyment of the natural environment and its features;
- develop an understanding of the physical, biological, and social components and their interactions to produce the given environment;
- gain a better understanding of how humans depend on the environment and of the importance to use resources wisely;
- provide teachers with the skills necessary to investigate the environment and environmental issues as well as to recognize and solve actual or potential environmental problems;
- develop a deeper concern for the quality of local and distant environments and for the people living there;
- develop a greater willingness to become personally involved in protecting the environment and participate in the solution of its problems.

It is important to learn through activities instead of lectures: some of the activities help students learn about their environment, others encourage learning in the environment. All activities involve learning for the environment. Activities may be classified into four categories:

- Environmental awareness
- Environmental issues
- Environmental principles
- Environmental knowledge.

1. Mujib Nature Reserve
2. Wadi Rum Nature Reserve
3. DANA Nature Reserve
4. Shaumari Nature Reserve
5. Aljouni Nature Reserve
6. Azraq Wetland Reserve
7. The Guld of Aqaba

Map of Conservative Reserves in Jordan



The Mujib Nature Reserve

This is the nature reserve located in the world's lowest spot near the east cost of the Dead Sea, about 400 meters below sea level, with mountain ranges reaching 900 meters above sea level in some places. This 1,300-meter variation in elevation, combined with the valley's year round water flow from seven tributaries, provides a habitat for over 300 species of plants.

Sandstone cliffs are an ideal habitat for one of the most magnificent mountain goats in the world, the horned ibex. RSCN established a captive-breeding program for them. It is also the home of carnivorous species, such

as the caracal, a medium- sized cat distinguished by its black and white ear tufts. Some of the remote mountain and valley areas are difficult to reach for humans and thus offer safe havens for rare species of cats, goats and other mountain animals. A hike through the Wadi system may prove to be a challenge to the body and the mind. The reserve offers two main hiking trails, the circular and the lower trails.

Wadi Rum Nature Reserve

Famously described by T. E. Lawrence as "vast echoing and God-like," and acclaimed by many as one of the most stunning desertscapes in the world, Wadi Rum is a nature lover's paradise.

Serious mountaineers relish its challenging climbs on sandstone and granite cliffs 1,750 meter high. Some prefer a camel ride or a night under the stars in the Bedouin tent. Over 2,000 species of wildflowers may be observed in spring. There are plants both rare and endemic to its ecosystem. Gray wolf, Bland Ford fox, the sand cat and the ibex exist within the area. In addition, it is an ideal area for birdwatching with 110 recorded species.

Dana Nature Reserve

This reserve covers 308 square kilometers (km^2), composed of a chain of valleys and mountains, which extends from the top of the Jordan Rift Valley down to the desert lowlands of Wadi Araba. Reserve facilities include a nature shop, visitor's center and guest house by the tower entrance at Dana Village. It contains 20 large tents, bathrooms and barbecue grills for visitor use. It can accommodate 60 persons per day and 75 persons for a daily visit. There are many facilities for camping. The reserve contains a variety of rare species of plants and animals. Dana is home to 600 species of plants, 37 species of mammals and 190 species of birds.

Shumari Nature Reserve

Shumari was created in 1975 by the Royal Society for the Conservation of Nature (RSCN) as a breeding center for endangered or locally extinct wildlife. It covers an area of 22 km^2, which is the habitat of animals like the oryx, ostrich, gazelle, and onager. The visitor's center contains a small museum with interactive materials, slide shows, and videos on the history and wildlife of the reserve. A playground and picnic area are located outside. There is an observation tower. Activities are centered around the oryx as it is the highlight of this reserve.

Ajloun Nature Reserve

Located in the Ajloun highlands (north of Amman), this reserve is dominated by open woodlands of live oak, pistachio, pine, carob, and wild strawberry trees. Established in 1988, it covers 13 km². It offers two hiking trails and a special place for camping. Roe deer are adapted to this forest habitat. There are various ancient ruins and archaeological digs scattered in the woodlands.

Azraq Wetland Reserve

This unique wetland oasis is located in the heart of the semi-arid Jordanian eastern desert. Its attractions include several natural pools and ancient reservoirs, a seasonally flooded marshland, and a large mudflat know as Qa'a. A wide variety of birds stop at the reserve each year. Azraq offers a seasonal habitat for a large number of wildlife species. It is an ideal place to learn birdwatching, including the Temmink's horned lark, desert lark, hoopoe lark, desert wheatear and trumpeter finch, cranes, imperial eagles, thick-billed lark, red-rumped wheatears, and others.

The Gulf of Aqaba

Touching the Red Sea are a series of mountains and desert areas. The gulf waters house 120 species of hard corals, 110 species of soft corals, and over 1,000 species of fish. Scuba-diving and snorkeling are typical activities.

Admonitions for Teachers Visiting Reserves With Students

- Keep noise levels down as noise can disturb native birds, mammals and reptiles!
- Keep to proper footpaths, do not feed wildlife, pick flowers, or trample down shrubs!
- Don't soil trees and historic monuments with graffiti!
- Keep water sources clean!
- Fire-making is strictly prohibited in all reserves, except in designated barbecue areas!
- Don't approach, threaten, or feed wild animals!

Good Advice for Nature Trips

- Avoid hiking alone or in the dark!
- Always stay on the trail and watch your footing on rocky or steep slopes!
- During heavy rainfall, avoid low-lying areas such as canyon floors that are susceptible to sudden flash floods!
- Bring your own water, hat, comfortable hiking shoes, camera, binoculars, and wildlife guides!

- For camping trips, take a sleeping bag or blankets, food, blastic bag for garbage, a flashlight, a compass, matches, and waterproof clothing and a first aid kit!

By minimizing your impact on wildlife, you will help and preserve the sanctity of Jordan's nature for future generations to enjoy!

Some of the purposes of visiting the reserves for teachers and students are:

- to improve their knowledge of the reserves and to gain new information;
- to apply different activites in the nature reserves concerning wildlife and nature. Some of these learning activites are described in detail on the following pages.

There are a number of ways available for the teacher to set the tone in order to begin the activities:

- Meeting in the classroom and discussing the importance of preserving plants and wildlife;
- having students construct models after providing them with data about reserves;
- playing different roles of living things in the reserves;
- watching video clips and slides from the reserves;
- and finally, visiting the reserves by bus.

Activity A: Guess Who I Am

The aim of this activity is to help students acquire some knowledge about the wildbirds in Jordan and to provide them with a skill to recognize them in accord with their appearance.

Basic principles of environmental awareness covered by this activity:

- Better appreciation, more interest, and deeper awareness of the environment and wild species.
- participation in protection activities and attempts at finding solutions for the problems facing wildlife.

Materials Used

Cards for competition, resource-books about birds.

Procedure

The teacher asks the students to listen carefully, telling them that she will read information describing a bird that exists in Jordan. After this information, they should be able to identify the bird. But he who thinks he knows must not say it aloud, but instead hold his nose. To help the students, the teacher reads all the keys to the solution of the question one by one, with the last one being the easiest.

The Roles of the Teacher in this Activity:

- Provider of some information about birds in Jordan, and provider of journals such as "Al Reem", which give more environmental information, and of some books about birds;
- demonstrator, showing posters and pictures about birds;
- animator for activities about birds from the visitor's center. The teacher may explore these before using the cards described below.

The Roles of the Students:

- Discoverers, trying to discover the name of the bird in question;
- interactors, discussing their experiences among themselves to see if some of them have watched the bird and can provide more information about it.

Additional Activities:

- Ask the students to prepare more quizzes about different kinds of birds, using different resources, and checking in books to be sure of their information. Have students make similar activities for themselves;
- have them provide a variety of riddles about mammals and plants.

Guess who I am?
I live in wood, field, and garden.
My wings are wide and of black, brown and white color.
I feed on big worms and invertebrates that live in the soil.
My habitat is in Jordan throughout all months of the year, but my numbers increase in winter because some of my kind immigrate to Jordan from Europe.
My voice rings with sadness and is formed of two syllables.
My color is brown-lined.
I have a long curved beak.
I have a crest on my head.
I live in a sand tunnel or in a hollow trunk.

The answer : hoopoe

Activity B: Like and Dislike

This activity will help the students make decisions about the environment they wish to live in and their role in producing it. By the end of the activity, the students will have identified the aspects of their environment (natural or manmade) they like and dislike. Aspects of environmental education covered:

- Greater awareness of and sensitivity to the surroundings;
- development of skills to evaluate environmental options and to make choices between alternative ways of using the environment.

Equipment Needed:
Copies of a worksheet or a blank sheet of paper (one for each student), pencils, coloring pens, access to an outside area that the students know well.

Environmental and safety concerns that have to be considered: warn students not to touch any litter. Items such as broken glass and rusty metal can be dangerous.

Before the activity, talk with students about the components of the environment, emphasizing the difference between the natural and the manmade. Ask them if they have a favorite place and encourage them to explain why they like it.

At the beginning of the activity, issue to each of the students a copy of the worksheet, or let them draw their own, outlining the boundaries of the area to investigate. Allow them to explore an area they know well and then to draw three things they like about it and three things they dislike, or think could be improved, unto the sheet.

Bring the students together at the end of the session to discuss the things they have drawn. Be sure to finish the session on a positive note, by talking about what the students can do to improve things.

The students should leave the session feeling empowered to take charge of the environment around their home.

The Roles of the Teacher in this Activity:
- Moderator, discussing with the students what they like around them and what they dislike and for what reasons;
- guide, taking the students to an outdoor area;
- provider, preparing the equipment needed;
- tasksetter, asking students to identify everything they like or dislike and to draw their findings on paper.

The Roles of the Students:
- Participators in the discussion, to indicate their personal likes and dislikes and to give reasons;
- observers, concentrating on everything around them;
- designers, registering and representing what they like by drawings.

Activity C: Sound Recordings
This activity will make students become better aware of the sounds around them. By the end of the activity, the students will have listened to and recorded the sounds around them. Aspects of environmental education covered:
- Greater appreciation and enjoyment of the environment;
- better awareness of and sensitivity to the surroundings;
- understanding of the impact of human activity (noise) on the environment.

Equipment Needed:

Paper and pencils; access to an outside area where the students can sit quietly.

Before the activity, explain to the group that this is a chance for them to spend a few minutes close to nature, soaking up the sounds around them.

Show them how to record the sounds they hear by drawing them. Use a few sounds as examples. Explain that they must draw what they think the sounds would look like, if they were a picture.

At the beginning of the acitivity, ask students to find a quiet place on the school grounds (or within an area you indicate) where they can sit undisturbed. Tell them to sit quietly for a few minutes with their eyes closed and then, when they feel calm and relaxed, to open them again. Ask them to record five minutes of noises using pictures. Arrange a signal, e.g. a bell, drum or whistle, to call them back when five minutes are up.

At the conclusion, ask students to share their recordings and the sounds they heard. Talk about the natural sounds they heard and the manmade ones. Find out which sounds were dominant.

For a follow-up activity, the pictures they have made could be used to compose a piece of music, following the same rhythm or pattern as the sounds they recorded.

The Roles of the Teacher in this Activity:

- Provider of opportunities for students to hear different sounds in a suitable out-of-doors area;
- provider, preparing the equipment needed;
- listener, who herself has an ear for sounds without giving continuous instruction;
- sound-engineer, in case of difficulties going outdoors due to limited time, having the students close their eyes and listen carefully to prerecorded noises.

The Roles of the Students:

- Careful listeners;
- Recorders, who register and draw what they are hearing;
- signalers, who give a sign without any noise when they recognize a sound.

Activity D: Ethical Questions

This activity challenges students to think about their role in protecting the environment and provides an opportunity for them to develop their own values.

By the end of the activity, the students will have discussed environmental conflicts they face in daily life. This will help empower them to make decisions in real life. Aspects of environmental education covered:

- greater willingness to became personally involved in protection of the environment and helpin to resolve its problems;
- sensitivity to the conflicts that arise around environmental issues.

Equipment needed:

Photocopied cards (one set for each group) or, as appropriate, questions written on the board.

Before the activity, explain that the situations are fictional but are ones that the students could find themselves in. Explain that they must consider the impact on the environment versus the inconvenience to them. Tell the group that there are no right or wrong answers and encourage them to think what they can do, as well as what they think they should do. You may prefer to make up your own questions, discussing issues that are important in your school or community.

At the beginning, ask students to work in-groups of three to six students each. One member of each group picks a card, another reads aloud the questions for the group to discuss.

Make sure the session ends on a positive note. The students should realized that they have an important role to play in protecting their environment and that their contribution really can make a difference.

An alternative way to use these questions is as five-minute activities at the end of the lesson or between other activites.

The Roles of the Teacher in this Activity:

- Indicator, she should be aware of environmental problems and issues;
- provider of needed equipment;
- organizer, dividing the students into groups and making arrangements to lead the discussion;
- facilitator, who will not force her opinion on the students, instead giving them a chance to express their own.

The Roles of the Students:

- preparers, who should read beforehand about the environment's problems;
- participators in discussion, who are as active as they can without getting noisy;
- fairminded contributors, who take turns in the discussion, sharing viewpoints and asking questions of each other.

Activity E: Camouflage Caterpillars

This activity allows students to discover camouflage and help them understand its importance in nature. It also introduces the concepts of warning color and mimicry. Aspects of environmental education covered:

Knowledge of natural processes, which take place in the environment; examination and interpretation of the natural environment.

Equipment Needed:
"Caterpillars" made from plaited string and a variety of colored wool. You need at least one caterpillar for each child.

Environmental and safety considerations lead to the conclusion that the teacher must insist that the children find and remove all the caterpillars – however long it takes! Leaving any behind is like littering and sets a bad example to the children.

Before the activity, hide the caterpillars in natural places, for example in a tree, in a clump of bushes or around a flowerbed. Be sure to count the caterpillars before you hide them! Hide a mixture of colors – some that are camouflaged and some that are not.

At the beginning of the activity, ask the children to imagine that they are a hungry bird. Tell them that there are caterpillars hiding all around and it is their job to find them and bring them back to their nest (you). Set a rule that they can only carry one caterpillar in their beak at a time.

As the children find the caterpillars, place them in a row in a "nest". This will help them notice that they found the brightly colored, uncamouflaged caterpillars first. Keep going until all the caterpillars have been found.

To conclude, discuss with the group which caterpillars were easiest to find. Which would be the safest camouflage if you lived on a rock, in a tree, in the desert?

As a follow-up activity, introduce the idea of warning colors. Think about why some animals are brightly colored and not camouflaged, but don't get eaten. Perhaps they taste bad or are poisonous. Look at real pictures of animals and insects and how they use camouflage. Some creatures are harmless but mimic the colors of other dangerous ones.

The Roles of the Teacher in this Activity:
- Constructor of the artificial caterpillars;
- Guide, who takes the students to a suitable natural place where caterpillars may be found;
- helper to the students, giving hints and signals.

The Roles of the Students:
- Searchers, studying the area as well as they can;
- imaginators, trying to imitate the situation of a hungry bird and searching hard to find caterpillars.

Activity F: Web of Life

This activity will help students appreciate that all areas of their environment, including the natural and the nonnatural ones, are linked to each other. It demonstrates that human activities have repercussions beyond the immediate environment. By the end of the activity, the students will have seen how different parts of their environment are connected and will be able to demonstrate the impact of human activities, which break these links. Concepts of environmental education covered:

- Humans share the world with other living things;
- everything affects everything else;
- the environment can manage without humans, but humans cannot manage to live without the environment.

Equipment Needed:

Picture cards showing aspects of the natural and human environment; rope or thick string cut to 1.5 m length.

Before the activity, you may talk to the group about Chief Seattle whose eloquent plea for the protection of his tribe's land has become famous all over the world. "We didn't weave the web of life, we are merely strands in it."

At the beginning of the activity, ask the group to form a circle, with each student holding a picture card. The students pass the rope to each other to form links and say the link out loud as they do so. For example: "Water is connected to people because they drink it." "Birds are connected to insects because they eat them."

Let the students continue to create links until everything is connected to another and the strings form a web. Now introduce some environmental problems and see how they break the links in the web. For example, try a water pollution accident, overuse of pesticides, or too much hunting. As each link is broken, let the rope fall to the floor so that the students have a clear picture of the web falling apart.

At the conclusion, have them think positively. Highlight how each student can help to protect the links in the web.

As a follow-up activity, focus on one link in the web, for example water, air or soil, and investigate it in greater detail.

The Teacher's Roles in this Activity:

- Provider of background information from sources such as books, pictures and other resources to help the students recognize the connection between living and nonliving things;
- organizer, asking the students to form a circle;
- moderator, giving students the opportunity to form a connecting web and then to discuss the connections in this web with the students.

The Roles of the Students:

- Inquirers, who find out about the interdependency of species;
- modelers, who try to model a web by using the cards of these species;
- improvisers, who discuss each web they form with the teacher and suggest alternatives to building more appropriate webs.

Activity G: Some Questions about Behavior and Environment

This activity will encourage students to think about their roles in protecting the environment. It will provide them the chance to elaborate on their values and to grow positive attitudes by improving on the ways to deal with the environment. At the end of this activity, the students are able to discuss people's negative behavior towards the environment, especially the things they see each day. They should be able to suggest appropriate ideas to solve these attitudinal problems.

Aspects of environmental education covered:

The students' desire to participate and contribute in protecting the environment and find the appropriate solution to the problem will be met, their knowledge about negative or wrong environmental behaviors occurring around them will be increased, and their attention will be directed towards seeking a successful solution.

Equipment needed:

A set of cards (preferably of card-stock paper) with written questions or described problems. If it is not possible to make cards, questions may be written on the board.

Before the activity, the teacher expresses and clarifies the information on the cards. She explains the reported situations and to what extent they have had an environmental impact. She explains that that there are no right or wrong answers, but that the object of this activity is to encourage students to think and to try to find a solution to each problem.

At the beginning of the activity, the teacher divides the students into small groups of three to six students in each group, and she issues a card to each student. Each student in the group reads his card and then discusses it with his group. The problems described on the cards should be school or community-related.

The teacher must be careful that the students reach a conclusion at the end of the discussion and that they take a positive attitude as to the possibility of finding solutions. She reminds them that they, as they are members of this community, should have an effective role protecting their environment.

The Teacher's Role in this Activity:

- Raiser of awareness, as she should be aware of the serious environmental problems in the country and the world;
- informer, who should command sufficient knowledge to lead the discussion and to judge the correctness of data introduced;
- preparer of cards, who carefully designs the questions;
- provider of films and pictures to support descriptions of problems.

The Roles of the Students:

- Readers, who study carefully the serious problems in their country and the world;
- Notetakers, who write down information that they might use in a discussion;
- possible protectors of the environment, who have a strong desire to participate in such an endeavor.

Activity H: Assessment of Your Own Behaviour

These activities are designed to give students the sense of a wide range of environmental problems. Thus it may appear that they are not related to the previous activities conducted by Ms. Hally.

Think Environmentally:

* Imagine that you have been appointed to a board. Explain why you approve or disapprove of widespread use of.
  - Genetic engineering.
  - Drugs to slow the aging process.
  - Nuclear power plants.
  - The abortion pill.

*You have been given the task of maintaining or increasing biodiversity on a small island. What steps will you take? Why?

* Some people argue that each individual animal has an intrinsic right to survival. Should this right extend to plants and microorganisms? Justify your answer.

* Do all species have a right to exist?
  - What about the anopheles mosquito, which transmits malaria? Tigers that kill people in India? Bacteria that cause typhoid fever?
  - Defend you position.

* How and when does your school dispose of solid waste? Is a recycling program in place? How well does it work? If you don't have a recycling program in your school, are you planning to work with other classmates to establish it? Justify your answer.

*Your father asks you to go hunting with him. *Do you*: • Go along with him • Say you can't go because you have to study. • Say you won't go because you don't want to kill wild animals. • Something else.	*One of your schoolteachers always has the lights on, even when it's sunny outside. *Do you:* • Ask if you can switch them off. • Switch them off at the end of the lecture, as you leave. • Leave the lights on. • Something else.	*Your friend's car is making thick black smoke. *Do you:* • Tell him it's polluting the atmosphere but accept a ride. • Refuse a lift and tell him he should walk too. • Say nothing and accept a ride. • Something else.
*Your friend has an off-road car. He takes you through the desert and wants to drive off the road. *Do you:* • Tell him it would be exciting. • Tell him it damages the desert plants, but go for a ride anyway. • Insist he stay on the road, to protect the desert plants. • Something else.	*You visit Petra and see visitors carving their names in the stones. *Do you:* • Join them and carve your own name. • Pretend that you haven't noticed. • Stare at them, so they know you disapprove. • Tell them to stop.	*You are shopping with a friend and he throws an empty can of drink on the ground. *Do you:* • Tell him to pick it up and put it in a bin. • Pick it up yourself and put it in the bin. • Say nothing. • Do something else.
*After you leave school you get a good job with a foreign company. The company wants to take more water from a well in a village. *Do you:* • Say nothing because you are worried about your job. • Suggest they find ways to manage without extra water. • Do some research at home to find ways they could save water instead?	*You have promised to plant some trees with the teachers. A friend offers you a free ticket to see your favorite band instead. *Do you:* • Tell the friend you have promised to plant trees and miss the concert. • Tell the teacher and then go to the concert. • Just go to the concert. • Do something else.	*You have gone home with a friend after school. When you are ready for home at 5pm you are offered a lift, even though your house is only a 10-minute walk away. *Do you:* • Accept the lift. • Refuse the lift and walk. • Refuse the lift and say we should try to save energy and prevent pollution.

Conclusion

Ms. Hally mentioned to me that she has a membership with the Royal Society for the Conservation of Nature (RSCN). The environmental activities that she taught were designed and produced by this society. In addition, Ms. Hally told me that since its establishment in 1966, the RSCN has been working on

protecting natural resources from regression and the environment from pollution. Through this society, in cooperation with the Ministry of Education, over 250 nature preservation clubs were established in schools all over Jordan, with a combined membership of over 10,000 students. The aim of these clubs is to raise public awareness of the environment. Club members pledge to preserve nature in their country, work for the protection of its soil, air, water, flora and fauna, so that it may stay beautiful and rich for their generation and generations to come.

In addition to the RSCN there are other Jordanian societies that aim at improving EL among Jordanians, such as the Jordanian Friends of Environment Society, the Jordanian Environment Society, and others. (For more information see the article by Theodora D. Baz.)

By having first-hand experience through interaction with their environment, our students will be able to move from a local point of view to a global understanding of worldwide environmental problems. As an example, the theme of the Amman congress (IUCN'S Second World Conservation Congress) was "Ecospace", a term indicating that environmental protection at various geographical scales is a prerequisite for the social, economic and political security of people. This congress focused on local environmental issues in order to assure security for people in that area and for other people all over the world.

The kind of activities that Ms. Hally applied in her teaching will help our students make their future decisions about their environment and be able to apply the Decide Model (Donatelle and Davis 570) to the environment:

D efine the problem
E xplore your alternatives
C onsider the consequences
I dentify your values
D ecide and act
E valuate the results.

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Zeid Al-Bashaireh

Fieldwork Builds Environmental Literacy

People learn about the environment from a variety of sources in a range of different ways, and for a varied number of purposes. Field trips are one of these sources now recognized as an integral part of Environmental Literacy (EL), especially in connection with science education. Fieldwork provides students with the opportunity to study organisms and their interactions in their natural environment. It also plays an important role in student-student and student-staff social interactions. Field teaching takes place outside the classroom or laboratory and has a wide range of uses for a wide range of activities (Openshaw and Whittle). It may include many aspects of other disciplines such as geography, history etc., depending upon the context. Well-planned, directed, and kept simple, it is a common-sense method of environmental learning. Moreover, field teaching can serve as an interactive type of learning outdoors through direct experience, dealing with natural material and life situations.

When children are on field trips, they usually visit a place that is relatively unfamiliar to them. Providing children with new experiences tends to be part of this philosophy. Falk's research supports the notion that significant cognitive learning can and frequently does occur on field trips. The information acquired on field trips may be remembered for a long time.

It is well known that students in Jordan can take advantage of the country's varied geographical climates, such as the Jordan Valley, Wadi Araba, and the Gulf of Aqaba in winter, and the mountains and the desert during other seasons. The Dead Sea, which is about 400 m below sea level, offers one of the most intriguing sites and, indeed, is often visited by school groups. Such localities give teachers a chance to take their students to places at any time during the school year (Al-Bashaireh). These field trips could contribute to student awareness of their environment.

The purpose of this paper is to highlight the importance of field trips in learning about the environment since ecological fieldwork advances the understanding of the natural processes and their interaction. The local environment – even in the most urbanized areas – provides the educational potential to demonstrate ecological principles and concepts, to extend investigations to incorporate various disciplines, and to develop a range of student skills (Hale).

Furthermore, fieldwork can have a strongly motivating effect on many students, and this could carry over to other areas of study if integrated into other coursework (Gayford).

The motivating effect of field trips is their main purpose, because discoveries made by a child through direct observation are infinitely more important to him than the same ideas learned from hearsay or acquired from books. Children are deeply interested and curious about what they learn in the world around them (Dilke). So outdoor education is both a subject and an approach to education. It concerns itself with the overall development of young people and supports an organized approach to learning in which direct experience has a lasting effect. This experience can enhance learning in a number of curriculum areas and can make a valuable contribution to the personal and social development of students (Mitchell), as well as improving his/ her awareness of the environment.

Field techniques and different types of field trips will be briefly described to provide ideas for the best applications of this educational approach. Requirements and preparations are also important to gain the most from fieldwork. There are many difficulties, some of them related to class schedules, others related to student safety, financial reasons, a concern for parents, and logistical and legal matters.

The Purpose of Field Trips

Whatever the location of the field trips, there is a variety of purposes to be served by the experience. One of the primary reasons for including field trips as a method for teaching about the environment is to provide an additional source of information to support the development of skills, concepts and attitudes. There is a limit to how much information can effectively and realistically be included in printed materials provided for students. There is a limit to how much information the student can take from classroom exercises that simulate real life situations. There is a limit to student ability to transfer concepts and information from classroom dialogue concerning practical applications to life itself. In short, there is a definite advantage over classroom learning in the first-hand experience that field trips provide (Clifford and Fisher).

Field trips may also provide the opportunity for students to see several small areas in normal habitats with all types of environmental and biotic interactions. Students can observe animals and plants as isolated organisms (as in most laboratories), but also in their natural surrounding where their special adaptations to conditions such as amount of light, food, water, and soil can be demonstrated. Students can apply their knowledge or use a key to identify trees, flowers, and other forms of wildlife. They may see a habitat such as a swamp that is quite different from the environment in which they live.

The more field trips a student participates in, the greater will be his sense of community. Students learn to appreciate that their community is made up of a variety of elements and a number of these elements are concerned with some aspects of science. The interplay of the governmental, industrial and educational forces can usually be illustrated. These types of field experiences can be referred to once the children are back in the classroom.

The development of social attitudes and the ability to be self-sufficient or cooperative with other people is also an important purpose of field trips. Field trips increase student awareness of environmental issues. Long-term knowledge is gained during the field trips and serves to educate about nature conservation (Orion and Hofstein).

Ecological field trips may also provide a basis for practical work. They broaden and reinforce many areas of the curriculum, such as a conceptual approach like adaptation and examination of species in relation to environmental influences (Hale).

In its widest sense, fieldwork challenges all types of children by providing a sense of adventure, the thrill of achievement, and the shared experience of fieldwork. Not only the gifted but also the less able child can have his curiosity stimulated and his experience broadened. And by working individually or in a group, he can be given some training in self-reliance and responsibility.

Fieldwork is also an essential part of EL-training, namely by developing general processing abilities such as measurement skills, observation skills, recording of data, and data analysis and presentation (Owen).

Requirements and Preparation

Field trips require even more extensive preparation than other types of teaching. The teacher planning a trip should become well acquainted with an area before taking a class. She should know what she expects the students to see and how they can best observe what she wants them to notice. The teacher should be ready to admit that she does not know everything – but must also be prepared to explain where to find the answers to students' questions about their findings on the field trips (Rosengren). Hubbard summarized field trip requirements as follows:

Teacher's Time

It must be accepted that in outdoor education teachers are involved with the same children for longer periods of time. Time must be allowed for meeting and discussions since these are vital to the success of a field trip. To do effective fieldwork, teachers must have time to get to the site, take measurements and samples and to get back to school.

Children's Time

Blocks of time are necessary at different seasons of the year and the implication of this must be accepted by the head of the school and education authorities. A flexible time table is absolutely essential, adequate time should be allowed for the study of background materials and instructions in the use of route plans and ordinance survey maps of various scales (Schools Council) as far as these can be provided.

Finance

The cost for transport, equipment and residential accommodation can be high and therefore consideration must be given to possible additional sources of income, e.g. through children's contribution and funding from the parent teacher association. Parents should be informed of the overall cost per child, taking into account the authority's and the governing body's charging and remission policy. Parents should also be informed of any deposits required, further payments and their dates and the methods which can be used for making payments. Care should be taken to ensure that all elements of the total cost of a visit have been calculated beforehand. In the case of Jordan, there are insufficient financial resources for fieldwork. Schools always have only limited funds available to support such activities. Parents sometimes finance their children's trips by paying for the transportation (Al-Bashaireh).

Equipment

The type of equipment purchased depends on the activities selected for the course and here the qualification of the staff will be the deciding factor. Since the proposed objectives are concerned with the personal development of the child, it is perhaps an advantage to provide less sophisticated pieces of equipment, which can be used without too much assistance from the teachers. Schools in Jordan are generally not equipped with the materials, tools, and utensils students might need in the field (Alawneh).

Student Safety

The safety of students is of prime importance. Therefore, teachers planning field trips must be aware of possible dangers and should not underestimate the risk involved. Safety instructions must be clear and precise and understood by the students. All members of the group must wear suitable clothing and footwear for the weather and terrain likely to be encountered (Fisher and Harly). Safety also is rooted in the knowledge that all issues concerning teacher responsibility are understood and have been addressed.

Educational and logistical planning

Orion pointed out that in an outdoor environment, the development of field trips is subject to three main criteria:

- Administrative criterion; the field trip should be easy to organize.
- Curricular criterion; the field trip should cover basic concepts that can be taught in the field by applying concrete activities.
- Educational criterion; the field trips should be mainly a learning experience rather than a social event or adventure.

Techniques

Various options are available to utilize field trips as a teaching and learning approach. The most fundamental principle to be kept in mind is that field trips should have a purpose and the purpose should contribute to the development of concepts, skills, and attitudes in the context of EL.

Another principle for field trips is that they must be planned. A trip during which the teacher is as ignorant as the students regarding to what might happen may not be an appropriate learning experience. A trip led by a substitute should be an exception and take place only provided the substitute's and teacher's plan and purpose for the field trip are consistent. Some types of field trips may be taken with the expressed purpose of exploring a particular environment. Usually the students should be given a point of focus as to what is to be explored.

Students taking field trips may require specialized equipment and/or observation skills in order to make good use of the learning experience. A trip to study living things outdoors may be enhanced by the use of collections and handling equipment, such as monitoring devices (measurement kits) to examine the quality of surface water etc. Trips to industrial sites may require previous experience of terminology and/or processes in order to understand the industrial applications being explained. Edward and Fisher pointed out that students should have the opportunity to preview the activity in such a way that:

- The purpose of the trip is clear to them.
- Appropriate training and equipment is provided.
- The logistics of the trip are explained.

At the conclusion of the field trip, follow-up activities will be necessary to ensure proper conceptualization of the activities students have engaged in. Activities like discussion, role play and demonstration can help articulate the experience. Falk pointed out that children may spend more time involved in learning activities on a field trips and get more out of an informal learning experience than they do in a conventional school classroom. The key to ensuring that students will benefit from field trips is to realize that settings do have an effect on learning. Orion summarized the process of developing field trip activities using the following steps:

1. Selection of the field trip area.
2. Definition of duration.

3. Drawing geological and biological maps of the area for teaching purpose.
4. Concept matching; the curricular concepts are matched to the relevant items in the educational field inventory.
5. Planning the route; the organization of learning stations in an order which satisfies the educational and the administrative constraints.
6. Development of learning aids; for example field trip booklets to direct the students' work at each learning station.
7. Placing the field trip in the course structure; this involves determining what will be taught before the field trip and what will follow.

Accurate recording of observations made on the field visits is essential. Student-teacher discussions and articulation of appropriate questions will direct students to think about a problem or observed phenomena. The observation should be made permanent either by tape recording, written recording, graphic representation (photographs, maps), or by presenting collected specimens (Perry, Jones and Hammersky).

Some students need to be reminded that the countryside should be used responsibly, that they should not climb over walls and fences, leave gates open, trample crops or disturb wildlife, and never litter fields and roads with refuse and garbage (Fisher and Harley).

Kinds of Field Trips

Field Trips to Natural Areas in the Vicinity of the School

This may be a small area of vacant space with a few trees such as in a city, school, or a common orchard area in a suburban or a rural high school. A trip near the school or nearby mountains and forests can provide the opportunity to use tree keys and to show nitrogen-fixing bacteria nodes on clover plants, tap fibrous roots, show erosion on worn-out paths and on slopes. Students can theorize about specific problems if a plant or tree is found that is defoliated by insect larva, has nematodes which have destroyed its roots, or is wilting because of hundreds of sucking insects. Students rarely realize that plants are susceptible to parasitic, bacterial, and viral attack (Rosengren).

There are many advantages of field trips to such natural areas. Hale summarized them as follows:

- The cost associated with fieldwork is substantially reduced in terms of transportation, accommodation, course fees and additional administration.
- The disruption and rearrangement of timetables may not prove necessary as field trips may be undertaken within single or double periods.
- The teacher is given the additional freedom to plan lessons and related fieldwork as required, he has the flexibility to re-schedule arrangements.

- Children can relate to their own familiar environment more readily and are less inclined to associate fieldwork with something done only in different and invariably unique environments. This will foster a sense of belonging and caring for the environment.
- The provision of additional opportunities for children to come into contact with live organisms in their natural surroundings should encourage an understanding and respect of other forms of life.

Ecology Trips Away from School

Trips away from school on an all-day basis should be few and far between, taken only if the trip has a specific purpose and shows the students habitats or special areas that they have not seen before. Some schools are near the Gulf of Aqaba where marine life can be observed. Day-long field trips should be planned for Saturday, if possible. The teacher should obtain written permission from each child's parents. A tentative time schedule for the day should be prepared, so teachers know approximately how much time can be spent exploring in one spot. After he has taken a trip several times, it will be easier to estimate the amount of time needed to adequately cover a particular ecological area. Students should fully understand that on the trip the teacher must know exactly where they are at any time, if students are not with the main group, and they should be on time for field trip activities. Students also should be given a list of equipment to bring, such as collecting jars, nets, and personal items.

Trips to Industrial Laboratories

Many high schools are located near colleges, universities or industrial research centers, so student trips to these areas may provide desirable science experience. Some of these trips may be taken on Saturday or after school time if the research centers are nearby. Teachers may plan half-day trips with science clubs or in some cases small numbers of very interested students. Some research centers will take only small groups of top students. These trips illustrate the type of research done, the training needs of a researcher, and the special types of scientific tools used and not generally found in high school laboratories, such as electronic microscopes or altar centrifuges for separation of cell components.

Science clubs can often take interesting field trips within the community to a sewage disposal plant, a water purification plant, or a hospital or industrial laboratory. These trips give the students a better understanding of the community in which they live and also provide the men and women working in these laboratories the chance to talk about their work. Many researchers enjoy discussing their work particularly with young people who might be interested in similar careers. Such laboratories may be found at the universities, mine companies and industrial areas, such as Sehab industrial city near Amman.

Difficulties and Problems to be Encountered

Teachers are often presented with several problems when taking field trips, reasons why field experiences are not included as often as might be warranted. The first of these difficulties is the extra time needed to arrange for a field trip. Unless it is a simple excursion around the schoolyard, trips may require special arrangements for transportation, meals, parental permission, and onsite arrangements for guides and facilities. Problems related to teacher circumstances include lack of time (due, for example, to a full syllabus that does not leave a single hour flexible for changes and due to class scheduling), facilities (equipment, books and suitable local site) and financial resources (to support field trips and provide staff training), as Humphreys pointed out. In these cases, a teacher should not hesitate to ask for aid from parent volunteers or the school secretary to make arrangements and to ask for input from teachers who have previously taken field trips to the site.

Another important concern is for student safety. The teacher is best adviced to check local school community regulations that may apply. The school principal should be able to take care of special insurance needs and alert the teacher to hazards present in the field experience. The experience of other teachers may be of help here. In general, the teacher must remember that due caution should be exercised to eliminate all foreseeable dangers to the students.

Lack of suitable equipment sufficient for the needs of the whole class, such as laboratory equipment available for testing and examining collected materials, may limit the thoroughness of certain investigations. In this case alternatives are available, for example, the substitution of soil pH indicator papers instead of the more accurate pH meter.

It should be possible to rearrange class schedules to allow maximum benefit from field trips in all subject areas. The benefits of adapting an environmental approach to all the traditional disciplines has not been fully communicated and in some instances has led to some competition between subjects for classroom hours. Booth summarized a number of issues, which contribute to preventing the subject of ecology from being taught, as follows:

- The nature of the subject.
- Difficulties and confusion about how to teach the concepts of ecology.
- Examination syllabi and papers, and difficulties of field trips assessment.
- Lack of teacher confidence or the feeling of entering the unknown if they have never been involved in real ecological work. Confidence may be encountered by providing in-service training and the provision of information about the school environment and local sites. This requires the cooperation of teachers from all levels of education, park managers, local planners, and other members of the community.

- Facilities; one of the major problems facing teachers concerned with ecology is scheduling students so that local sites can be used. Teachers need facilities to go to for environmental studies.

In the case of Jordan, Zaitoon summarized these difficulties as follows: lack of sufficient time, teacher awareness of the possibility of jeopardizing student safety, lack of financial resources, bureaucratic issues, class schedules, and personnel issues related to both students and teachers.

Field Trips Assessment and Evaluation

Edwards and Fisher suggested four strategies to help evaluate field trips:

1. Students must be assessed whether they understand the aims and the objects of the trip.
2. Students will be asked to judge different environmental programs. The teacher assists by helping them to evaluate the programs in a step-by-step fashion. Focus will be upon forming and using criteria to judge properly and upon developing a rationale explaining the basic evaluation technique. Students will be given several examples of environmental programs and are asked to rank them from best to worst. They are then asked to write an explanation justifying their rankings and to compare their rankings. Ranking differences should be discussed.
3. Students will be given a series of opinions concerning solutions to local environment problems. They will be asked to evaluate their opinions and hand in their written evaluation to the teacher. Feedback must be given. Discourse on these issues should follow.

The assessment of field practice should be considered during field trip preparation. Methods, as suggested by Groves, might include the following:

- Field notes, logs or maps
- Material produced in the field allows for a fair assessment of each student's field performance. It can be assessed using criteria such as a standard of notes, sketches and measurements, the objectivity of descriptions and observation and general structure, order and comprehensiveness of record.
- Summary log, map or other diagrams

Students can summarize their observations in a single diagram upon completion of their fieldwork. Such summary diagrams can be prepared after subsequent laboratory analysis and, in the case of graph logs, can incorporate brief interpretations.

Field Report

Although not only a test of field performance, the preparation of a field report is a valuable exercise, testing student skills of analysis, interpretation, communication, and presentation.

Conclusion

It is widely believed that field trips offer a realistic learning environment by providing opportunities for developing practical skills, techniques, and enabling students first-hand to be problem-solving scientists through investigation and obtaining experience at fieldwork. For instance, the concept of the balance of nature can be more realistically portrayed in the natural environment than through pictures or mockups. Students also can apply classroom science lessons to their local community, such as the study of living things in biology. With regards to EL, environmental problem sites have to be seen in loco in order to be understood. Such sites include, polluted rivers, garbage dumps, or sites of controversial planning, e.g. for industries with insufficient emission control or inadequate environmental precaution. Therefore, outdoor education may involve academic, physical and social activities. This may contribute to the improvement of students' Environmental Literacy. Finally, one could emphasize that the value of a field trip can be maximized through an orderly, structured approach, and within the aims and purposes of each excursion.

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Imad Sa'di

Environmental Literacy Activities for Primary School Children

The foundations of pre-adult attitudes, thinking, and performance towards the environment are laid during early childhood and will probably govern behavior through adult life. These can serve as the first steps in the development of an environmentally literate and concerned citizenry with great potential for changing the way the natural world is treated (Kirk and Karbon; Pomerantz; Wilson).

Early childhood EL is important, for both the development of children themselves and the preservation of the world. It can help children grow self-confidence and develop an appreciation of natural beauty and diversity.

One would agree that there is a need for developing an environmentally literate society in Jordan. The land and rural places have been attacked by buildings, motorways, and the continuous spread of cities and towns. People have been subjected to the discomfort and health hazards of air pollution, extreme noise, traffic development, and the dumping of litter.

The present primary school education in Jordan does little to modify children's environmental behavior patterns, such as consumption and wastefulness. To possess EL children must be given the opportunity to develop their investigative skills and understanding of environmental issues and problems within factual situations in the context of exploration and investigation. Thus, environmental education topics and issues could be better understood if they were made concrete and exemplified through outdoor experiences. As a result of such an experience, EL could be gained easily.

Methods of teaching environmental topics might be more effective if they are concerned with opportunities for an action-oriented approach and directed towards the solution of problems in natural settings. By utilizing this procedure, students develop the ability to think critically and creatively. People will be most effective when they are open-minded: when they can weigh options, look at an entire situation, try to find the reasons behind something, look for alternatives, keep the problem in focus throughout decision-making, gather information from a variety of sources, communicate, ask the right questions, analyze inputs and assess their credibility, define the problem clearly and make decisions. They ultimately learn the essential knowledge and skills of solving environmental problems, gain positive attitudes towards the environment and the capability to generalize or transfer this learning and utilize the same skills

and procedures to solve environmental problems that might confront them in the future, thereby becoming environmentally literate citizens.

The activities stated in this section have been developed to help teachers in achieving the very important goal of EL with primary schoolchildren in a practical context. During the development of the activities, careful consideration has been given to the stage of development of primary schoolchildren.

The activities involve children in outdoor activities. This method of teaching is different from other approaches, which our children in Jordan are familiar with, particularly lecturing. The children will be involved mentally and physically in exploring objects and events in the environment around them. Working through these activities, children will develop their own ideas and, hypotheses. They will investigate issues and problems, collect data, and interpret findings. It is hoped that this will ensure children's scientific ideas and findings. They should change their ideas according to their findings. The role of the teacher is to guide children toward more scientific and creative thinking.

The activities deal with "pollution" as an important environmental issue. They take this topic as an example for more similar or related activities in areas such as "waste" with inherent concepts of conservation, reduction, reuse and recycling. The format of these activities is as follows:

Stop and think!	to motivate students to start learning.
Activity	to manipulate, understand, investigate and solve problems.
Follow-up Activity	to emphasize learning and findings.
Remember!	to clarify environmental concepts and issues.

In this simple manner, children are enabled to deal with each individual activity from a simple starting point. Some of these activities can be dealt with as individual studies. Some encourage cooperative and collaborative learning.

Assessment is essential for evaluating the effectiveness of such activities. It should be built on the objectives of the unit. It should be carried out daily, activity-based, and should be collected as an organic part of student work by using some of the following techniques: observing how students carry out practical activities, discussing their work, assessing their skills, and understanding and evaluating drawings, diagrams, posters, leaflets, writing tasks and designs.

General Objectives

After working through this topic the student should be able to:

- define the term pollution and the related terms: air pollution, water pollution and noise pollution;
- list the major causes of air pollution, water pollution and noise pollution at home, in school, and in the community;
- describe in writing some problems of air pollution, water pollution, and noise pollution in the community;
- discuss ways in which pollution (air, water, noise) can damage both living things and non-living things (note particularly its effects on people!);
- observe some pollutants of air, water, and noise;
- investigate some of the pollution problems in the community;
- use problem-solving steps to solve some of the pollution problems at school and/ or in the community;
- take positive action towards environmental problems;
- develop and implement action plans to overcome pollution problems;
- plan and carry out a campaign to make people aware of air pollution caused by cars, trucks, and buses;
- design, assemble and distribute a booklet on a pollution issue;
- illustrate three ways how he/ she enjoys unpolluted air, water, and less noise at home, while playing, and on holidays;
- make a drawing to show three ways how he/she and the family avoid the dangers of polluted air, water, and noise;
- understand that human beings should protect the earth, in order to be able to continue support future generations of living things;
- show responsibility for pollution problems.

A local newspaper has the following headlines:

Our air is highly polluted.
The dust hurts our eyes.
The ozone layer is wearing thin.
No Diesel cars in Jordan.
People without ears.
Restrictions on car horns.

If you read these headlines thoroughly, you might know the extent to which people have damaged their environment. They have been using the available resources for many years while ignoring the consequences. One of the major effects that damage the earth is pollution (Porter et al. 58).

Stop and Think!
What is pollution?
Pollution is a term used to describe .....

To help you in rewriting your definition, try to answer the following questions:
Have you ever

1. seen a burning garbage container? [yes-no]
2. heard noise that was too loud? [yes-no]
3. tasted salty water? [yes-no]
4. smelled dusty air? [yes-no]
5. found litter around a bin? [yes-no]
6. seen a black wall or building? [yes-no]

These questions may lead you to better statements describing the term pollution. Now try to improve your statements.

Remember!
"*Pollution is* a very broad term used to describe anything which is likely to have a detrimental effects on the environment" (Nuffield Primary Science 114).
Pollution is "the addition of unwanted substances or effects (pollutants) which adversely alters the natural or man-made environment" (Centre for Environment Education 84).

There are different kinds of pollution including air pollution, water pollution and noise pollution in addition to land pollution. In order to recognize the terms, read the statements of the following activity and organize them into three categories: air, water and noise.

Activity

What type of pollution is it? (Stapp and Cox 81)

Categorize the following statements into three groups according to the type of pollution they are related to (air, water or noise pollution):

- Some students burn leaves in winter to warm their houses.
- Some industries dump sewage in waterways.
- Some people smoke cigarettes.
- The record player was very loud.
- Oil tankers wash out their tanks at sea.
- Some students have fun burning tires in winter.
- The horn of the gas seller was loud.
- Some students enjoy throwing stones into ponds.
- Some students like to use spray deodorants.
- Black smoke was released by chimneys into the air.

Air pollution	Water pollution	Noise pollution
-	-	-
-	-	-
-	-	

Answers:
Air pollution(a, c, f, i, j).Water pollution (b, e, h). Noise pollution (d, g).

Air Pollution

The first type of pollution we are going to learn about is air pollution. Think about the following questions:

- Can you smell, see, feel the air?
- How do you know it is around us?
- Can you see evidence of its presence outside? What is it? (Stapp and Cox 110)

People around the world and all living things need air for survival. Human beings breathe air that is a mixture of various gases as well as some solids and liquids. These gases are essential to all life (Texas Education Agency 31).

Stop and Think!
What is air pollution? .....
Air pollution is .....

To help you define air pollution, discuss the following questions with your friends:

- Have you ever had something stuck in your eyes? How did it get there?
- Where did the dust come from?
- Have you ever seen dust on leaves? Where did it come from?
- Can you see or smell dirty air?
- Does air contain many impurities? How do you know? (Stapp and Cox 110)

Follow-up Activity

Play a game at home with someone else to identify pleasant and unpleasant smells.

The steps of this game are:

- Let the one who wants to play with you be blind-folded.
- Let him/her identify some pleasant and unpleasant smells.
- Record the responses.
- Change places and repeat the steps again.
- The winner is the one who identifies most smells.

Record your smells in this sheet:

Smells	1	2	3	4	5	6	7	8	9	10	Mark
You											
Partner											

Air, as you might realize, is not always clean as it should be. Some harmful substances might be mixed with it and cause unpleasant smells. These substances, such as dust, smoke, and sulphur dioxide, are called pollutants. The pollutants are the causes of air pollution.

Stop and think!
Study this category!

People-made pollution	car engines, burning fuels, factory smoke, car and truck exhausts, fumes coming from cars, open burning, smoke coming from chimneys, burning leaves and garbage, and heating homes using fireplaces.
Natural pollution	dust storms, forest fires, volcanic eruptions, and rotting plants or animals bodies.

I can add the following pollutants:
People-made: .....
Natural: .....

Remember!
The air is polluted when some pollutants are mixed with it. In other words, air pollution means dirty air which might cause health problems and affects living and non-living things.

Activity

Investigate air pollution in your school surroundings by collecting leaves from different areas. Look thoroughly at the leaves and make notes in the box below.

Plant	Dust Seen	Place of Tree	Place of Leaf	Picture of Leaf
- - -				

Activity

Visit the school parking lot. You are going to investigate a new type of pollutant. Observe your teacher do the following:

- Place a white piece of cloth over the exhaust pipe of a car;
- start the engine;
- remove the cloth after five minutes;
- let you examine the cloth.

Now, answer the following questions (Swan and Stapp 65):
What can you see on the cloth?..... .
What type of pollutant is this?
It is ..... .
Are there gases that can't be seen? How do you know?
..... .
Does the car add unnecessary pollutants when it is allowed to run while standing ..... ?
What can we do to remind others of good habits?
We can ..... .

Follow-up Activity

Stand at the corner of your house for approximately fifteen minutes. Investigate the number of vehicles passing along the street (cars, trucks, buses) and whether or not smoke is released from them. If it is released, what color is it? Use the table below.

Vehicle	*Cars*	*Buses*	*Trucks*	*Total*
No smoke				
Black				
Blue				
Total				

Stop and think!
How does air pollution affect living and non-living things? Remember how leaves were affected (Activity 2). Polluted air is affecting the health and well-being of plants, animals, and living things, as well as non-living things.

Activity

Interview your parents in order to investigate the effect of air pollution on living things and non-living things (Texas Education Agency 31).
You could ask some of the following questions:

- Does air pollution affect plants and/ or animals?
- How do you think air pollution hurts us and other living things?
- Does air pollution affect non-living things? How?
- What diseases might it cause?
- Does air pollution have to do with: lung disease, coughing, headaches, eyes watering, vomiting, nausea and fatigue?
- Does air pollution color buildings? What color is it?
- Does it dissolve marble and pit metal?
- Does it corrode steel?

- Does it discolor paint?
- Are your parents smokers?
- Does smoking affect their lives? How?

When you have completed your interview, analyze your data by filling in the following sheet:

Living Things			*Non-Living Things*			
Disease	Yes	No		Yes	No	How
Lungs			Buildings			
Cough			Marble			
Eyes			Steel			
Headaches			Paint			
Vomiting						
Breathing						
Asthma						
Nausea						
Fatigue						

Stop and think!

Do you think that air is polluted in your school? What proof do you have?

You should realize that air pollution affects our health. Therefore, we should try to have clean air and support people who are stopping air pollution.

I think air is (polluted/ not polluted) at our school.

My proof is: .....

Activity

A doctor will visit you to talk about the effects of air pollution on your health. With the cooperation of your parents, prepare some questions about some issues or health problems you or your parents are worried about, in order to ask the doctor about them when he/ she visits our school on / / 2001.

Activity

Investigate whether or not air is polluted in your school (Stapp and Cox 108; Nuffield Primary Science 98). Try the following experiment:

Take some white cards. Smear Vaseline thinly over them and hang them in various places outside. After 30 minutes examine the cards and answer the following questions:

- What color are the cards now?
- What can you see on the cards?
- What do you think it is smoke, soot, dust, fume, pits etc.?

- Is the air polluted or not?
- Is the pollution man-made or natural?
- Do you think that there are other sources of air pollution in our school? What are they?
- How can we reduce air pollution in our school?

Observe and note:

1. The color of the white cards has been changed to.....
2. I can see.....on the cards.
3. I think it is.....
4. There ..... air pollution at my school.
5. Is it man-made or natural pollution? It is.....
6. The other sources of air pollution at our school are
   .....
7. We can reduce air pollution at our school by
   .....
   .....

Compare results of your investigation with those of your friends.

Follow-up Activity

Draw pictures of four sources of air pollution you observed at school using the boxes below (write the names alongside the numbers):

1.	2.	3.	4. .....

Have a candle, a match, and a lighter. Blow them and hold a plate of glass over them individually. Investigate if they cause air pollution or not? How can you show that?

Discuss with your parents how to carry out an anti-car pollution campaign. Consider the following points:

- The efficiency of the engine in burning fuel.
- Ask your parents, after the experiment with the exhaust pipe, where the black color comes from and whether there are other gases released?
- Discuss the electric or steam car with your parents.
- Find arguments for people to use bicycles and/ or public transportation.
- Cars should be kept in good condition.
- The production of cars that have a pollution-control device.

- Drivers should avoid rapid acceleration and braking (which causes attrition pollution).
- The possibility of arranging shared rides.

Try the Following:

- Advise your parents to stop their car's engine while it is not in motion.
- Make a poster presentation of vehicles, air pollution problems. Distribute and display it at school and in your community.
- Prepare and distribute leaflets about air pollution caused by cars.

Using the information you have gathered on air pollution, design and assemble a booklet that illustrates:

- The major sources of air pollution in your community.
- How pollution hurts man and other living things as well as non-living things.
- How we can help reduce pollution in the air and overcome its bad effects.

If possible, make the booklet of recycled or reusable paper. Pictures of problems could be placed in it with a story about each picture. Share your ideas with friends, teachers, and parents, in particular the best solutions of air pollution. Distribute the booklet when finished, particularly among the members of your family in order to inform them of the problems and possible solutions of air pollution.

Water Pollution

The second type of pollution we are going to learn about is water pollution. As you have realized, air is essential for living things. Water is also next in importance to it. Every living thing needs water to stay alive. Moreover water is used in different aspects of life, such as construction, washing, cooking, transportation, sports, and in other ways (Texas Education Agency 25).

Activity

My family used water last (Friday) for:

User	Ways of Using Water			
My Mother				
My Father				
My Brother				
My Sister				
Myself				

Other families should be nearly the same in size as your family.

- The quantity of water has been (increased/ decreased) in my house, in the community, and in the world after using plenty amount of water.
- Collect pictures from magazines, newspapers and old texts. Make a special book to show some benefits of water. Write one sentence under each picture telling why it matters that water is clean.
- Categorize the ways you and your family use clean water into three groups, and draw a picture underneath each of these:

Support Life	For Enjoyment	Non-Human Uses

Discuss with others what would happen if it does not rain all winter. The following points will be mentioned in my discussion:

.....

.....

Ask your parents whether they can live longer without food or without water (Stapp and Cox 59)?

We can live for a longer time without....., but not without ..... .

Stop and think!

What does water pollution mean?

Water pollution is .....

Try to remember what air pollution means, what are the substances which pollute air, what are pollutants? Think of a comparison between the two terms (air and water pollution). Have you found the meaning of water pollution? The following questions may help you explain what you mean:

- What would happen if clean water is added to more clean water?
- What would happen if stones are thrown into drinking water resources?
- What would happen if oils, heavy metals, chemicals, sewage are thrown or dumped into drinking water resources?

Have you formed some statements to define water pollution? If so, please write them in the box below.

Water pollution is.....
.....

Remember!
Water pollution is the entry of foreign substances into water, such as oil, dust, chemicals, cans, paper, litter, glass, fertilizers, pesticides, or any other things. Water due to these pollutants becomes dirty and not usable (Stapp and Cox 35).

Discuss the following questions with your group:
- Where do we get our water from?
- What do we use water for?
- What happens to water after we use it?
- What does a sewage treatment plant do?
- If we dump sewage into a lake what would happen to the fish?

Follow-up Activity

a. Have two aquariums.
b. Fill both of them with clean water from the source your family uses to drink from.
c. Put sand into one aquarium until the water becomes cloudy.
   What is the pollutant in your experiment? It is ..... .
   Who is the polluter? It is ..... (Stapp and Cox 35).

Activity
Now observe your teacher doing an experiment to show you water pollution and start thinking about the causes of water pollution (Stapp and Cox 135).

Suggested Procedure and Techniques (for the Teacher):

Have a big jug or a glass container. Tell your students to consider it a lake. Ask them whether the water is clean or not. Put in one drop of any colored liquid into the lake, e.g. ink. Ask the students whether the water is colored or not by one drop. Have each student put in a drop of the same liquid into the lake. Ask them:
- Is the color much different?
- Can they swim in the lake or not?
- Can they drink the water or not?
- Why is the lake polluted since each one has put only a small drop of pollutant into it?
- Why it is important for each one of us not to pollute water?

When finished, identify the causes of water pollution. Discuss them with your students. Emphasize that running water is less easily polluted than water in lakes, reservoirs, and ponds, which are more abundant in Jordan. Discuss visible and invisible water pollutants.

You (the student) might realize that water pollution is caused by different pollutants and ways:

Chemicals; sewage dumped in the water; oils; silt; industrial chemicals and heavy metals; chemicals from the air dissolved in rain water; pesticides and fertilizers leached from the land; radioactive materials; individual and community sanitation; human and industrial waste (Centre for Environment Education 85-86).

You have to know that most resources of water in Jordan are springs, ponds, and lakes. These resources are more easily polluted than rivers and streams because pollutants tend to accumulate in springs, ponds, and lakes. Some pollutants are visible (sand, leaves, pebble, milk.. etc.), while others are invisible pollutants (salt, sugar, chlorine etc.).

Follow-up Activity

- Investigate people's actions in your area and how they pollute water.
- Check your water container on the roof of your house, and the ones of your neighbors. Have a decision of the extent to which they are polluted, and if so, what kind of pollutants you've observed.

Container	*Clean*	*Dirty*	*Pollutants*	*Suggestions*
My Family				
Neighbor 1				
Neighbor 2				
Neighbor 3				

Discuss with your parents the following issues:

- It is important for each of us not to pollute water
- What would happen if all the water in our area slowly becomes unusable due to pollution factors. Write a short story about that.

Activity

Visit:

- A local spring or pond. Investigate the extent to which it is polluted. You have to collect as much information as you can before going there.
- A sewage treatment plant. Have an idea about its operations.

Fill in the blank spaces:

The problem of this spring (pond, reservoir) is .....

Some information about it :.....

What might be done about it to solve the problem .....

Stop *and think!*
Does water pollution affect living things ?

Water pollution as well as air pollution affects living things. It affects human survival, might spoil human fun, and spoil non-human life as well. The effects of water pollution are: it causes many diseases; prevents sunlight getting into seas or rivers, or to plants. Therefore, it kills plants and animals; creates dead lakes; filtering water means extra costs for families and the local community; and it pollutes soil.

Categorize the list of water pollution effects mentioned on the blackboard into three main groups:

Human Survival	Spoils Human Fun	Spoils Non-Human Life

Follow-up Activity

Visit a doctor. Ask him/her about the diseases that polluted water might cause. Write a report about diseases caused by polluted water. Discuss it with your friends and hang it in the classroom: .....(use extra sheets if needed)

Stop and think!
How do you help to keep water clean at home, at school, and in your community?

As you investigate some of the sources of water pollution describe to your group three ways to keep water cleaner. One is personal, the other is a family project, and the third one is national or related to your community. The following points are mentioned to help you:

- Water containers should be cleaned at least once a month.
- Prevent sources of pollution from reaching water at home.
- Do not throw objects into water.
- Remove paper and cans.
- Filter water to ensure its cleanliness.

Follow-up Activity

1. Draw three pictures showing how water is polluted to be displayed at school:
2. Write and draw three ways of avoiding dangers of polluting water at home, during playing, and on vacation.

3. Discuss with your parents how to carry out a plan of action to reduce water pollution at home, at school, and in the community. The following sheet may help you:

A Plan of Action
At home, I could reduce water pollution by:
.....
At school:
.....
In the community:
.....
To help reduce water pollution, I'll do the following:
.....

Noise Pollution

There are various types of sounds around us:

- Sounds made by different materials: animals, car engines, doors closing and opening, water running from a tap, tires on roads, and so on.
- The weather: sounds made by rain, hail, wind, and thunder.
- Sounds generated by different materials through: striking, plucking, shaking and blowing, and sounds that are made by different musical instruments (Hopkins and Hanter 30).

Activity

Talk to your group about the following sounds:

- Sounds that you can hear.
- Sounds which frighten you or make you feel safe.
- Warning sounds: the school call, bike horns, car horns, telephone bells, and fire alarms.
- Toys that make distinctive sounds.

You have been at a noisy area. You should know that noise is a type of pollution whenever it is not appropriate for ears.

Stop and think!
What is meant by noise pollution?
Noise pollution is .....

The following questions may help you define noise pollution:
Is the discussion inside the classroom a type of noise pollution? [yes–no]

Is your oral reading a type of noise pollution? [yes–no]
Is the sound of a loudspeaker a source of noise pollution? [yes–no]
Is the sound of cars horns a source of noise pollution? [yes–no]

Remember!
Noise pollution is the increase of the average level of sounds. It is an irregular pattern of sound vibration, whereas pleasing sounds are produced by regular or harmonic vibrations, such as those which produce music (Texas Education Agency 23).

Activity

Listen to, think, and identify sounds.

You'll hear some sounds on a tape (played by your teacher). Try to identify these sounds and categorize them into two groups: noisy sounds or not:

Sounds	1	2	3	4	5	6	7	8	9	10
Noisy	7									
Not Noisy	3									

Try to listen to sounds released in two places in your area for ten minutes, then answer the questions below:

The [first-second] one is noisy.
I would like to live in the [first-second] area. Because it is .....

Follow-up Activity

Stand outside your house for ten minutes, try to identify whether your area is noisy or not. Repeat the same process inside your house. Is it noisy or not?

As you know something about noise pollution, let's ask this question: What are the sources (or causes) of noise pollution in our community? There are many sources of noise pollution, some of which are: subways, motorcycles, jack hammers, trucks with faulty exhausts, wedding parties, fire-truck alarms; vehicles such as school buses, ice-cream cars, and gas trucks, continuous noise from streets, factories, aeroplanes, and loudspeakers; industrial noise such as, machines of factories and electricity generators and children playing in the streets.

Activity

Listen to different sounds inside and outside your house. Record the type of sound and check whether it is pleasant or annoying.

Sound	*Pleasant*	*annoying*
1. A piece of music.	7	3
2.		
3.		
4.		
5.		

Follow-up Activity

Collect a variety of natural and manufactured sounds. If some are stark, try to draw a picture of them and hang it in your class. Try to do different sounds and decide whether they are noisy or not.

Listen to this story:

Many years ago , there was a skillful musician. His name was Ziryab. The people at that period of time used to meet at night in the Caliph Palace. One day Ziryab was one of the attendants. He was requested to play a piece of music. Once he started playing, the audience felt sad. He played another piece and the audience began crying. The Caliph ordered him to stop playing such pieces. Therefore he started a new one and the audience altogether felt merry and was laughing.

What do you learn from this story? Is there such an effect to music on human feelings?

Stop and think!

What is the effect of noise on humans and non- humans?

People around the world may suffer from hearing impairments. Noise from very loud and shrill sounds may even sometimes lead to death, particularly among small children, who may die prematurely. Super sonic sounds have been known to shatter windows, weaken foundations of buildings, and influence the health of humans and productivity of farm animals.

Depending upon such facts noise pollution can cause physiological damage to the human ear as well as considerable mental strain and stress (Hopkins and

Hanter 89). Continuous noise from streets, factories and loudspeakers can cause permanent hearing loss. Noise pollution may cause stress, including high blood pressure, ulcers, and a variety of psychological disorders.

Consider the effects of noise pollution on:
Humans: .....
Non-humans: .....

Activity

Ask a doctor, if possible, about the causes of hearing problems in people. Record your investigations in the table below.

Patient	*1*	*2*	*3*	*4*	*5*
Hearing					
Non					
Cause					

Follow-up Activity

Record undesirable sounds and listen to the tape with your parents. Discuss each sound and its effects on humans or non-humans according to the table below.

Sound	*Effects on Humans*	*Effects on Non-Humans*
1.		
2.		
3.		

Stop and think!
As you have realized, noise pollution is harmful for hearing. Therefore, it is the responsibility of each one of us to think about what we can do to decrease noise pollution.

There are many ways to reduce noise pollution, some of which are:

- Passing laws that prevent noise pollution such as from car horns inside the city (camp-village);
- encouraging workers who are working in a noisy situation to wear ear protection devices;
- planting trees which absorb noise and reduce noise pollution;
- encourage people to avoid noisy behaviors.

Noise pollution should be reduced in the following ways:

1. At home: .....

2. At school: .....
3. In the community: .....

I will do the following, to reduce noise pollution: .....

Follow-up Activity

- Make a leaflet to encourage people to avoid noisy behaviors. The leaflet should point out sources of noise pollution, effects of noise pollution on humans and non-humans, and people's actions to reduce the level of noise in the community.
- Ask your parents to suggest actions to reduce noise pollution at home and in your local area.
- Make models of fire trucks, jet planes, and industrial machines.
- Collect items which help minimize noise and display them at school.

Additional Investigation

As you learn about pollution, you should know that there are other serious pollution problems hurting the environment, such as garbage, chemicals, fertilizers, broken vehicles – these are land pollutants.

In Jordan, homes, factories and shops dispose of hundreds of tons of waste every year. Most of this waste is thrown on the land or buried in it. Therefore, a new type of pollution exists. This type of pollution is land pollution (Porter et al. 49).

Think about the problem of land pollution.

- recognize an environmental problem related to land pollution;
- discuss the problem with your friends, brothers or sisters, teachers, and parents;
- define the problem of land pollution, particularly in your area;
- collect information, use the school library, ask people, and cooperate with your friend;
- organize the collected information;
- analyze the information;
- generate alternative solutions;
- develop a plan of action;
- investigate one cause of land pollution in your area. Apply problem-solving steps to deal with it. Write a report about it.

Remember!

- Harmful gases must not be released.
- Industrial waste and sewage must not be dumped.
- Horns, loudspeakers and machines must not be heard.
- Waste, chemicals, and fertilizers must not be thrown on land.

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Feryal Oweis

Dimensions of Jordan's Water Problem

Introduction

This chapter will introduce a number of Environmental Literacy (EL) activities related to Jordan's water problem. They are designed for use by science, geography and vocational schoolteachers (both in-service and pre-service), for supervisors of both the Ministry of Education (MOE) and University staff, as well as for parents and their children. These activities aim at enhancing the awareness and understanding of Jordanian students about important aspects related to the country's problematic water situation. School children represent a sizeable portion of Jordanian society. One might hope that providing them with an awareness and understanding of water-related issues will go a long way in transferring that knowledge to the whole community.

Water is one of Jordan's most important natural resources and requires attention and careful study, especially in light of the complexity of problems involved. It is essential for every Jordanian to be involved in the effort of protecting this most precious resource. People can get involved with water protection through well-planned programs and achievable goals. Jordan's water situation is characterized by different problems. The first one is its scarceness and the limited number of renewable resources (Ministry of Water). This problem was exacerbated by an excessive population increase over the last 25 years. The population increase is related to three major reasons:

The waves of migration of Palestinians (fugitives) in the years after 1948; the influx of Jordanians and Palestinians returning to the country in the aftermath of the "Gulf War" of 1991; the high fertility rate among Jordanians, which has resulted in a population growth of about 3.6 % annually (GTZ).

Consequently, the amount of fresh water available to each person is decreasing each year. This problem is the source of an endless debate among responsible people and government agencies seeking solutions to the following questions: How can clean, fresh water be provided for the entire population, and how can Jordan's water resources be saved and responsibly managed? Another urgent and important problem affecting Jordan's water resources is this: many water resources are polluted as a result of bad waste management processes used by industry, agriculture and social engineering (Al-Kofahi). This limits both the quantity and quality of available fresh and healthy drinking water. Pollutants from industrial waste, from sewage water treatment plants, and from

the solid waste dump sites are the most common threats to the quality of drinking water in Jordan. Those pollutants require thorough management in order to minimize their effects on Jordan's fresh water supply and in order to improve the state of health of its population (UNICEF). A safe water supply is the right of every person in this world. Most of the old civilizations cropped up in places where a fresh water supply existed. Humans always have sought water as a precious element that is intimately connected to every aspect of our lives, including drinking water, water for cleaning and cooking, for irrigation and watering, and for transportation (Baez).

The following activities illustrate a number of aspects and examples of the dimensions of Jordan's water problem. They will show a number of unusual ways to introduce the discussion of different water-related problems. Students' mental and psychomotoric skills can be improved through problem-solving tasks. In addition, the activities aim at improving student attitudes and patterns of behavior about saving and protecting natural resources. The activities may encourage students to share ideas with family, friends, and neighbors. At the beginning of each set of activities, background information about the specific problem is briefly provided. In the following chapter, six dimensions of the water problem are described and a number of classroom activities introduced.

Six dimensions of the water problem

This section covers six different dimensions of the water problem and introduces a number of associated activities, including:

1. Limited water resources
2. Leakage
3. Increasing rate of Population Growth
4. Water Management
5. Pollution
6. Economical Aspects

1. Limited water resources

Jordan is considered one of the planet's ten countries with the poorest water resources (Hadidi and Sallak). This requires an understanding of Jordan's actual situation in terms of its water resources and availability. Such an understanding may encourage each person within a community to share their ideas on dealing with and solving the problem (Bani Hani).

Water resources in Jordan can be divided into three main categories:

- Surface water: Considered to make up the largest portion of Jordan's water resources, about 600 million cubic meters (m^3) in 1995. Its amount varies from year to year according to the rate of rainfall (Al-Kofahi). It can be

subdivided into four main forms. First, catchments, perennial flows and seasonal flows. Second, lakes such as Tiberias, which stores all of upper Jordan's surface water but is used as a reservoir by Israel only (GTZ). Third, there are about 21 dams and reservoirs in Jordan, some of them in use before 1972, some before 1990, others under construction, and the rest planned for construction. The total capacity of these reservoirs is about 164 mcm (GTZ). Fourth, flood water, an integral part of the surface water in Jordan. With 332 mcm annually (GTZ) it accounts for 48 % of the surface water total.

- Groundwater: Considered to be the main source of fresh and drinking water in Jordan. It consists of renewable and nonrenewable parts There are twelve groundwater basins distributed all over Jordan in different geographical settings. Three examples: The Red Sea basin in the south, the Yarmouk basin in the north, and the Azraq basin in the eastern part of Jordan (GTZ). The total capacity of Jordan's groundwater supply is 407 mcm (Al-Kofahi).
- Wastewater treatment plants: There are fourteen plants with various capacities in different regions of the country. Together, they represent the smallest portion of Jordan's water resources (Al-Kofahi). The water is used mainly for agricultural purposes, where 58 mcm were treated in 1992. The figure was expected to be as high as 75 to 100 mcm per year by 2000 (GTZ).

All of these resources and their storage volumes are subject to seasonal variations depending on the rate of rainfall. The rate of rainfall varies each year. There is, however, an altogether generally rather low rate in Jordan, only about 7,200 mcm per year on average (Al-Tall, A.). This creates an imbalance between the availability of water in real terms and future predictions in this country. Nevertheless, the 1999 Annual Report of the Ministry of Water shows that the amount of water consumed from all the resources available was much higher than the amount stored or restorable in the renewable basins and reservoirs of Jordan. For example, in 1999 the rate of rainfall was only 35 % of the average, which resulted in a shortage for recharging the reservoirs. They were filled to only 30 % of their capacity that year. In addition, the combined amount of drinking water stored in all its renewable sources was 208 mcm, while the total consumption of water was 283 mcm with a 9 % shortage (Ministry of Water). This example illustrates the problem's urgency and deserves greatest attention. New and creative strategies must be considered to overcome the problem and to avoid negative consequences on the country's social, economical, environmental, and health sectors. The demand for water will increase as the population becomes more educated. The costs of planned water projects and the improved infrastructure that is necessary to overcome the

problem of an ever-increasing demand, pose a challenge of the highest order to the country's economy. Salt-crusted soils, which are the product of water drying on irrigated land, pose an environmental problem. Also, the population's health, in a situation where high-quality drinking water and clean water are limited, is of major concern (Al-Tall).

It should be clear by now that Jordan seriously suffers from its limited water resources. The following activities clarify the problem by concentrating on water resources available in Jordan.

Role Play
Grades: 4-6
Objectives: After participating in this activity, students should be able to:

- express their understanding of the different stages of the water cycle; know where our water comes from;

be aware of different types of natural water supplies.
Procedure: The teacher

- discusses the water cycle with the students and explains to them the role of (sea, sun, clouds, rain and snow, rivers and floods);
- asks the students to draw a diagram of the water cycle on paper;
- asks five volunteers to play the role of sea, sun, clouds, rain and snow, rivers and floods;
- asks each student to talk about the role of the element he/she is enacting.

Follow-up questions: The teacher may ask the following

- Define the water cycle in nature.
- What do you think would happen if one of the elements of the water cycle was missing?
- Where does our drinking water come from?

Data Collection
Grades: 7-8
Objectives: After engaging in this activity, students should be able to

- use different strategies to collect data about water resources in Jordan;
- present their data to their classmates;
- discuss with their classmates the information they have collected;
- make predictions about the future water situation;

suggest solutions for future water resources.
Procedure: The teacher

- divides her class into four groups;
- the first group collects data about the groundwater basins in Jordan, their locations and capacities;
- the second group collects data about surface water, its locations and capacities;
- the third group does the same for wastewater treatment plants;

- each group presents their data to their classmates;
- the fourth group prepares a map of Jordan, and plots the data collected by the first three groups on the map;
- the class discusses the locations and the capacity of the various water resources in Jordan.

Follow-up questions: The teacher may ask

- What do you think about the distribution of the water supply sources in Jordan? Is this distribution equal for all the regions in Jordan? Is it fair?
- Are there any relations between this distribution and the density of population in different regions? How and in what way?

2. Leakage

Water leaking from the networks is another water problem in Jordan (UNICEF). This problem results from the bad repair that the water pipes and networks are in. These networks have become old and rusty over time, damaging the pipes. And the damaged pipes in turn have caused two different problems. Firstly, a large quantity of water is leaking through these pipes, with losses of vast amounts of water, actually of up to 50 % of the water going through these pipes in some cases (Al-Kofahi). This contributes to the reduction of fresh and drinking water resources.[1] Secondly, the defective pipes eventually fill up with debris, rocks and soil. This further reduces their ability of transporting the right amount of water. In addition to this, polluted water sometimes will escape from nearby sanitary plants and enter these networks and pollute the water they carry. This leads to a loss of water quality, which can no longer serve as drinking water. It is worth mentioning that the government through the Ministry of Water has started a project of replacing these old networks with new ones in Jordan (Ministry of Water).

This problem has several consequences in the social, economical, environmental and health areas. Social effects result when people are obliged to change lifestyles for the shortage of water. Economical effects result when the government sets a priority to invest money to replace or rehabilitate the old networks with new ones, thereby taking monies away from other areas of concern. The environment is affected when the water supply is polluted to the point that it causes disorder in the natural environment. And, worst of all, health effects result as people drink water of bad quality that in turn causes various diseases and loss of health.

Leakage problems also are caused through ignorance such as poor maintenance of dripping pipes and leaking faucets.

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[1] (This information was reported by Jordanian consulting engineer co. supervising water projects in Amman).

Calculation

Grades: 4-6

Objectives: After participating in this activity, students should be able to

- calculate the amount of water lost through a small leak from a household tap;
- appreciate the amount of water lost through a small leak from a household tap;
- express their feelings towards irresponsible behavior such as not closing taps firmly.

Procedure: The teacher introduces a poster of a leaking tap to her students, asking

- What do you see?
- What do you think should be done?
- Why?

Then the teacher asks the students to calculate the amount of water that could be lost from this tap during the course of one night if the faucet loses two liters each hour.

She then discusses the results with the students in terms of questions such as

- What do you think about this result?
- How do you feel about the water lost in this way: Is it alright for water to be lost this easily?
- Where does the water go?

Then she asks the students to

- estimate how many persons would lose their drinking water because of this lost amount of water, and for how many days (presuming that each person needs one liter of water per day).

Poster

Grades: 6-8

Objectives: After engaging in this activity, students should be able to

- appreciate the importance of saving water from leakage;
- participate in enhancing their school mates' awareness about ways of saving water from leaking;

develop positive attitudes towards managing water leakage in their homes.

Procedure: The teacher divides her class into several groups;

- asks each group to design a poster to hang in their school that gives advice on
  a. How to deal with leakage in their homes,
  b. Why it is important to prevent water from leaking.

3. Increasing Rate of Population-Growth

Jordan's population has increased rapidly since 1948. By 1961, the population in Jordan had increased 4.6 times. The growth rate of Jordan's population is about 3.6 % annually (GTZ).

Population is an important element in the study of supply and demand of water, and population growth can be a major determinant for water distribution among the different domains of consumption, such as domestic and social activities (GTZ). Therefore, the growth of population in Jordan adds to the water problem, considering that fresh water resources are limited, and that there is dependence on the seasonal rainfall, the yield of which is usually unpredictable (Salameh). This adds to increasing the efforts by the government and especially by the Ministry of Water to find solutions and to look for possible alternatives in order to satisfy demand for water for every person. This situation will also have social, economical, environmental, and health implications for the community (Al-Labadi).

Investigation

(This is an investigative activity about the past, current and future consumption of water in Jordan, and its relation to the rate of growth of population.)

Grades: 7-8

Objectives: After engaging in this activity, students should be able to

- gauge sources of information about the relationship between water consumption and the rate of population growth;
- have a clearer picture about the past, current and future demand on water in Jordan and its relationship to population growth;
- predict the future demands on water in relation to population growth and to water resources available in Jordan;
- make suggestions of what might be done to satisfy the future demand on water in Jordan.

Procedure: The students

- conduct a general discussion about water consumption and its demands in Jordan, at present and for the future, highlighting existing potentials and future problems related to population growth;
- calculate the rate of water consumption for the last 10 years and compare this to the rate of population growth;
- present their findings to their classmates;
- predict this relation for the next 10 and 20 years, extrapolate with the aid of a diagram;
- present their findings and ideas to the class;
- analyze and evaluate the given and the future water demands in terms of population-growth, emphasizing that water will become a strategic issue of Jordan's policy.

Follow-up questions: The teacher may ask

- How do you feel about the future of water in Jordan?
- What can you do to pass on the knowledge you have gained to your community?
- What can you do to help your community to deal with this problem?

Extrapolation

Grades: 6-8

Description: Daily water use in homes varies from household to household according to family size, life style and the facilities available in each home. Some homes may have large gardens, more than one car and many persons living together. These will typically consume more water than small homes without gardens, etc. What follows is an activity to estimate the daily use of water in a family of average size. The aim is to show how much water can be saved if family members think about their behavior (and are willing to change their habits) related to daily use of water (Salameh).

Objectives: After this activity, students should be able to

- appreciate that water is wasted through our patterns of everyday use;
- estimate the amount of water that is wasted through our everyday use; acquire positive attitudes and behaviors towards saving water in their everyday consumption of water;
- transmit this insight to their classmates, schoolmates and families.

Procedure: The students conduct a brainstorming session about their everyday patterns of using water;

- make a list of these uses;
- categorize everyday uses of water into three main groups:
  a. necessary uses,
  b. less necessary,
  c. unnecessary;
- estimate the amount of water consumed everyday for each use and give a sum for a, b, and c;
- compare the sum of a, b, and c;
- think about ways of reducing the amount of water consumed in a, b, and c;
- give an estimated sum of the amount of water that might be saved;
- compare the amount of water consumed to the amount that could be saved (ratio);
- in small groups, list the actions that can help reduce everyday water use.

Follow-up activities: The teacher may ask the students to do extra activities to further enhance their attitudes towards saving water, such as

- design posters that show possible ways of saving water in homes and hang them up in their school;
- design posters depicting wasteful ways with water;

- focus on the flushing of toilets, and calculate how much fresh water is used every day if each time twelve liters are used and the average family size is six persons and each person flushes the toilet two times per day. How much water would be used in the entire country if 80 % of Jordanians flushed the toilet two times per day (Jordan's population is five million people)?
- Give good advice to reduce the fresh water consumed by flushing the toilet.

4. Water Management

Poor water management is another aspect of Jordan's water problem. Management procedures are among the most important steps towards a resolution of the complex water situation (Abedah). Managing water resources successfully and wisely is crucial to coping with limited resources, pollution, economical and (perhaps, worst of all) the overuse of water resources (Al-Labadi).

Joudeh defines successful water management, as "a comprehensive process that enforces the relation between water and people's economical and health needs in the community." He also claims that water management activities should be flexible and changeable according to unexpected conditions and aim at sustainability. Sustainable water improvement takes three main angles into consideration: National strategies for the conservation of water resources, a national plan for environmental protection, and planning for economical and social improvement.

One of the management activities by the Ministry of Water and related sectors on the national level is the "Water Awareness Program in Jordan". This program includes a comprehensive description of the actual water situation in Jordan, communicates it to the public by way of mass media and produces different kinds of posters for schools. This program aims at encouraging Jordanians about the reality of the water situation in their country, and to raise awareness towards saving water resources and to manage them wisely and carefully (Al Zoubi). Another activity relates to the field of agriculture by demonstrating to farmers different ways of managing rainfall and water harvesting arrangements, as well as modern facilities for irrigation and for recycling wastewater in order to contribute to saving water (Abu Sharar). Moreover, reuse of recycled industrial wastewater in other projects was suggested (Al-Tall, M.). Other important management projects that have been planned by the Ministry of Water to reduce the waste of water are replacement and repair of water networks, expansion of water treatment plants, the drilling of new water wells (Al-Tall, A.).

Calculation
Grades: 6-8
Description: A calculation about water harvesting. Water harvesting is one of the management processes suggested by the Ministry of Water as a tool to participate in saving rain water in homes and on farms.
Objectives: After engaging in this activity, students should be able to

- understand and appreciate the role of water harvesting activities for the collection and saving of water in homes;
- calculate the amount of water that can be saved using this action in homes;
- apply their mathematical and scientific skills.

Procedure: The students may

- conduct a plenary discussion about water harvesting strategies and their uses and applications at home and in agriculture. They emphasize the meaning of water harvesting, its use in homes, the advantages of its use and the arrangements for homes that must be taken care of prior to the commencement of water harvesting activities;
- give an example of a house that is using water harvesting by collecting water from the roof to a cistern, e.g. presume that one house has a cistern connected to the roof via a rain pipe. Given that the size of the well is 16 cubic meters and the roof surface area is 160 square meters, how many millimeters units of rain water does it take to fill the cistern?
- transform the amount of water collected by this well into liters;
- calculate: if this cistern covers 30 % of the family's everyday use of water, what are some of the water saving effects on the family budget and on the economy?
- *Follow-up activities:* The students may do further activities to enhance their knowledge about nation-wide water management projects, including: do an investigation about different water harvesting strategies used in agriculture;
- interview managers in the Ministry of Water and other related societies about water management activities;
- design a poster that shows advantages of different water harvesting activities.

5. Pollution

Water pollution is considered one of the major water problems not only in Jordan, but worldwide. This is because quality water is absolutely essential for human health and diet. Clean water is at the core of different tasks of human life, such as cooking, cleaning, bathing and many other social activities, in addition to its uses in agriculture and industry. In other words, water is very important on the social and economical levels, and all its uses have a direct connection to the human state of health (UNICEF).

Al-Jayousy claims that the water pollution problem in Jordan is unique, because the government is the only party that examines the quality of water and decides the standards acceptable for its uses (through the Royal Jordan Society and the Ministry of Water). The two agencies do not make results of their water examination activities accessible to the public.[2] This policy generates a degree of distrust among the population. Many of the residents of Amman are purchasing imported and/or bottled water, especially after an incident of pollution at the Zay water plant in 1988 (Al-Hiary). Water pollutants can be divided into two main groups, as Al-Joyously points out, harmful pollutants, and non-harmful pollutants, solvent pollutants, suspended pollutants, precipitant pollutants, plants or/ and small organisms, chemical compounds.

Non-harmful pollutants are those that exist in a low percentage in water, such as elements like iron, hydrogen sulfur, chlorine, manganese and soda, in addition to some organic substances that cause water turbidity. The existence of water pollutants can cause dreadful results for human health.

Some of the health problems that might result from different kinds of water pollutants are

- Cancer caused by chemical pollutants that are found at the bottom of lakes and reservoirs and contain lead and mercury (Hattar).
- Organic compounds: substances that initially have a weak effect on human health but accumulate over time into poisons that cause cancer and other diseases. Some examples of these organic substances are DDT, Dicofol, PCBs and PBBs. These substances enter human bodies especially through the consumption of seafood that might contain them (Hattar).
- Highly poisonous industrial wastes, such as PCB and Dioxin, acidic water, chlorine and others. It is worth mentioning that adding chlorine to water that is polluted with organic substances results in the formation of new compounds known as trihalomethane which are carcinogens cancerogenous (Hattar).
- Infant diseases affecting mostly newborns between three and six months of age. These are caused by nitrates released from pesticides. The infants' digestive systems at this age turns nitrate into nitrite which combines with the hemoglobin and disables transfer of oxygen to the rest of the body (Hattar).
- High blood pressure and other diseases that affect different parts of the human body such as the hearing senses of the elderly in addition to anemia. These are caused by lead in water that comes from runoff of paints, soil and cars that infiltrate the water main. Some people use softeners at homes

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[2] This author tried to obtain some information from the Royal Society in Amman, but was told that they didn't have the authority to make it accessible to the public.

to reduce hardness of water, which increase the water's acidity so that lead becomes soluble in it (Hattar).

Some Examples of Polluted Water Resources in Jordan:

Al Zarqa river: This river is located in the northeast of Amman. It runs through Zarqa, Resayfeh and Jerash in a region full of industries. Most of the industrial chemical wastes are being discharged into this river, polluting it to the degree that it is barely useable even for agricultural (or any other) purposes. (Al-Kofahi).

Al Bqourieh, Al Sheridan and Haggier water mains: These water mains are supposed to supply the Salt region with water. They suffer, however, from a high degree of acidity, and carry water that is especially hard because it contains a high percentage of calcium, magnesium and bicarbonate, in addition to a high level of salt, and many kinds of visible pollutants. The main cause of pollution in these water mains is the fact that the sewage water pipelines are located close to the water mains and that these pipelines are not sealed well enough to prevent leakage (Al-Hadidi).

Zay treatment plant: This plant is located northwest of Salt. It supplies Amman with drinking water. The pollution problem in this plant began in 1998, when people complained about badly smelling drinking water. The pollution in this plant is caused by bio-organisms, such as various kinds of bacteria; (the ministry of health always acknowledged and monitored the existence of these bacteria) various kinds of algae that cause bad smelling water; free living organisms such as nematode micro worms and the protozoa such as giardia. Giardia is a killing organism.

Chemical pollutants: These consist of non-organic and organic chemical pollutants. Non-organic chemical pollutants are made up of different groups:

- zinc, lead, mercury and chrome;
- copper, iron, zinc manganese and cobalt;
- radioactive pollutants such as alpha and beta particles;
- phosphate, nitrate and ammonia from agricultural activities.

Organic chemical pollutants result from human and agricultural activities. These pollutants consist of a group of substances too long to be listed here.

Organic chemical pollutants result from the addition of chlorine to water and contain lots of algae, thereby producing the poisonous compound (Al-Hiari). The pollution problem is one of the most serious water problems in Jordan because of its many health effects on people in different age groups. Many human lives have been lost to cancer and other diseases caused by polluted water, which translates into a major loss to Jordan's social and economic life (Hattar).

Field Trip "Zarqa River"
Grades: 7-9
Description: Industrial and sewage wastewater is the main source of pollutants of the Zarqa river. These pollutants have contaminated the water in the river to a degree that limits its uses to the point of impossibility. Students may participate in a field trip and visit different industries located along the river to collect data about discharge and emissions from these industries.
Objectives: After this visit, students should be able to

- know different industries along the Zarqa river with regards to
- their products, nature of waste materials, their methods of waste management: How do they test the toxicity of emissions; describe the amount of pollutants produced by these industries and discharged into the river;
- suggest solutions to the problem of reducing the amount of pollutants discharged into the river.

Procedure:

1. Teacher takes her students to the industrial area near the Zarqa river, breaks up the class into four or five groups, has each group visit a different industry, and interview the manager asking the following questions:
   - What kind of goods does this industry produce?
   - What kind of waste does it produce or emit?
   - Where is the waste discharged? Do they test the waste for toxic substances? How is this done and who is in charge?
2. Back in the classroom, each group presents their findings in form of a table that shows:
   - A list of the goods the industry they visited produces;
   - A list of the types of wastes they learned about;
   - The location(s) where waste is discharged;
   - Testing for toxic substances: Yes/ No; if yes: how?
3. The students reflect upon their findings to assess the situation along the river. They combine their findings into one poster that is presented to the rest of the school community.

Follow-up activities: About students further investigate

- the effects of this problem on the use of the river for irrigation purposes; health effects on people who live in the area along the river, in terms of intensity and frequency of typical diseases;
- effects on the smell and color of the water.

Investigation
Grades: 6-8
Description: Jordanians in general and especially in Amman have begun to lose their confidence in the safety of tap drinking water when in 1998 drinking water in Amman appeared to be contaminated (Al-Hiari). Many people buy bot-

tled drinking water, believing that the bottles contain mineral water (a different kind of water than that coming from the faucet), which is supposed to be "healthier". However, most of the bottled water is locally produced, with only a small amount being imported from abroad. But are there any differences between the local and the imported bottled drinking water? And between the locally produced waters themselves? Which of the bottled waters are more likely to meet drinking water standards set by the Ministry of Health? This activity encourages students to answer such questions through an investigation.

Objectives: After investigating the drinking water quality, students should be able to

- engage in an investigative activity;
- know about different kinds and resources of bottled water in Jordan;
- compare between different kinds of bottled water – local and imported, in terms of compliance to Ministry of Health standards;
- communicate what they have learned to other children;
- make appropriate recommendations about those samples of bottled water that comply to Ministry of Health standards.

Procedure: The teacher

- introduces the topic and motivates the students to participate in the activity;
- divides the class into two groups, one to investigate different bottled drinking water resources and to list the information on the labels of these bottles, the second to investigate drinking water standards set by the Ministry of Health;
- representatives of each group present the findings;
- students from the two groups prepare a compliance sheet that shows the data given on the labels of the bottled water and deviations from Ministry of Health standards and requirements;
- they prepare a list of recommendations as to the status of bottled water on the market.

Follow-up activities: The teacher may encourage the students to do more research about locally bottled water on the Jordanian market in terms of

- the sources of the water in these bottles;
- the ways they are advertised;
- the nature of the water sold: Is it underground (mineral) water from a natural well or is it manufactured (retreated tap) water?
- the cost of the bottled water to the customer.
- the costs in terms of waste produced: What is done with the empty plastic bottles?

Acid Rain
Grades: 9-10
Description: In addition to those already mentioned, there are other sources of water pollution. Acid rain represents a different pollutant in water. Do we have acid rain in Jordan? Does it pollute our water sources? What are the causes and effects of acid rain in Jordan? How can we examine the acidity of rain water? What can be done to reduce the acidity of rain water? It is questions such as these that students are trying to answer in the course of the project suggested.
Objectives: After completion of this project, students should be able to

- perform a project-oriented activity;
- outline origins of acid rain and water problems associated with them;
- describe acid rain as a source of pollution to water resources;
- name the causes and effects of acid rain;
- apply measuring skills and tools within the context of acid rain.

Procedure: Teacher introduces the concept of acid rain as an additional water pollutant; she motivates her students to perform a project that might provide answers to questions such as:

- Is our rain acidic?
- What causes acid rain?
- What are possible effects of acid rain on water resources and other parts of nature?
- How can we find out if our drinking water is acidic or not?

Follow-up activities: Students do the following activities to expand their knowledge about acid rain
Examination: A group of students collects a number of drinking water samples such as tap water, bottled water, rain water collected in cisterns, underground water from a stream. Then the teacher asks the students to examine the acidity in these samples, providing them with the acid test paper strips available from pharmacies to determine the pH-value of liquids, and demonstrating the use of the strips as prescribed on the packages. Students present the results of their investigation and try to assess the outcome's acceptability. They discuss their findings and formulate recommendations about the protection of drinking water against acidification.

Problem solving: Students participate in a brainstorming, problem-solving effort as to "What can be done to reduce acidity in rain water?"

6. Economical Aspects

Jordan's natural resources are limited. This has made it a poor country in terms of its economical situation. Jordan's economy relies to a large degree on agriculture, which consumes 75 % of the total water resources available (Far-

dos and Al-Shrouf). Hence, problems with water will affect agriculture directly because it depends on water for its survival. With less water available for irrigation, agricultural products and goods must be purchased from other countries to cover demand. Additional expenses will exacerbate economical problems. Moreover, water is basic to industrial use. Industry is another important income for Jordan to support the national budget, foremost by exports of phosphate, concrete and agricultural and processed produce. If the water supply is limited, industrial development will also be affected, which in turn will cause more financial problems in terms of foreign trade. Such considerations have led the Jordanian government to invest a great deal of financial resources into possible solutions to the water problem. Several infrastructure projects were initiated, dealing with wastewater plants, with drilling for water, and with pumping water from the aquifer and from underground wells, from lakes and reservoirs as well as the adaptation of new agricultural strategies (Ministry of Water). The costs for these projects are high, even though Jordan's financial resources are as limited as its economical natural resources. This has led to an increase in the national debt from funding provided by foreign donors, countries, and international agencies such as the World Bank. Borrowing money has put Jordan on a track of more economical problems, with obligations to pay money back to lenders in the future, and the payment of interest on loans (GTZ). Most of the water projects in Jordan are supported by different international financial organizations such as the American USAID, the German GTZ, the European Union, and Japan, in the form of long-term loans (Ministry of Water).

Even this brief description of the state of Jordan's water supply should clarify that the country faces a complicated situation due to its limited resources, the pollution problem and the future demands of its population. The related health and environmental consequences can also be described in economic terms. All of this is committing different national and governmental sectors in Jordan to expand their greatest efforts to protect and preserve our water supply , and to manage it effectively and wisely with regards to all aspects of the needs of our community.

Brainstorming
Grades: 6-8
Description: Economical problems and problems of water supply are like two faces of one coin. If there are problems with water, then it is the economy that is called for the solution of these problems. By the same token, economical problems will inevitably affect the water supply such as shutdowns of construction of reservoirs etc.
Objectives: After engaging in this activity, students should be able to

- gather as many ideas as possible about the effects of water problems and their relationship to the economy;
- appreciate the financial effects caused by different water-related problems by pointing out the economical aspect of each of the problems mentioned.

Procedure: The students

- brainstorm and share their ideas about the relation between water-related problems and the economy;
- explain their ideas and discuss them with their classmates;
- design a poster that shows this relation and its effects on the economy.

Investigation

Grades: 6-8

Description: There are different water-related construction projects in Jordan, such as water treatment plants, networks, wastewater treatment plants, and drill and pump stations with pipelines to carry water over long distances. All these projects are in need of financial support. What is the cost (rough estimation) of these projects? Who finances them?

Objectives: After this investigation, students should be able to

- conduct an investigation to collect data and learn about the relationship between water-related construction projects, their financing and costs;
- appreciate the efforts done by the government, the Ministry of Water, the contracting companies and the related societies in attaining the water development projects in Jordan, by pointing out the contribution of each of these agencies to the task;
- communicate and present their findings to their classmates and schoolmates.

Procedure: The students

- investigate different water-related construction projects completed in Jordan (water treatment plants are an example) in terms of the kind of project, its size, its location, its costs, its capacity, its financing;
- present their findings to their classmates emphasizing cost and financial sources (to be presented in table format if the students investigate more than one project);
- reflect upon their findings in terms of the relationship between water-related projects and the economy of the country.

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RESOURCES

Theodora D. Baz

Environmental Resources in Jordan

A. Environmental Education and Public Awareness

Jordanian habitats and wildlife communities have undergone significant changes over the centuries and continue to be threatened by a number of factors. A rapidly expanding population, industrial pollution, and habitat loss due to development have taken a toll on Jordan's environment.

In recent decades, Jordan has addressed these threats to its environment, beginning the process of revising environmental decline. A true foundation of environmental protection requires awareness upon the part of population, and a number of governmental and non-governmental organizations (NGOs) became actively involved in educating the populace about environmental issues.

In order to maintain a viable resource base for economic growth, Jordan adopted a national environmental strategy. With help from the International Union for the Conservation of Nature (IUCN), a team of Jordanian specialists completed a practical and comprehensive working document entitled National Environment Strategy for Jordan in May 1992. The document is a long-term environment blueprint for government, NGOs, private sector businesses, communities and individuals. The strategy addresses the areas of agriculture, air pollution, coastal and marine life, mineral resources, wildlife and habitat preservation, population, and water resources. The strategy is based on the fundamental principle of sustainable development, which the report defines as "development which increasingly meets human needs, without depleting the matter and energy of the ecosystem upon which development is founded." The document presents specific recommendations, addressing the areas of agriculture, air pollution, coastal and marine life, cultural resources, mineral resources, wildlife and habitat, population, and water resources. Moreover, the plan outlines five strategic initiatives for facilitating and institutionalizing long-term progress in the environment:

- Construction of a comprehensive legal framework for environmental management.
- Strengthening of existing environmental institutions and agencies.
- An expanded role for Jordan's protected areas.
- Promotion of public awareness of and participation in environmental protection programs.
- Priority to water conservation and slowing Jordan's population growth.

To ensure that future generations inherit a country that is still beautiful and of better quality to its people, the Ministry of Education has introduced a new literature into the government's school curriculum to promote awareness of environmental issues among young students. In collaboration with several local environmental societies, they have also encouraged the formation of environmental clubs in schools where students may join environmental campaigns, participate in environmental camps, seminars, conferences, field activities, media and environmental competitions for school and university students.

The strong and influential environmental societies have been successfully encouraging a wide range of activities in schools, which include paper recycling, studies of wildflowers and animals, investigating local environmental problems, visits to nature reserves and museums, games and competitions, lectures and discussions on environmental topics, helping to establish public parks, presenting exhibitions, in addition to practical projects like tree planting and clean-up campaigns. Schools are also encouraging student participation in a number of activities during the special environmental events (see table at the end of this article). These activities will ensure that some of the knowledge acquired in the classroom is applied in practical ways to the good of the environment and the local community. Encouraging such activities can also help change behavior and instill a spirit of innovation and creativity among children. Through collaboration between the public sector, represented by the Ministry of Education, and the private, voluntary sector, represented by the environmental societies, school environmental clubs may become vehicles for many activities, and may serve as a vital link between the school and the community.

In this chapter, a description of the environmental societies and natural reserves in Jordan will be presented, followed by a list of environmental events.

B. Environmental Societies

1. The General Corporation for Environmental Protection

Tel.: 5350149
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P.O. Box 1408
Amman 11941 Jordan
Web site: www.nic.gov.jo

In the past, environmental concerns were the responsibility of the ministries and municipalities through their related sections. In 1980, the first environmental institution was established in Jordan, the "Department of Environment". It was affiliated with the Ministry of Municipal, Rural Affairs, and Environment. In 1995, the first comprehensive Law of Environmental Protection (no. 12) was issued by which the "General Corporation for Environmental Protection" was established as an official public entity to replace the Depart-

ment of Environment. The GCEP is considered the main authority for the protection of the environment in the country. The Minister of Municipal, Rural Affairs and Environment (MMRAE) chairs the Environment Protection Council (EPC), which consists of 23 members representing a number of ministries and agencies concerned with environmental issues. The EPC's main task is to set environmental policies, while the GCEP is the executive agency for these policies through its directorates and divisions. As the environmental issues were getting more attention, many ministries established departments of environment to deal with specific environmental concerns, for example: The Ministry of Health established the Department of Environmental Health; The Ministry of Water and Irrigation established the Department of Information and Water Awareness. The GCEP is the national umbrella of all environmental organizations, both public and private. It includes a number of directorates to deal with local environmental issues, such as environmental education and public awareness, water quality, air quality, land and agriculture, wildlife and nature, flora, environmental health, and waste management. Some units have been established to deal with international agreements and global environmental concerns, such as industrial pollution, climatic change and biodiversity, solid waste management, and environmental law enforcement.

The UNDP-funded project, Jordan National Agenda 21, launched in 1996, is being implemented by GCEP in order to set the stage to move towards sustainable development.

2. Royal Society for the Conservation of Nature

Tel.: 533 79 31/2
Fax: 534 74 11
P.O. Box 1215
Amman 11941, Jordan
Web site: www.rscn.org.jo

The Royal Society for the Conservation of Nature is an independent, voluntary organization, founded in 1966, devoted to the conservation of natural resources in Jordan, under the patronage of Her Majesty Queen Noor. The mission of the society is to conserve wildlife and wildlife habitats and to integrate conservation with economic development, while promoting wider public support for the protection of the natural environment. The activities of the RSCN include the following:

- Establishing and managing natural reserves and national parks to protect key habitats and species. It is currently responsible for six major reserves, covering over 1,000 square kilometers (km^2)
- Breeding and reintroducing endangered species to save them from becoming extinct. So far, the society has been able to breed the Arabian Oryx, Gazelle, Ibex and other species.

- Enforcing government laws for the protection of wildlife and controlling illegal hunting throughout all regions of the Kingdom.
- Seeking a balance between the needs of wildlife and the needs of people through the development of large-scale conservation programs designed to integrate environmental protection with the socio-economic development of local people.
- The implementation of a large-scale awareness program addressing the public and including a number of TV awareness campaigns and other media campaigns, and the production of Al-Reem magazine.
- Establishing a regional training unit for high-quality vocational training in environmental management in the Middle East.
- Raising awareness of environmental issues through education programs and activities. The Society has set up over 1,000 Nature Conservation Clubs in schools. Clubs are established in cooperation with the Ministry of Education.

The society is seeking to enhance conservation programs for schools through consolidating and improving the effectiveness of the nature club network and influencing the content of the national curriculum.

3. Jordan Environmental Society (JES)

Tel.: 569 98 44
Fax: 569 58 57
P.O. Box 922 821
Amman 11192, Jordan
Website: www.environment.gov.jo/jes.html
E-mail: jes@go.com.jo

This non-profit, private, voluntary organization was first established by a group of university professors, engineers, medical doctors, lawyers, and agricultural specialists under the name "The Jordanian Society for the Control of Environmental Pollution". In 1988, its name was changed to "The Jordan Environment Society" (JES). This society includes 24 branches distributed among the cities and towns of Jordan.

The goals of the society are the following:

- To work toward the adoption of policies and the application of necessary standards and procedures to protect the Jordanian environment and to control pollution.
- To attract concerned people and specialists in the field of environmental protection and provide the appropriate conditions, which are conducive to initiatives and participation in the effort to reach a clean environment.
- To identify environmental pollution problems and participate in finding solutions to them according to priorities and to control all forms and sources of pollution whether industrial, chemical, or biological.

- To promote environmental awareness in all sectors of society and to help create individual and national commitments in dealing with environmental issues and rationalizing the use of its elements.

The activities carried out by the society include:

- Organizing seminars, conference meetings, workshops and participating in events related to environmental protection and concerns on the local, Arab and international levels.
- Inviting concerned people and specialists from the various environmental fields to participate in JES activities.
- Increasing environmental awareness and education programs to promote public awareness of the importance of conserving the environment.
- Exchanging information and experiences with other environmental societies and agencies, issuing of a quarterly periodical "Risalat Aal-Bia" in addition to other publications related to the environment.
- Participating in activities such as environmental (school) campaigns, environmental competitions for school and university students, study circles, field activities, youth camps, media activities, in addition to implementing environmental projects.
- Coordinating with scientific agencies, study and research centers, and other national institutions to promote environmental research.
- Cooperating with the Ministries of Municipal, Rural Affairs and Environment; Education; Higher Education; Agriculture; Water and Irrigation; Information; Health; Awqaf and Islamic Affairs; Energy and Mineral Resources; Finance; Sport and Youth.

The follow-up and continuation of providing public awareness programs, the issuance of publications, in addition to establishing branches and specialized committees are important factors in promoting the society's credibility, increasing volunteer work, and strengthening the environmental movement in Jordan.

The society is affiliated with networks, consortia or umbrella organizations, such as The World Conservation Union (IUCN), Switzerland; International Association on Water Quality (IAWO), England; Environment Liaison Center International (ELCI); and The Arab Network for Development and Environment, Egypt.

4. The Friends of the Environment Society

Tel.: 5514430
Fax: 5514431
P.O.Box 840795
Amman 11184, Jordan
E-mail: foes@nets.com.jo
Websites: www.JNEF1.Foe.org.jo; www.foe.org.jo

The Friends of the Environment Society (FOE) is an independent, non-profit organization formed in 1994. The main founders of the society are groups of Jordanians interested in carrying out environmental community development projects, aimed at encouraging the young generation to take an active part in conserving and improving their natural environment. FOE's main concern is to create an environmentally aware generation by encouraging creativity and innovation among students in solving the environmental problems that face our planet.

The main objectives of the society are to:

- Encourage creativity and innovation among students in addressing environmental issues.
- Utilizing natural energy sources, such as wind, water, sun, etc. to create projects that will serve the country by preserving Jordan's economic resources and promote sustainable development.
- Provide training for the younger generations and enhance the spirit of teamwork in addressing national environmental concerns.
- Create an environmentally aware generation.
- Preserve and protect the environment to ensue a clean and healthy future.
- Encourage the participation of local firms and businesses in efforts to increase environmental awareness.
- Encourage the local business community to contribute to projects aimed at supporting student environmental action.

FOE's primary task is to educate young school children in order to increase their environmental awareness and to prepare graduating school students for the world of work ahead of them by thinking environmentally and by presenting practical solutions to existing environmental issues that take into account the present social, economic and political realities.

Moreover, FOE seeks to address Jordan's chronic environmental issues through collaborating and networking with members of the government, business, and industry to achieve sustainable environmental community development.

The Jordanian Network for Environmentally Friendly Industries is the first such network in Jordan and in fact in the Middle East. It comprises the Friends of the Environment Society in cooperation with the Industrial Development Band and Jordan University of Science and Technology's (JUST) Center for Environmental Sciences & Technology. This network supports industries that are seeking economical solutions to their environmental problems.

5. National Environment and Wildlife Society (NEWS)

Tel.: 515 4640
Fax: 515 4640
P.O. Box: 961983
Amman 11196, Jordan
Website: www.environment.gov.jo/fsnewseng.html

The National Environment and Wildlife Society (NEWS), formerly the Friends of Plants Society, was established as an independent, non-profit, non-governmental organization in 1996. It is engaged in activities in different areas concerning the protection of the environment, wildlife issues, and the promotion of sustainable development. NEWS consists of a team of volunteers addressing different environmental issues. This team refines and disseminates environmental knowledge to assist policymakers and the general pubic in protecting the environment and wildlife and in using natural and environmental resources wisely and sustainably.

The objectives of the society are the following:

- To promote the nutritional environmental health and commercial value of plant resources in Jordan and to encourage people to use them in a proper and sustainable manner.
- To conduct surveys, research, and studies and document the results for local knowledge of the environment and plant resources as a service to the community.
- To encourage public participation in the protection of the environment and nature and to adopt environmentally-sound initiatives.
- To increase the area of vegetation in urban communities, specifically focusing on activities with key intermediary community members, such as journalists and women.
- To work toward the establishment and application of policies, standards and action for the protection and improvement of Jordanian wildlife.
- To keep major environmental elements healthy and balanced by adopting a national framework for the conservation of the environment.
- To decrease environmental pollution.
- To identify local environmental problems and to participate in seeking solutions to these problems in accordance with national priorities.
- To improve the level of environmental awareness among all strata of the Jordanian community.
- To inspire self-commitment and the general attitude toward environmental matters.
- To conserve the use of natural resources, hence creating new positive behavioral patterns toward the environment.

NEWS has more than 150 individual members. They represent public scientists, environmentalists, botanists, journalists, and policymakers. NEWS

publishes a monthly newsletter "Dahnoun" that documents activities and future plans. On the NEWS premises, a bi-monthly program on awareness and information exchange is held.

6. Jordan Society for the Protection of Animals (JSPA)

Tel.: 5865451
Fax: 5865452
P.O. Box: 141697
Amman 11814, Jordan
Website: www.jspa

This society is a branch of the Society for the Protection of Animals, SPANA, which is a London-based, British charity founded in 1923. SPANA aims to enhance positive attitudes in dealing with and caring for animals, and to provide educational skills for the care of animals. The Society aims to promote welfare and good husbandry and aims to prevent cruelty to animals. It provides first aid for working animals. The Educational Program commenced in 1993, in cooperation with the Ministry of Education, and offers regular lectures in schools and has established animals protection clubs in schools. The Educational Program aims at improving the level of care for all animals, overcoming old practices of ignorance, fear and cruelty when dealing with animals and increasing awareness of the important relationship between humans and animals.

7. The Jordanian Society for Desertification Control and Badia Development (JSDCBD)

Tel.: 5651081/2
Fax: 5651082
P.O.Box 910 994
Amman 11191, Jordan
E-mail: jsdc@index.com.jo

This non-governmental society was established in 1990 for the purpose of studying the desertification conditions in Jordan and proposing the necessary solutions.

Its activities include specialized studies and research related to the desertification phenomenum and Badia development. The services of the organization include: the identification of desertification problems, their causes and impact; protecting natural plant cover to establish environmental balances, and elevating public awareness for maintaining and protecting the natural environment. One of its projects is to encourage water harvesting (gathering rainwater) and the use of treated wastewater necessary for developing the Badia to control desertification. It also focuses on media programs to elevate public awareness of desertification and to seek public support for its programs.

Members of networks, consortia or umbrella organization include The World Conservation Union (IUUCN), Switzerland, and the Arab Network for Development and Environment, Egypt.

8. The Fertile Crescent Society

Tel: 5160826
Fax: 5160827
Amman, Jordan

This society was established in 1998 in Amman. The goals of the society are to: 1) maintain the elements of the environment, namely; water, air, and soil sound and unpolluted; 2) identify environmental problems suffered in countries of the region and identify solutions to these problems; 3) encourage scientific research and communication between universities of participant countries; 4) activate the role of public participation in order to develop a national sense for interacting with the environment; and 5) intensify public awareness.

9. Jordan Badia Research & Development Programme (BRDP)

Tel.: 5340401
Fax: 5335284
P.O. Box 36
Jubeiha 11941, Jordan
Website: www.badia.gov.jo

This program was established in 1992 in an effort to combat desertification and the depletion of natural resources. The program aims at improving quality of life through sustainable development in the Jordanian Badia (arid and semi-arid land). Goals are pursued through scientific research and translating the various research projects done over the years into generating benefits for the Bedouin people that will lead to an enhancement of the contribution of the Badia within the national economy and development. The BRDP carries out its functions under the aegis of Jordan's Higher Council for Science and Technology in partnership with the UK's Royal Geographical Society.

10. Jordan Royal Ecological Diving Society (JREDS)

Telefax: 679142
P.O.Box 831051
Amman 11183, Jordan

This non-profit, non-governmental organization was founded by a group of concerned divers who felt the need to protect Aqaba's marine life from further degradation. JREDS's objective is to prevent the destruction of the Gulf of Aqaba through promoting sustainable management of natural marine resources, raising public awareness, encouraging community participation, and conducting environmental monitoring. JREDS is implementing a number of projects and programs, aiming to promote public awareness of the importance

to preserve the marine ecosystem, through printed materials, underwater photography exhibits, beach clean-ups, clean-up dives, and environmental lectures and workshops for school students and community members. The projects are: Sustainable Tourism Project, Mobile Exhibit, Associate Ranger Program, Awareness Raising for Environmental Protection in "Old Town Aqaba", Educational Computer Research Center, Environmental Impact Assessment, in addition to the installation of three coral monitoring stations to monitor the current and future well-being of the coral reef in Aqaba.

11. Royal Scientific Society (RSS) (Environment Research Center)

Tel.: 962-6-84 47 01
Fax: 962-6-84 48 06
P.O.Box: 925 819
Amman 11110, Jordan

The Royal Scientific Society is a non-profit institution that aims at conducting scientific and technological research. It also aims at disseminating awareness in the scientific and technological fields and providing specialized technical consultation and services to the public and private sectors. The RSS has been involved in environmental assessment and protection activities since 1976 through the Environmental Division of the Industrial Chemistry Center. In 1989, the Environmental Research Center (ERC) was established. The main goal of the center is to provide scientific and technical advisory services to the public and private sectors in Jordan in order to enhance the quality of the local environment through waste minimization and pollution prevention techniques and methods. ERC comprises the following three major divisions: Water Quality Division, Air Quality Division, Studies & Design Division, in addition to the Environmental Impact Assessment Unit.

12. Environment and Biodiversity Museum Project for Children

Tel: 566 5195
Fax: 566 5196
E-mail: hayacenterfirstnet@com.jo

This museum was established in 2000 at the Haya Cultural Center. Since the Center's establishment in 1976, it has been dedicated to educate and entertain children. It includes a children's library, a planetarium, a science museum, an art studio, and a theater.

Each year, the center receives thousands of children from all over the country, who benefit from the wide variety of educational and cultural programs offered at the center. Several successful environmental campaigns have been launched to have trees planted by children in the threatened regions. In order to focus children's attention on the environment and to increase their awareness of the environmental problems in Jordan, it was decided to establish an

environmental and biodiversity museum for children. The museum includes educational and live exhibits of great interest to children and introduces them to the following subjects:

- Biodiversity in Jordan;
- importance of biodiversity to other creatures including humans;
- environmental problems threatening animal and plant species and their negative consequences;
- energy consumption and renewable energy.

C. Nature Reserves

The Royal Society for the Conservation of Nature (RSCN) has been given a mandate by the Jordanian Government to set up a network of protected areas. So far it has established six nature reserves, covering about 100 km². The following is a description of the reserves:

Shaumari

Shaumari was the first wildlife reserve in Jordan. Established in 1975 in the eastern desert and located near Azraq, it covers an area of 22 km² on a flat desert scrub. It was created to provide a safe home for the most endangered animal: the Arabian oryx. This magnificent desert animal, originating from the fabled unicorn, was saved from the verge of extinction by an international rescue effort. Shaumari was the first place to have the Arabian oryx back on Arabian soil. In 1978, eight animals were flown from the World Breeding Herd in the zoo of Phoenix, Arizona, to Shaumari. By 1999 – twenty years later – the herd had grown to over 200 animals.

Shaumari is also a breeding center for other endangered or locally-extinct desert animals, including the Persian onager, the ostrich, and the goitered gazelle. The breeding enclosures provide a small zoo for visitors, making it a popular spot for children and school outings. There are many wild animals too, including a wide variety of birds during the spring and autumn.

The reserve serves as an educational center and includes a special visitor's center and education programming. Students can take a walk, watch the oryx, take an oryx safari, use the observation tower, watch birds, and enjoy the visitor's center.

Azraq Desert Oasis

Azraq is a unique wetland located in the heart of the arid Jordanian desert. Established in 1978 in the eastern desert on 12 km² of marshland, it contains several pools, a seasonally flooded marshland, and a large mudflat. A wide variety of birds visits the reserve each year, stopping for a short rest on their long migration between Africa and Europe; or they stay for the winter and some breed in the wetland.

The word Azraq means "blue" in Arabic, and before water pumping began in the 1980s, the oasis provided a sparkling blue jewel in the desert, attracting up to half-a-million migrating birds at any one time. By 1993, however, the extraction of water was so great that no surface water remained and its ecological value was virtually destroyed.

With international support, a rescue effort began in 1994 and a significant portion of the wetland has been restored. Many of the birds for which the oasis was renowned are returning and special boardwalks and observation stations have been constructed to enable visitors to see and enjoy them.

Students can participate in the bird watching activities, walk on the elevated trails through the marsh, experience a green haven in a harsh desert, and enjoy the visitor's center.

Wadi Rum Nature Reserve

Wadi Rum is acclaimed by many as one of the most stunning desert scapes in the world. The sheer granite and sandstone mountain cliffs are 1,750 meters high. Wind and water erosion over the years has sculpted the sandstone of Wadi Rum into a visually impressive wonder of the desert. Wadi Rum is known for its rugged mountain ranges and undulating hills and ridges separated by wide, generally flat-bottomed wadis and sand plains.

Wadi Rum holds plants and animals rare and endemic to its ecosystem. A baseline survey of the Wadi's fauna detected the existence of the gray wolf, Blandford's fox, sand cat, and ibex. Additionally, the site, with its 110 recorded species, is an ideal area for birdwatching. In springtime, many species of wildflowers can be observed.

Wadi Rum can be explored on vehicles that take visitors into the heart of the desert. Camping, hiking and camel-riding are only a few of the activities that can be organized. Presently, the Reserve is settled by semi-nomadic and resident Bedouins who depend mostly on tourism and livestock.

Wadi Rum was designated a protected area in 1998. The project tries to ecologically sustain the tourism operations alongside local community development.

Wadi Mujib Reserve

Established in 1987 on the eastern shore of the Dead Sea on 220 km^2, the Wadi-Mujib Reserve is the lowest-lying nature reserve on earth. Its main habitat consists of rugged, arid mountains and flowing rivers.

The deeply cut sandstone mountains of the Mujib Reserve span an elevation drop of over 1,200 m: from 900 m above sea level to 400m below sea level – the lowest ground level on earth. Because of this dramatic change in altitude and the presence of several flowing rivers, it has many different habitats, supporting a wide variety of plants and animals .

One of the most important animals in Mujib is the Nubian ibex, a large mountain goat, which became threatened as a result of over-hunting. RSCN established a captive breeding center in the Reserve in 1989 and the initial group of 20 ibex has multiplied to over 100 animals. Over 30 of these animals have been successfully returned to the wild.

Mujib is also well known for large carnivores like the regionally scarce striped hyena and the Syrian wolf, and for many kinds of birds. Among the important birds are the lesser kestrel, imperial eagle, Bonelli's eagle, and the Griffon vulture, all of which are declining in number throughout the world. As important as it is for resident birds, the Reserve is strategically important as a safe stop-over for the huge number of birds, which migrate annually along the rift valley between Africa and northeastern Europe.

Visitors can hike the trails, swim in the river, take an adventure tour down the river Mujib, camp in the wilderness, and see the ibex enclosure.

Dana Nature Reserve

The Dana is a system of mountains and valleys, extending from the top of the eastern Rift Valley to the desert lowlands of Wadi Araba, an elevation drop of over 1,600 m. It embraces two major biogeograpical zones and four distinct vegetation zones. This condensed variety of landforms and habitats, combined with dramatic changes in elevation, results in a very high biological diversity. The total number of species recorded so far consists of 697 plants, of which three are new to science, and 282 animals. Many of these animals are now very rare and some threatened with extinction: animals like the gray wolf, Nubian ibex, lesser kestrel, eagle owl, and the desert monitor lizard. So far, 45 endangered or vulnerable animals have been found in the Reserve, making it truly a place of global importance.

Apart from its wildlife, Dana is also rich in archaeology and culture. About 100 archaeological sites have been identified, of which the ancient copper mines in Wadi Feinan are particularly special, being considered the most important archaeological complex in southern Jordan outside of Petra.

Dana might be best known as a model of integrated conservation and development, where protection of biodiversity goes hand-in-hand with improvement of the social and economic welfare of local people. Developmental activities include a substantial ecotourism operation; local artisanship, specifically jewelry-making from silver; and food processing, a goat-fattening scheme for nomadic pastoralists provides plants and more sustainable systems for the use of grazing lands in the Reserve. Over 800 people now benefit from these income-generating schemes, and tourism revenue is covering all the running costs of the Reserve. Visitors can stay on the campsites or in the beautiful guest house, hike the trails or take a guided walk, or see the visitor center.

Ajloun Nature Reserve

This evergreen forest was established in 1988 in north Jordan, near Ajloun on 13 km². Zubia is a reserve of rolling hills covered by woodlands of evergreen oak, interspersed with some pistachio, pine, carob, and wild strawberry trees. These woodlands resemble the original forest, which once covered most of northern Jordan.

Many woodland animals inhabit the reserve, including badgers, foxes, and a few fierce wild boars; and also many typical birds like the great tit, goldfinch, turtle dove, hooded crow, and jay. In spring, there is a profusion of wildflowers with drifts of colorful anemones and wild rock roses.

The Reserve was fenced in to provide a safe release site for the locally-extinct roe deer. But the proximity of several villages and pockets of private land have prevented this release from taking place. Wood cutting, illegal grazing and hunting continue to cause problems for management, and RSCN has been seeking to establish an alternative woodland reserve in the area. Students can take a woodland walk or picnic among the trees.

Environmental Events

No	Event	Date
1	Arbor Day	January 15
2	International Water Day	March 22
3	International Earth Day	April 22
4	International Transportation Day	May 4
5	International Day for Combating Smoking	May 31
6	International Environment Day	June 5
7	International Day for the Prevention of Desertification	June 17
8	International Day for Combating Drugs	June 26
9	International Population Day	July 11
10	Ozone Day	September 16
11	Clean Up the World Campaign	September 23-24
12	Arab Environment Day	October 14
13	International Health Day	October 16
14	Recycling Day	November 15
15	Volunteer Day for Cleaning the Environment	December 8

Sonja Alberts

Databanks as Tools to Promote Environmental Literacy

Introduction

Since ancient times, knowledge about poisonous substances in plants, animals, fungi, and minerals, their detection, avoidance or destruction was essential for human survival. Nearly all harmful substances humans could come into contact with were of natural origin. Their occurrence was often restricted locally, and knowledge about them could be handed down through generations.

With the development of modern civilization, new industrial processes and materials have been invented, and in their wake a whole range of substances hitherto non-existent has been introduced into the everyday life of everyone on this planet. These new substances can be found not only in industrial production and modern agriculture and medicine but also in building materials, food, textiles, domestic products, and in many objects of everyday use.

Because these substances are new and, because there is such a large number of them, it is virtually impossible to gain knowledge about any potentially harmful properties they might have solely through traditional ways of experience. Therefore, this task must be carried out professionally.

The Science of Toxicology

The scientific discipline that studies the harmful effects of substances is called toxicology. It originates from the study of drugs and poisons, and historically evolved out of pharmacology and pathology. During the twentieth century, the medical focus shifted to a more general approach with closer links to applied chemistry, and toxicology established itself as an independent area of research. In recent years, yet another change in perspective has taken place: now, toxicology not only examines the direct influence of chemicals on human health or on a few other species but tries to determine the complex effects, which chemicals can have when they are released into the environment. This branch, which is concerned with ecosystems rather than single species, is called ecotoxicology.

Like in any other science, toxicological knowledge is acquired through research with methods and experiments that must be reproducible. The estab-

lished method of studying the effects of a substance within a living organism is animal experimentation. Animals are specifically bred with the aim of obtaining a maximum of genetic conformity. About 99 % of them are rodents, with an 87 % majority of mice and rats (Müller 10). Unfortunately, research often does not report on the general conditions under which these animals are kept, so that it is often impossible to reconstruct the results exactly.

When a substance is described as toxic, this is not so much a matter of an intrinsic toxicity of the substance itself but has to do with the amount up to which contact with this substance can be tolerated. Therefore, the 1537 dictum by Paracelsus is still the core statement of toxicology: "All things are poison and nothing is without poison - only the dose makes that a thing is not poison" (Müller 6). In addition, the length of time of exposure to a certain substance must also be considered.

The effect of a substance on the organism is described by the relationship between dosage, which is the amount of the substance applied to an animal per kilogram (kg) of its body weight, and the resulting response. If a certain substance shows a certain effect in 50 % of all animals, this dosage is referred to as effective dose ED_{50}. If 50 % of the tested animals die, the dosage applied is referred to as lethal dose LD_{50} (Ballantyne 10).

In order to make these data applicable to humans, they have to be transferred. This can cause several problems, because the metabolism of rodents is somewhat different, which means that the actual toxic effects of a substance are sometimes higher, sometimes smaller, and sometimes quite different in humans. Therefore, risk assessment of substances with regard to their teratogenity (causing harm to the embryo), mutagenity (causing harm to the genes), or carcinogenicity (causing cancer) cannot be made with absolute certainty, as these properties are often not observed in animals. Assessment as to the harmful effects on the central nervous system generally cannot be made at all, because that of most animals is of a different evolutionary stage compared to humans (Müller 11). So, apart from ethical problems, which also need to be considered in connection with animal testing, the development of in-vitro alternatives and other more standardized and reliable methods is highly desirable.

The new complex problems, which chemicals can cause, were for the first time noticed by the general public when Rachel Carson published her book *Silent Spring* in 1962. This study about the environmental damage caused by the indiscriminate use of pesticides was a turning point in the perception of toxicological aspects of chemicals. Until then, a substance was considered safe when it did not show immediate toxic effects on people. Problems like the accumulation of very small amounts of substances inside the body over a prolonged period of time, or accumulation through the food chain, which eventu-

ally might reach dangerous levels, was hardly considered, and the effects a substance might have on wildlife or the ecosystem as a whole were not taken into account. The new awareness brought about new regulations for the use of chemicals, especially for the use of pesticides and for the exposure to chemicals in the workplace, and new forms of mandatory testing for the usage of substances were introduced.

But even the most careful research into potentially harmful properties cannot guarantee absolute safety as many dangerous effects cannot be tested at all or are unknown when a chemical substance is declared safe.

When paints for wood treatment, which effectively stopped wood from rotting and discoloring, became available, this seemed to be a real blessing in the climate of northern Europe. These paints were widely used both outdoors and inside buildings. In the 1980s, it became apparent that prolonged exposure to these paints could cause severe immunological, neurological and hormonal disorders, which virtually ruined the lives of thousands of people (Derner). The levels of the substances, which cause these disorders had been considered safe but eventually proved to be wrong.

Sometimes substances can react synergistically, which means that when occurring together, they produce a new or enhanced effect compared to their separate effects. These synergisms are extremely difficult to assess, even under standardized laboratory conditions. When they have to be examined in complex ecosystems with a considerable variance in environmental conditions, this task can be rightfully described as "finding avenues in a pitch dark labyrinth" (Eijsackers 83). It is therefore very difficult to make any valid statements about the true nature of the effects, which the continuous exposure to a large number of very small amounts of potentially harmful chemicals can have on human health or on the environment as a whole.

Nowadays, when the use of chemicals is discussed, their toxicological properties are of central concern, especially to environmental organizations, which play an important part in disseminating information about the dangers they may possess. The trend that was started by *Silent Spring*, making toxicology a matter of public concern with an ever-increasing number of people trying to protect themselves and their environment from harmful chemicals, produced an ever-increasing number of public literature on the subject, mostly in the form of guides for healthy living.

Information Resources

The classic way of obtaining general knowledge about toxicology is through textbooks. Most are written for academic teaching and try to serve the professional needs of toxicologists, medical students, chemists or biologists. The most important criterion for recommending their use is the date of publication,

because toxicological knowledge is expanding with such speed that the data supplied in books older than ten years tends to be seriously dated. This is, however, a problem even with "new" books, because there is always a considerable lapse of time between the writing and compiling of texts for a book and their actual distribution. Textbooks on general toxicology are, nevertheless, a good starting point for further studies. Details of new books currently available, or of books about to be published, can be obtained from the catalogs of the major scientific publishers.

A book that can be specifically recommended for use in libraries is General and Applied Toxicology, 2nd edition, edited by Bryan Ballantyne, Timothy Marrs and Tore Syverson (London: Macmillan Reference Ltd., 1999). The editors have provided a compilation of articles about most aspects of modern toxicology, taking into account all branches and recent developments. The three volumes give information about fundamental concepts and theories, about the methods used, and about the evaluation of empirical studies. An extensive section deals with toxicological problems related to various body parts and organs, including the immune system. Genetic and reproductive toxicology are also included. There are chapters on environmental chemistry, regulatory and legal problems, and on specific substances such as organic solvents, metals, or food additives. The book also discusses topics often neglected as marginal, such as ethical and moral aspects, animal welfare in the laboratory, or the education of toxicologists. The articles serve an introductory function to the special aspects they discuss.

For more detailed information, it is necessary to look into the various scientific toxicological journals, such as *Archives of Toxicology, Ecotoxicology and Chemistry, Journal of Applied Chemistry, Toxicology Letters.* The articles usually deal with very special topics and research projects and are intended for the information of professional toxicologists. Subscription rates are sometimes substantial, so they are often not available in printed form through ordinary libraries. Some journals are available through the internet, although downloading of articles can be quite expensive.

Other scientific journals such as *Science, Nature,* or *Scientific American,* are more readily available and also publish articles of toxicological content, but usually with a broader approach, so it is worthwhile searching their indices when looking for toxicological topics.

The internet is a new gateway for gathering information on toxicological matters. However, as it is easily accessible to anyone who wishes to publicize material, it is often difficult to ascertain the quality and scientific correctness of the information found. If the URL (Uniform Resource Locator) of a certain site is known, access to this address is no problem. Otherwise the locating of relevant addresses has to be done using the various search engines or subject

directories. Employing Boolean operators is of great help. If you are searching for websites dealing with pesticides in drinking water, the two search entries can be linked by AND, which will retrieve only those sites that contain both entries. Sometimes, however, this method may not produce any results, because the search area indicated was too narrow. It can be broadened by adding other topically related search entries, linking them with OR. A search for *pesticides* AND *drinking water* OR *freshwater* OR *water supply* might be more successful. Another method of broadening the chances of finding relevant sites is the truncation of entries, usually done with the asterisk: entering *toxic** will retrieve all sites which contain the words toxic, toxin, toxicology, toxicological. The operator NOT, which excludes certain entries, should be used with care, because it might unintentionally exclude important search results; entering *drinking water* NOT *rivers* could eliminate useful information. The problem of finding information is very often above all a problem of linguistics, especially if the proper technical terms for the search area in question are unknown.

As a starting point for further inquiry, sites linking to various other sites dealing with toxicology are of great help. The state-funded Institut für Umweltanalytik und Humantoxikologie, ITox (Institute for environmental analysis and toxicology in humans), in Berlin offers such a site with links to various toxicological databases, databanks, fact sheets and libraries all over the world. The ULR is http://www.bbges.de/itox/linksdat.htm. A similar site is available from ECETOC (European Centre for Ecotoxicology and Toxicology of Chemicals) at http://www.ecetoc.org/pages/InterestingLinks.cfm. ECETOC describes itself as a "scientific, non-profit making, non-commercial association, financed by 50 of the leading companies with interest in the manufacture and use of chemicals" (homepage). Their publications are, however, not available free of charge.

Some universities also offer compilations of internet addresses about toxicology and related topics. The University of Düsseldorf in Germany offers many interesting links concerned with environmental protection under their virtual library section: http://www.uni-duesseldorf.de/ulb/uws2.html.

The most extensive collection of toxicology-related data is available through the US National Library of Medicine, or NLM (http://www.nlm.nih.gov). From its homepage, the link *General Information* gives an introduction to the wide range of internet information provided by the NLM, most of which is offered free of charge. The best way to start searching is either via the MEDLINE link or through the library services. The NLM offers several databases about toxicological topics, which are hyperlinked from the Special Information Services, (SISS) page under Toxicology Information: http://sis.nlm.nih.gov/tox_chart.cfm. These databases list specialized literature currently available on

a topic by arranging it into subcategories and giving abstracts of the articles listed. Through this categorization, the lists of abstracts become readable documentations about toxicological problems in their own right. On entering *bis (tributyltin)oxide*, the TOXLINE link, for example, offers one large section on *Human Health Effects* and another on *Environmental Fate and Exposure*, with paragraphs on *Evidence for Carcinogenicity, Probable Routes of Human Exposure, Environmental Bioconcentration*, and *Sediment/Soil Concentration*, among others.

Data retrieval about chemical substances can be easily accomplished by allowing for a wide range of synonyms and by searching for the registry numbers of chemicals used by the Chemical Abstracts Service. These CAS Registry numbers can be found on many listings of potentially harmful chemicals. It must be noted, however, that most of the information given can only be appreciated with a working knowledge of chemistry and a basic understanding of toxicology. For a very small number of chemical substances, the NLM offers easy-to-read fact sheets.

The various toxicological societies can also serve as valuable sources for further information. Some information is offered free, but sometimes it is available to members only. EUROTOX (Association of European Toxicologists and European Societies of Toxicology) is one such source (http://www.uta.fi/eurotox./cover.htm).

The American-based Society of Toxicology http://www.toxicology.org has the most extensive online presentation. There is a large section with links to other toxicologically relevant societies and organizations. Under the Publications link there are well written short articles on toxicological problems such as *Neurotoxicological Consequences of Developmental Exposure to PCBs, Cigarette Smoke and Tumor Production*, or *Scientists Discover Link Between Air Pollution and Stroke*, which can be understood without extensive chemical knowledge. A new article is published every month, and many of them provide excellent material for introducing the subject of toxicology into the classroom.

Some chemical societies are also valuable sources: The society of German chemists, Gesellschaft Deutscher Chemiker (GDCh), for example, lists on its website a number of quality textbooks on the subjects of environmental chemistry and ecotoxicology. This list can be viewed at http://www.tu-bs.de/institute/oekochem/ak-umweltchemie/books.htm.

Of the more than 100 scientific journals about toxicological matters, the journal called *Environmental Science and Pollution Research* is one with a special focus on ecotoxicology. The abstracts of articles and conference reports, which are very detailed, are available free of charge. Quite often the email addresses of the authors are given, so it is possible to contact them directly for

further information. The site can be found at http://www.scientificjournals.com/espr/espr.htm.

For a broader approach on toxicological questions, it is often worthwhile contacting the sites of environmental organizations. An address with links to online publications of many of those societies is Green Net (http://www.gn.apc.org). Among its interesting links is the homepage of the Pesticides Trust, where some articles can be downloaded in full-text version free of charge from their journal *Pesticide News*. The URL is http://www.gn.apc.org/pesticidestrust/index.htm. These articles are not specifically aimed at toxicologists or chemists but are written for interested laypersons, focusing on the practical aspects of pesticide use and the resulting dangers and health risks.

Another source of general information about harmful substances are the various consumer associations around the world. If they deal with toxicological topics, it is always with direct concern for human health at-risk owing to the properties of some particular products. Food, cosmetics, toys and other children's products are the most common areas on which toxicological information is provided. In most cases, detailed, full-text information is available only to subscribers. A site to visit, among others, is the American Consumers Union (http://www.consumersunion.org).

A state-financed agency dealing with toxicological aspects of consumer goods is the US Consumer Product Safety Commission (CPSC). The full-text versions of research reports on the toxicological risks associated with certain chemicals in consumer goods can be obtained free of charge. An example is the report on the toxicity of a softening agent for plastics, diisononyl phtalate, in children's products. The CPSC homepage is at http://www.cpsc.gov/index main.html.

Another useful address to contact is the US Food and Drug Administration (FDA), whose homepage can be found at http://www.fda.gov. The information provided, however, is less about the toxicological risks of certain substances but focuses on those that are considered safe when appropriately used. Special emphasis is on drugs and medicines. The examples given for toxicological information on the internet can only highlight a very small sector of the broad spectrum of toxicology-related data available on the world wide web. The easy approach of these information resources and the comparatively low costs involved in using them is an important step forward towards establishing toxicological knowledge among the general public. Raising consciousness about the possible dangers, which could be in store for all people everywhere in the world if the release of chemicals into the environment is not closely monitored and carefully researched, is a very important task. Therefore, it is essential to make toxicological information public in a way that it can be understood and its relevance appreciated.

Very few people in the early 1960s would have read a book titled "The accumulation of DDT in ornithological species and its possible consequences." Instead, Rachel Carson chose the title *Silent Spring*, which made people realize at once that something important was at stake, something that meant a lot to their personal lives, something they loved. For those working in education, this is an aspect, which must not be ignored.

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CASE STUDIES

Hussein A. Baarah

Can Science and Technology Build an Environmentally Healthy City?

Environmental Literacy

Environmental Literacy (EL) is not ecology, nor is it outdoor education. These two concepts (Ecology and outdoor education) are synonymous with environmental education (Hungerford, 1975). Therefore, the term Environmental Literacy is not the same as environmental education.

EL is the ability of the individual to understand and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or to improve the health of those systems. EL can be defined in terms of observable behaviors. That is, individuals should have the ability to demonstrate in some observable form what they have learned – their knowledge of key concepts, skills acquired, and disposition towards issues (Roth).

Some educators assume that EL is equivalent to scientific literacy. Simmons argues that there is a good reason for making this assumption because, on the one hand, environmental education has not been infused into the curriculum but seems to be considered as an enrichment to the science program. On the other hand, science educators have demonstrated more interest and involvement in environmental education than have others.

The focus of EL derives from the following four basic issues that take it beyond the boundaries of science education, or any of the traditional disciplines :

- the interrelationships between natural and social systems;
- the unity of humankind with nature;
- technology and the making of choices; and
- development of learning throughout the human life cycle (Roth).

Citizenship Participation in Solving Environmental Problems

Before students can address local and global environmental problems, they must be knowledgeable about these problems (Monroe and Kaplan). Hungerford and Volk support this statement, adding to it that knowledge of environmental problems leads to an awareness of these problems and, hence, this will lead to environmental action. Moreover, Hungerford and Volk suggest that the environmentally responsible citizen is one who

- is aware of environmental problems,

- has a basic understanding of the environment and its problems,
- has a feeling of concern for the environment,
- can identify and solve environmental problems, and
- is actively involved at all levels toward a resolution of environmental problems.

During the 1980s, environmental educators used survey techniques to determine the need for environmental education programs. Educators recommended that environmental endeavors focus not only on awareness but also on attitudes, skills development and citizenship (Volk, Hungerford and Tomera).

Decision-Making as Process

Decision-making is the making of reasoned choices from among alternative courses of action that are connected to personal or public issues which require judgment in terms of one's ideas (Cassidy and Kurfman). For decisions to become a process, the learner must identify the problem, evaluate alternatives, develop criteria, generate alternatives, and finally choose a solution (Kortland). Decision-making as problem-solving tool for environmental issues on the local and global scales is an approach that creates an opportunity for meaningful learning (Disinger, 1990).

Monroe and Kaplan suggested the following elements to be important in decision-making toward solving environmental problems:

- knowledge of the environment and of issues,
- familiarity with the solution of environmental problems,
- knowledge of active strategies that help resolve environmental issues,
- action-taking skills,
- attitudes and values toward environmental problems,
- sense of responsibility and commitment toward the environment,
- group process skills, and
- communication skills.

It is expected that individuals who are knowledgeable about environmental problems become aware of these problems and, hence, are able to make decisions on, e.g., "how to build an environmentally healthy city." This expectation led us to the purpose of the present case study.

Purpose

The thrust of this case study was based upon two assumptions: Firstly, it was assumed that exposing individuals to training strategies in identifying and solving environmental problems could develop their ability to make decision about the features of an environmentally healthy city. Secondly, it was also assumed that the interrelationship between science and technology would affect individuals' decisions about the lifestyle of the residents of the proposed environ-

mentally healthy city. The main purpose of this case study was to propose features of an environmentally healthy city through a decision making process as perceived by the participants of an environmental education course. The purpose can be circumscribed by answers to the following four questions:

- What are the health aspects the participants will decide upon when proposing the features of an environmentally healthy city?
- What are the environmental aspects the participants will decide upon when proposing the features of the environmentally healthy city?
- What are the scientific aspects the participants will decide upon when proposing the features of the environmentally healthy city?
- What are the technological aspects the participants will decide upon when proposing the features of the environmentally healthy city?

Method

Population and Sample

The population of this case study comprised all the preservice teachers at the faculty of Educational Science at Mu'tah University. The total population consisted of 1,200 preservice teachers (80 % female and 20 % male) enrolled in the summer session of the academic year 1997/1998. The sample of the case study consisted of 54 preservice teachers (33 female and 21 male) enrolled in the "Environmental Education" course offered by the faculty of educational science during the summer session of that year.

Units of Instruction

The units of instruction utilized in this case study consisted of the content of the "Environmental Education" course offered by the faculty of educational science during the summer session of 1997/98. The units of instruction were as follows:

- definition of the environment and ecology system, definition of environmental education, legislation concerning the environment in Jordan;
- global and local environmental problems: their sources and their effects on the environment and on individuals;
- the effects of science and technology on the environment and on individuals of the society;
- minimizing the environmental problems by good citizenship action.

Learning Activities

Over a period of two weeks the participants were given four learning activities and were asked to accomplish them in groups (six participants per group). After completing each learning activity, an inter-group discussion was conducted to exchange ideas between all participants. The four learning activities conducted were as follows :

1. arrange a given set of environmental problems hierarchically (from a global perspective);
2. arrange a given set of environmental problems hierarchically (from a local perspective/ Jordan);
3. identify and list a set of environmental problems (worldwide perspective). (Note: these environmental problems should be others than those mentioned in learning activities 1 and 2 above);
4. identify and list a set of environmental problems that have their roots in science and technology and affect society.

Development of the Case Study Report

The participants were asked to compose (individually) the main report of the present case study. The task of the report was: "Suppose you were asked to build an environmentally healthy city with a population of one million people. What are the health aspects, the environmental aspects, the scientific aspects, and the technological aspects that you would take into consideration to be applied to this city to be environmentally healthy?"

Participants were also asked to add any necessary comments about how the environmentally healthy city might look like. They were given a period of one month to finish the task.

Data Collection and Analysis

The 54 case study reports were analyzed and the main themes were classified according to the four aspects. Then the results were displayed as seen in Tables 5, 6, 7, and 8.

Results

Results of Learning Activity 1

The participants were given as a group twelve global environmental problems and were asked to arrange these problems hierarchically according to their importance. The environmental problems were war technology, water resources, air quality, land use, hazardous substances, human health, mineral resources, population growth, energy, extinction, world hunger, and nuclear reactors (Hassard). Table 1 indicates the hierarchical arrangement of these environmental problems.

Table 1: Hierarchical Arrangement of the Environmental Problems (global perspective) Global environmental problems ranked

1.	Population growth	2.	Water resources
3.	Land use	4.	Energy
5.	Mineral resources	6.	Air quality
7.	Human health	8.	Hazardous substances
9.	Nuclear reactors	10.	Extinction
11.	World hunger	12.	War technology

Table 1 shows that the environmental problem "Population growth" was perceived by the participants as being more important than the other environmental problems. Considered to be least important was war technology.

Results of Learning Activity 2

Participants were given (in groups) the same set of environmental problems found in learning activity 1 and were asked to arrange those problems hierarchically as they exist in Jordan. Table 2 indicates the hierarchical arrangement of environmental problems as they exist in Jordan.

Table 2: Hierarchical Arrangement of the Environmental Problems in Jordan

1.	Water resources	2.	Land use
3.	Air quality	4.	Energy
5.	Hazardous substances	6.	Mineral resources
7.	Population growth		

Table 2 shows that participants selected only seven environmental problems that exist in Jordan. The most important environmental problem in Jordan was water resources, while the one considered to be least important was "population growth".

Results of Learning Activity 3:

Participants selected ten environmental problems as shown.

Table 3: Worldwide Environmental Problems (ranked)

1.	Burning garbage	2.	Noise pollution
3.	Pesticides	4.	Oil leaks in the seas
5.	Household garbage	6.	Use of plastic bags in stores
7.	Unwise handling of expired batteries	8.	Excessive use of chemical fertilizers
9.	Plastic waste	10.	Overuse of detergents

Results of Learning Activity 4

As a result of discussing the concept of science-technology-society (STS) concerning the environment, the groups of participants identified the following S T S environmental problems found either on the local scale or on the global scale as shown in Table 4.

Table 4: Environmental Problems that Have Their Roots in Science and Technology and Affect Society (not ranked)

Ozone layer depletion	Acid rain
Thermal pollution	Gases emitted by factories
Lead pollution in the air	Global atmosphere change
Enhanced greenhouse effect	

Result of the Case Study Report

In order to build an environmentally healthy city, participants (individually) proposed health aspects, environmental aspects, scientific aspects, and technological aspects to be addressed in this environmentally healthy city. After classifying and grouping these aspects they were displayed in tables 5, 6, 7 and 8 below:

Table 5: The Health Aspects to be Addressed in the Environmentally Healthy City

1. Use non-polluted drinking water
2. Prohibit smoking inside buildings
3. Make legislation concerning covering garbage before collection, good healthy conditions for houses, prohibition for noise-pollution clings
4. Build factories outside the city
5. Grow trees in the spaces between houses
6. Distribute bulletins concerning health
7. Arrange for seminars concerning good health habits

Table 5 shows that the participants decided upon seven healthy aspects to be addressed in the environmentally healthy city (not ranked).

Table 6: The Environmental Aspects to be Addressed in the Environmental Healthy City

1. Use unleaded gasoline.
2. Change food wastes into organic fertilizers.
3. Utilize treated water from water treatment plants to grow forests.
4. Use landfills instead of incinerators to manage solid waste.
5. Decrease desert areas by growing forests.
6. Build a ring road with trees around the city.

7.	Separate solid waste into its main constituents.
8.	Recycle paper, aluminum cans, and glass.
9.	Decrease land erosion by planting grass.
10.	Use public transportation instead of private cars.
11.	Minimize the utilization of natural resources.
12.	Increase the number of parks in the city
13.	Conduct seminars about taking care of the environment.

Table 6 indicates that the participants selected 13 environmental aspects to be addressed in the environmentally healthy city (not ranked).

Table 7: Scientific Aspects to be Addressed in the Environmentally Healthy City

1.	Use hydrogen gas as a source of energy.
2.	Reduce emissions of sulfur oxides and nitrogen oxides into the atmosphere.
3.	Use organic fertilizers instead of chemical fertilizers.
4.	Reduce the use of chlorofluorocarbon gases.
5.	Use renewable energy resources such as solar energy and wind energy
6.	Use biodegradable bags in shopping.
7.	Establish scientific clubs.
8.	Establish a scientific information bank to be used as a reference to solve environmental problems.
9.	Enlarge windows of houses to facilitate use of solar energy.
10.	Establish scientific research centers to help solve environmental problems.
11.	Distribute a variety of science bulletins to citizens concerning effects of science on environmental problems as a whole.

Table 7 indicates that participants had selected eleven scientific aspects to be addressed in the environmentally healthy city (not ranked).

Table 8: Technological Aspects to be Addressed in the Environmentally Healthy City

1.	Use the drip-irrigation technology on crops.
2.	Use biogenetic engineering technology to produce plants with higher yield.
3.	Use technology to transfer solar energy into electric energy to run electric trains and electric cars.
4.	Use solar energy to heat homes in the winter.
5.	Use information technology to help solve environmental problems.
6.	Use bicycles in the inner parts of the city instead of cars.
7.	Provide factories with powerful filters to reduce the emission of gases into the atmosphere.

Table 8 shows that the participants decided on seven technological aspects to be addressed in the environmentally healthy city (not ranked).

Discussion of Results

This section will discuss the results of learning activities 1 through 4, and the result of the case study report.

Learning Activities 1-4

On the global scale, participants perceived the "population growth" environmental problem to be more important than all other environmental problems. This finding is in accord with the finding of Culen, Hungerford and Rubba, and Squillo, which indicated that population growth was a more important problem than other problems concerning the environment.

The participants made this decision because they believe that overpopulation in the world will lead to consumption of more food, more drinking water, more utilization of natural resources, and produce more poisonous gases from factories which pollute the environment and cause a lot of damage.

The concern of participants about global environmental problems stems from a feeling that environmental problems transcend boundaries, affecting all people around the globe (Wals). Therefore, individuals are supposed to take action to protect the environment. This insight might help the environmentally literate individual (Disinger and Roth), who is willing to take responsible environmental action (Ramsey, Hungerford and Tomera).

Concerning environmental problems in Jordan (the local scale), the participants decided that "water resources" was a pressing problem in Jordan. Shortage of water affects agriculture, industry, and even wildlife. The participants were aware of this problem because they knew enough about the main environmental problems facing Jordan. Population growth does not constitute an environmental problem in Jordan, therefore it was decided by participants to be of least importance. The participants themselves had selected a variety of environmental problems that are found in various places on the globe. They knew that pollution does not affect a specific place or a specific country, it rather does not recognize boundaries between nations.

Hungerford, Peyton and Wilke suggested four goal levels for curriculum development in environmental education, if citizens are planning to achieve and maintain a dynamic equilibrium between the quality of life and the quality of the environment. These four goal levels are the ecological foundation level, the conceptual awareness level, the investigation and evaluation level, and the environmental action skills level. Up to this stage, the participants seemed to acquire the first two levels, namely knowledge of environmental problems and awareness of environmental problems. The participants were able to identify a variety of environmental problems that have roots in science and technology and affect society, such as ozone layer depletion, acid rain, thermal pollution, gases emitted by factories, lead pollution in the air, global atmospheric change, and enhanced greenhouse effect.

This decision-making reflects the thoughts of Simpson, Volk, and Hungerford, who indicate three goal levels for dealing with science-related societal issues. These goals are: knowledge of the science-related societal issues, investigation and evaluation of science-related societal issues, and citizenship action on science-related societal issues. The participants seemed to have achieved the first two goal levels.

The Case Study Report

No doubt that science and technology affect all aspects of society in general and the health aspects of individuals in particular. Science and technology have also much influence on the environment, either positively or negatively. After conducting a series of learning activities concerning environmental problems and science-related societal issues, it seemed that the participants could visualize the characteristics of an environmentally healthy city. They suggested health aspects, environmental aspects, scientific aspects, and technological aspects to be addressed in this city. The question raised was: can science and technology build an environmentally healthy city? The answer was "yes".

The participants proposed characteristics of the environmentally healthy city confirm that we can build an environmentally healthy city and live safely in it. The health aspects selected by the participants reflect their knowledge and their awareness of the health component needed in the city. Some of these aspects included the use of non-polluted drinking water. Prohibiting smoking inside the buildings and construction of factories outside the city reflect an understanding of the dangerous consequences of toxic fumes on health.

The participants were fully aware of environmental aspects to be taken into consideration. Using unleaded gasoline, for example, will pollute the atmosphere to a much lesser degree. Changing food wastes into organic fertilizers has a lot of advantages for the environment. On the one hand, we get rid of food wastes, and on the other hand, we get organic fertilizers which are not harmful to our health. Recycling of paper, aluminum cans, and glass has a lot of advantages for the environment. The participants' choice for the necessity of the process of recycling reflects an awareness of the environmental problems to be avoided in this non-polluted city.

Conducting seminars and establishing environmental clubs will make information sources available to the citizens of the city. These will serve as a vehicle for educating citizens and may help increase EL among them.

The participants made valuable decisions about the scientific aspects to be considered in the city. Using hydrogen gas as a source of energy will cause less damage to health because it does not harm the environment. Biodegradable shopping bags will cause less harm to the environment compared to plastic bags.

Technology is the key aspect of society, especially in the 21st century. We are living in a technological era. Technology should help to make life easier and safer for citizens. Changing solar energy into electric energy is one example of the participants' suggestions. Solar energy has another advantage, it can be used to heat homes in winter and to produce hot water for daily use. The participants decided to utilize informational technology to help solve environmental problems and to help citizens in making daily decisions.

When participants were asked to suggest any ideas and thoughts that would make life easier and safer in the environmentally healthy city, they came up with some interesting ideas. For example, they suggested to use bicycles in the inner parts of the city. These bicycles should not be owned privately but by the city. Any citizen can use a bicycle to travel from one location to another and leave the bicycle there. Another citizen may then pick up the bicycle and go to another location and leave the bicycle there. This exchange could take place anywhere in the city.

Other suggestions were proposed to make life easier and safer. The participants suggested to use cars with odd numbers on the license plates on one day and those with even numbers on the other day. But in both cases the cars must be used as little as possible. Some participants suggested to use public transportation instead of individual transport because this will save energy and reduce pollution. Some participants suggested to use electric cars or electric trains for transportation. In this case, there have to be places to recharge the batteries of the electric cars.

It seems that all these choices are interrelated. Sometimes there are some interrelationships between health aspects, environmental aspects, scientific aspects, and technological aspects. But as a whole all of these aspects need to ve viewed together if we are to be sure that science and technology can build an environmentally healthy city.

Educational Implications

EL in general, and themes in particular, can be developed among students at the pre-college level (Rubba and Wiesenmayer). EL can be achieved through effective teacher training programs on STS components (Rubba, Wiesenmayer and Ditty). We can adopt a strategy to introduce the concept of environmental problems in schools (Ahalwat, Billeh, Akasheh and Shahbaz). As a result of adopting this strategy, the level of environmental awareness among students is expected to increase.

Conclusion

Decision-making concerning environmental problems is a process that can be adopted to help individuals live in harmony with their environment. This

process can be achieved by encouraging creativity among students. Students should be encouraged to think creatively (Horner). If this goal is achieved, then students may think critically about their environment, which is the stepping stone toward solving the environmental problems facing the world.

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CASE STUDIES

Ahmad Mohammad Qablan

The Case of Pollution in Zarqa

Introduction

Through the previous decades, Jordan has witnessed a noticeable development of its agricultural and industrial sectors. This went hand in hand with an enormous increase in population and an accompanied growth of populated areas, which led finally to the neglect of regional planning for cities and to the unavailability of a clear system of land use. These conditions illustrate the pressure on the country's fragile and limited natural resources. The environmental decline in Jordan particularly concerns water, land, and air quality.

Water resources in Jordan are considered among the country's biggest problems, as a result of the increase in population and people's increased needs. Both availability and quality of drinking water are affected. Also, there is an increase in sewage water, which in large part is not suitable processed. Rather, much of the untreated sewage flows into valleys, polluting surface water and rendering it unsuitable for agricultural use.

As for the land in Jordan, it suffers from soil erosion and is – aside from pollution – subject to desertification. The accumulated effects of these processes in the future pose a chilling prospect.

Air pollution is another factor that threatens the environment, with pollutants from gaseous or solid sources that come from the burning of fuel, sulfurous petroleum, substances containing lead. There is an increase of carbon dioxide concentration, and the pollution affects the soil not only around factories, but reaches even desert lands. Jordan's different regions are affected by different pollutants, varying from one area to another. In the Zarqa Governorate, 52 % of the country's industrial activities are concentrated. The case of pollution in Zarqa offers an occasion for the study of some of Jordan's worst problems in a nutshell.

Man has inhabited the area of Zarqa (northeast Amman) for thousands of years. Many factors contribute to the more recent founding of the city of Zarqa. His strategic position on the ancient traditional route, its proximity to the Al-Hijazi railway, the abundance of water in the region, its central location at the hub of crossroads, and the wealth of raw materials needed for manufacturing all these factors contributed to making Zarqa an important site that attracted citizens from all over the country. The increase in population in turn led to the need for more services: markets, health centers, schools, post offices,

employees and workers at these localities, and the infrastructure, electricity etc. Eventually, Zarqa became unique among neighboring cities, a point of concentration for industry that now exceeds 52 % of Jordan's total.

The industrial sector is characterized by its quick development. While it is considered to be a major center for consumers, it also is the source of an extremely polluted environment. Industrial pollution is nothing new, but through the rapid development of the area's industrial sector, pollution increased on a scale exceeding all expectations. In the last few decades, it has become evident that industrial pollution is not confined to the traditional pollutant. There are many complicated substances and compounds, which stem from industrial processes in the form of gases, small particles in the air, and liquid and solid wastes. The kind of pollutant emitted differs from one industry to another and is complicated by the combined effects of:

- the type of industry;
- the size of the plant, its age and maintenance system;
- the kind of work and production-line of the factory;
- the multiple techniques used in industry;
- the kind of fuel and raw materials used;
- the availability or methods used to limit pollutants and their efficiency.

The environmental singularity of Al-Zarqa governorate was recognized by the General Corporation for Protection of the Environment through the establishment of a special department that surveys further investment in the region, organizing the establishment of technical solutions for every plant and factory (see Tables 1 and 2).

The Present Situation in Zarqa

Sources

Industrial Activities: 52 % of the kingdom's industrial plants are in Zarqa. These activities result in different industrial wastes such as sewage water that flows into valleys and streams, as well as into the sewage network. These wastes contain highly poisonous components such as heavy metals, strong concentrations of salts and organic materials, and gaseous waste harmful to the environment, such as carbon dioxide (CO_2), nitrogen (N_2), sulfur (S), chloride (Cl) and other compounds. In addition to that, there is the gas emitted from the phosphate mines in Russeifeh and the poisonous industrial wastes drained randomly into the valleys and streams which are out of sight.

Khirbate Al-Samra Station: Considered internationally to be one of the largest four treatment stations using by natural purification. Large water basins

cover about 2,000 dunums[1], ranging, in different depths from one to five meters with a daily input that reaches 160,000 cubic meters of sewage water. The amount entering the station equals 82 % of the sewage produced in the whole kingdom.

As a result of the station's incapability to process the heavy load of organic wastes, the quality of outlet water has declined to a large extent. This led to the pollution of groundwater in the aquifer and the emission of poisonous gases such as CO_2, methane (CH_4), hydrogen disulfide (H_2S) and ammonia, producing nasty smells. It is known that the water coming from the station flows into the reservoir at King Talal Dam (KTD). The reservoir's water is used for irrigation in Al-Gor, giving that water a very poor quality

Solid waste dumping site: The dumping site receives about 2,100 tons of solid wastes daily, mixed with hospital garbage and plant wastes. This amounts to 77 % of the total solid waste produced in the kingdom. The dumping site is located close to the populous center of Al-Russeifeh. In this dumping area, the waste is being processed. The most important problems resulting are nauseating smells, vapors, and smoke containing CH_4 and H_2S.

King Hussein Thermal Station: This station supplies Jordan with about 40 % of its electrical energy. More than 500,000 tons of heavy fuel (crude oil) are burned annually. This petroleum contains a high percentage of sulfur, in excess of 3 %. As a result, large amounts of CO_2 are emitted, polluting the atmosphere. In addition, harmful nitrogen and carbon compounds that affect people's health are emitted. Another effect is the wastewater produced by the desalination process used in producing electricity. It contains a high amount of salts that accumulate in the soil and lead to soil pollution and the emission of salt into the aquifer.

The Jordanian Oil Refinery: It supplies the kingdom with all petroleum products and car lubricants. It burns 200,000 tons of crude annually, emitting large amounts of CO_2, as well as nitrogen dioxide (NO_2), carbon and volatile hydrocarbons. Water is produced from desalination applied in the production of petroleum fractions, and during the desalination of wastewater, which originates in the housing units of oil refinery employees.

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[1] 1 dunum = 1000 m^2

Table 1: Type and Number of Industries in the Zarqa Area

Industry / Area	Chemical	Nutritional	Mineral	Paper	Hygienic Paper	Medical	Animal Food	Leather	Construction	Weaving	Total
Zarqa	15	10	4	2	--	--	--	--	1	2	34
Russeifeh	20	10	5	1	1	1	--	--	1	4	43
Wad Al-Esh	11	--	15	2	--	--	2	2	6	1	39
Al-Hashemia	11	6	6	--	1	--	1	2	--	1	28
Al-Dhulail	8	11	1	--	--	1	2	2	3	--	28
Al-Azraq	--	3	--	--	--	--	--	--	--	--	3
Total	65	40	31	5	2	2	5	6	11	8	175

Table 2: Concentration of Trace Elements Emitted from Al-Samra Station, Zarqa Region, and King Tala Dam between May and October 1994

Site	pH		BOD (mg/l)[1]		Cl^- (mg/l)		NH_4^+ (mg/l)		NO_3^{2-} (mg/l)	
	W*	S*	W	S	W	S	W	S	W	S
Effluent from KA	7.5	7.5	183	183	355	355	108	108	28	28
23 km before King Tala Dam	7.7	7.8	106	225	345	412	77	79	33	26
King Tala Dam Reservoir	7.7	7.8	37	99	338	348	14	6.2	57	55
13 km below KTD Reservoir (Tala Al-Thahab)	8.0	8.0	28	22	327	323	6	7.5	57	42
Z.R. Above the Valley (Abu-Zeighan Weir)	7.4	7.5	14	20	728	467	3	201	55	42
KAC Before Mixing	8.2	8.2	6	12	106	126	0.3	0.2	15	12
KAC After Mixing	8.0	7.8	15	18	278	407	2.0	2.6	31	46

*W: average winter month values
*S: average summer month values
*KTD: King Tala Dam
*KAC: King Abdalla Canal

1) biochemical oxygen demand

Major Environmental Problems

Industrial wastes:

- Random dumping of industrial waste outside the factory boundaries;
- Keeping of chemical waste in containers inside the factory boundaries for long periods;
- Burying of industrial wastes, leading to toxification of soil and pollution of air; Centers of pollution:

Al-Hashemia: There are three main sources competing for polluting the air and botanical life with fumes the petrol oil refinery, King Hussein thermal station, and al-Samra for water treatment.

Al-Zarqa river: Polluted by industrial and sewage wastes.

Al-Russeifeh: Three main sources participate in polluting the environment, the Jordanian phosphate mines, a yeast factory, and a dumping site for solid materials.

. *Quarries*: Adding their share to air pollution by producing dust.

Impact of Pollution in Zarqa

Pollution from the sources mentioned above consists of sulfur oxides, nitrogen and suspended particles. These may aggravate and cause respiratory diseases especially in children. Children are also likely to suffer from heart conditions in connection with the lead emissions from factories and car exhausts that may have toxic effects on both respiratory and nervous systems and may finally lead to mental retardation, epilepsy and behavioral changes.

Pollution of food grown in soils that were irrigated with industrially polluted water may be as hazardous to human consumption; runoff from solid toxic wastes that are deposited in the ground or above ground may end up in the groundwater, irreversibly polluting the aquifer.

What can schools, society and government contribute to cope with the environmental situation in the Zarqa area?

The environment concerns all sectors of society. Schools might play a significant role by increasing awareness, demonstrating and clarifying related issues, and thus generating an atmosphere conducive to coping with and solving the environmental challenge.

Teachers in schools may demonstrate environmental issues to their students and stimulate them to creatively think about and perhaps suggest solutions, providing opportunities for discussion of ideas for solutions, including the obstacles facing them.

Students may become engaged through environmental inquiry-projects collectin data about some specific environmental issue from sites and agencies and monitoring the defective environment.

Citizens should understand the different dimensions of environmental problems and know about their impact on individual health, on plants and on animals; they also may contribute to an extent in the reconstruction of the environment by developing environmentally healthy habits.

It is the government's role to suggest suitable solutions for environmental problems in order to maintain the environment and to preserve the population's health and well-being.

Air Pollution, a Case Study

The following school activity will demonstrate the role of teaching and learning about air pollution in the Zarqa region.

Grade 10

Courses: Biology, Chemistry, Technology, Health Care

Objectives: At the end of this project, students should be in a position to

- describe the concepts of air pollution, of pollutant material, and of acid rain;
- determine the sources of air pollution;
- discuss the problems resulting from air pollution, especially those concerning human health;
- suggest creative, possibly suitable solutions for air pollution;
- practice appropriate conduct to protect the environment from pollution.

A. Exploration Phase

In this phase, the teacher focuses students' attention on questions concerning the issue of air pollution and its impact on the environment:

- What is the meaning of air pollution and what are some of its reasons?
- What are the sources of nasty smells distributed around us?
- Which are the most rapidly spreading diseases in the Zarqa area and what is their relationship to air pollution?
- Which is the most polluted place in the Zarqa area?

The class is divided into small working groups (3-4 students each) to explore the situation as follows:

Group I

Investigate air pollution and its reasons in the school library, including, if possible, the internet.

Group II

Visit the health department in Zarqa and inquire about respiratory diseases that are common in the Zarqa governorate, and their pattern of distribution.

Group III

Visit the meteorological department to find out about the rate of distribution at various weather patterns of air pollutants in Zarqa, especially in areas with heavy industrial activities.

Group IV

Visit the Zarqa industrial chamber (Chamber of Commerce) to collect statistics about industries in Zarqa.

B. Explanation Phase

In this phase, the teacher coordinates the classroom investigation giving each group the opportunity to demonstrate their data before the students to complete the picture of the sources of nauseating and toxic fumes, and to discuss results.

Teachers may invite their students inside the classroom to work as scientists, think about a research project to investigate the consequences of air pollution. such as acid rain: How is it formed? What damage does it do?

Students may be invited to take the role of an "interested party" (for example, factory owner, farmer ...) in a group discussion or a role play about acid rain that is a direct result of air pollution, presenting arguments for or against laws to control acid rain.

At the end of the class, students present their suggested solutions as to the environmental problem and share what they would do if they were in a position of responsibility. What decisions appear to be necessary and enforceable?

C. Expansion Phase

In this phase, the teacher leads the students to an understanding of the wider implications of the situation, in order to widen their horizon and to enrich their understanding. Leading questions might be:

- In what ways are surrounding areas affected as well by air pollutants emitted from Zarqa industrial plants?
- What is the relationship between air pollution and the phenomenon of global climatic change? What are some consequences of the "greenhouse effect"?
- Is there any other form of pollution than air pollution which we have studied? Discuss possible combined effects on human health!
- What are some economical effects resulting from air pollution?

The Part of Science and Technology

- What is the possible role of technological advancement in solving the problem of air pollution?
- Do the industrial plants use the most advanced methods in limiting their emissions to reduce air pollution?

- What are the international standards applied to limit air pollution?
- Does our country subscribe to these standards and, subsequently, hold its industrial plants responsible in accord with these standards?

The Role of Society

- In order to solve the problems of air pollution and its consequences, do people need to understand how pollution damage to the environment?
- What changes could be made in the technology used (e.g., converters on the exhaust pipes of cars, "scrubbers" to chemically remove oxides from gases leaving smokestacks, switching to raw materials that emit fewer toxic substances, such as by natural gas instead of crude oil), and what would be necessary to bring about the application of such changes?

The Role of Government

- How could the quality of oil fractions produced from refineries be controlled by governmental agencies?
- How could suitable legislation concerning the type of smoke emitted from industries be implemented?
- How could a monitoring system be established to control air quality over time?

D. Evaluation Phase

Along the lines of the following questions, a variety of standards may be applied to gauge performance of individual students and/ or small groups:

- What are the main sources of air pollution in the Zarqa area? Name some typical pollutants! What are some typical consequences of air pollution in terms of human health (knowledge acquired about names and terms, and cause-effect-relationships)?
- What are your suggested solutions regarding air pollutants in the surrounding area (knowledge of concepts about pollutants, creativity, viability of solutions suggested)?
- What can you do to participate in reducing the air pollution in your school and country (attitudinal and behavioral components, good health habits)?
- In cooperation with others, how would you demonstrate the problem of air pollution in the Zarqa area to a wider audience (school, community), using large sheets of paper (grasp of concept)?

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THE RELIGIOUS CONTEXT

Imfadi Abu-Hola

An Islamic Perspective on Environmental Literacy

Introduction

Man has forgotten his relationship with the environment and is instead trying to become its master. But, does he have an unlimited license to destroy (Abraham and Chacko)? Damaging well-established natural systems is a drama that has been running for a long time, with man playing the lead role. The drama's main part has taken place only in the latter half of the twentieth century. As its result, we have dangerous chemicals, nuclear wastes, acid rain, an increase of carbon dioxide content in the air, and many other problems (Damodaran). Prevention of further damage to the environment is necessary; it is preferable to the expensive repair of damage. An important goal of the environmental education curriculum is to raise environmentally literate citizens, who will take care of the environment.

What role can religious and social values play in achieving this goal? It is easy to conclude that religious and social rules aim to produce a clean and healthy environment for all humans, but humans have to follow these rules and must not mistreat and use up the environment they live in. People should be taught to care for the environment, because by caring , they enhance their own quality of life, not only for themselves but also for future generations (Disinger and Roth). This will require proper planning of all activities that have an impact on the environment, the religious and social approaches being of central importance. Public, religious, social and political awareness of the environment are also necessary. The goal of environmental education, to produce an environmentally literate citizenry who will take care of the environment, may be achieved with a team of well-trained, dedicated, religious, and socially and environmentally literate teachers. Environmental literacy is an important issue not only for environmental education but also for education as a whole. Functional environmental literacy indicates a broader knowledge, practice, and understanding of the nature of interactions between human social systems and natural systems. Operational environmental literacy indicates progress beyond functional literacy and the capability to gather information and to work for the sustenance of a healthy environment.

How can religious and social values promote environmental literacy?

A Doctrinal Approach to Environmental Literacy

On the doctrinal level, all religious beliefs have stressed the need for an environmental ethics within which man's relationship to his environment is defined. All religious beliefs impact moral perspectives. These assume that man must be guided by environmental ethics enshrined in religious texts and traditions. Such ethics ensure that a balance is struck between the maintenance of a healthy environment and the activities of man. This chapter argues that the moral concept developed by Islam should be adopted as the guiding principle.

Environmental ethics vary depending on religious belief and have different impacts in promoting environmental literacy if put into action. The three main religions existing in the world are Islam, Christianity and Judaism. Each of these religions embraces specific ideas and rules regarding the environment and environmental ethics and, thereby, has a role of its own in the promotion of environmental literacy. But in Christianity and Judaism, the discourse over these matters has led to conflicting views that make all-inclusive statements more difficult than in Islam. Islam's stance on environmental issues is particularly clear.

Islam and the Environment

One big goal of Islam is to make life easy for humans and to halt damage done to nature. The Islamic attitude toward nature and the environment is far-reaching. This is demonstrated by a host of Islamic rules and values toward the environment and life as they relate to God's representatives (Khilafa). Islam in general is built upon an ethical philosophy, with ethics being its heart and soul. Concerning ethics, the Prophet Muhammad (peace be upon him) said: "I have been sent to ensure the best ethics" (Hanbal, part 2, Hadith number 381). To better understand Islamic ethics and values as they relate to the environment, it is necessary to focus on the main environmental concepts expressed in Islam, which are:

- Oneness (there is only one God in this world). This means that God created this world and He is the source of values and ethics. This will unite humans towards thinking and working together. According to this concept, humans should be independent but respectful of others. And they should strive to build this world and to develop nature, not destroy it, as every human is responsible for making the best of life (Sardar, Fa'ori).
- Representatives (Khilafa). It means that humans are the representatives of God, and that their behavior will be tested. This is illustrated by many verses (Ayat) of the Holy Qur'an.

God Says:

"And (remember) When Your Lord Said to the angels: Verily, I am going to place (mankind) generations after generations on earth" (Qur'an, 2:30).

And He Says:

"And it is He who has made you generations coming after generations, replacing each other on earth" (Qur'an, 6:165).

And He also says:

"It may be that your lord will destroy your enemy and make you successors of the earth, so He may see how you act" (Qur'an, 7:129).

According to these verses, humans are responsible for and have a duty toward nature and toward the world as a whole. And above all, man is responsible before his creator (God). Humans do not have an absolute license to do whatever they want and whatever they can to benefit themselves. Rather, they have to look after and take care of their environment for themselves and for future generations (Al-Masri). For these reasons, the environment may be regarded as a wide and open field for testing humans and their obedience to God. The environment is holy and has its role in this world, as it was not created in jest. As humans, we are the keepers of all creation, including soil, air, water, animals, and trees. The main conclusion from these considerations is that Islam encourages the right ethics and values to benefit the entire universe. This is further clarified by the concept of life in the Hereafter (life after death). Our God Says:

"But seek, with that (wealth) which Allah has bestowed on you, the home of the Hereafter, forget not your portion of legal enjoyment in this world, and do good as Allah has been good to you, and seek not mischief in the land. Verily Allah likes not the Mufsidin (those who commit great crimes and sins, oppressors and tyrants)" (Qur'an, 28:77).

As belief in the Hereafter is one of the pillars of faith, it has a very strong effect on the relationship between humans and the environment. Taking care of the environment is one of the good deeds, which allows humans to enter heaven and escape from hellfire. God Says:

"Say (O Muhammad): " I am only a man like you. It has been inspired to me that your Ilah (God) is one Ilah (God, i.e. Allah). So, whoever hopes for the meeting with his Lord, let him work righteousness and associate none as a partner in the worship of his lord" (18:110).

In this verse, we find that life in the Hereafter guides the present. Without it, the present would be meaningless.

God Says:

"Did you think that We had created you in jest (without any purpose), and that you would not be brought back to Us" (23:115)?

The verses of the Holy Qur'an remind of the wealth of Islamic wisdom regarding environmental ethics. The Holy Qur'an also points to the unity between humans and other creatures. To this end, God Says:

"There is not a moving (living) creature on earth, nor a bird that flies with its two wings, but are communities like you. We have neglected nothing in the Book, then onto their lord they (all) shall be gathered" (6: 38).

According to Islamic rules and values, a bond of friendship, mercy and brotherhood between humans and their environment exists, much like the relationship between mother and baby. No one single creature is without importance in this life, and each creature has a duty to fulfill. It is a must for any human to keep and respect the life of any creature, and he has no right to stop the life of this creature without reason. A tradition (Hadith) related to this issue is narrated as follows: Prophet Muhammad (pbuh) Says: "A woman entered hellfire because she held a cat in captivity. She had not given it anything to eat or drink, nor had she released it to look food from the land" (Kushiree, part 14, 240). The Prophet (pbuh) also Says:

"No one single Muslim grow or plant a plant or shrub and a bird, a human or an animal ate from it, surely he or she will have a good deed for that" (Al-Bukahri, part 2, 817).

In conclusion, any act causing damage to the environment is forbidden, and any act causing the development and flourishing of the environment is encouraged and supported by Islam. Moreover, if an Islamic ruler found that one species of animal or plant is beginning to disappear because of heavy use, he should ban its use and protect it in its original environment (Sardar).

Allah (Our God) created this world and gave everything a role to play. God gave humans, animals and plants their lives, then helped them find their places in the world. This is narrated in the following dialogue, God says:

"(Moses) Said: "Our Lord is He Who gave to each thing its form and nature, then guided it aright" (20:50).

So, one can understand that God says to humans: Oh mankind, I created you like other species, and you have to follow the path of all my prophets as I am the all-living and all-knowing one.

The discussion of caring for the environment is an important one from the religious point of view. There are many sides to this topic and all are important: definition of environment, status of mankind in it, mankind's relationship with the environment, problems threatening the environment, such as pollution, desertification, and extinction. From an Islamic perspective, these are examples within an all-encompassing frame, as the environment plays host to humans. It should be clean and a host to all living creatures, offering them what they need for their existence. The problem of keeping the environment clean and productive is affecting developing countries more than other parts of the world.

"Environment" in the Arabic language literally translates as "home of man" or "house of bees", "place of camels" and "place where the baby lives in his mother's womb." It also means the place where one stays and lives. The modern definition of environment encompasses more than what was mentioned above. It consists of everything surrounding us: soil, air, water, etc. No doubt that the earth is our largest environment in the widest sense and that it is

not a silent island in a vast universe but an island full of life and activities to support human life for which God created soil, water, air, sunshine and food. Islam dictates that humans must live in harmony with the environment. As God says:

"O assembly of jinns and men! If you have power to pass beyond the zones of the heavens and earth, then pass (them)! But you will never be able to pass them, except with authority (from Allah!" (55: 33)!

A human being must not behave as if he was a different creature, because he was created from this earth (dust), which forms the main part of the environment. God Says:

"And among His Sings is this, that He created you (Adam) from dust and then (Eve from Adam's rib, and then his offspring from the semen, and), behold you are human beings scattered" (30: 20)!

According to this verse, man must investigate his needs and diligently care for the land to create a beautiful and green place. Also, he must dig to produce metals and other materials from earth for his needs. The Prophet (pbuh) Says:

" Search for sustenance and for what you need to live everywhere on earth."

Also, the Prophet (pbuh) says:

"If it is the day of judgment, and you have a small tree in your hand, plant it, so you will do a good deed."

The Value of Humans in Islam

Humans, from the Islamic point of view, are the cornerstones of this world. Islam pays much attention to humans, as they are not created to just eat and drink but have a crucial and vital role in this world. They must worship God and nurture the earth with their good deeds. God says:

"And I (Allah) created not the jinns and men except they should worship Me (Alone)" (51:56).

Islamic rules, values, and traditions embody the tools for human happiness and productiveness, but they have to obey and follow what they are ordered to. Thus, humans will have an easy life and a certain future. God says:

"On earth will be a dwelling place for you and an enjoyment for a time" (2:36).

Furthermore, God prepared all that is needed to achieve a happy life on earth in a balanced way. God Says:

"He it is who created for you all that is on earth." Then He Istawa (rose over) the heaven and made them seven heavens and He is the All-Knower of every thing" (2:29).

Therefore, all humans must keep this balance and not disturb it. Although they are encouraged to eat, drink and dress, they must do so in an ethical and reasonable way. Finally, all humans should thank God for his mercy and gifts. God Says:

"Then let man look at his food, that We pour forth water in an abundance, and We split the earth in clefts, and We cause therein the grain to grow, and grapes and clover plants (i.e. green fodder for the cattle), and olives and date-palms, and gardens, dense with many tree, and fruits and abba (herbage etc.). (To be a provision and benefit for you and your cattle)" (80:24-32).

God also Says:

"And the earth We spread out, and placed therein firm mountains, and caused to grow therein all kinds of things in due proportion" (15:16).

The purpose is to keep the environment in a balance for the pleasure of all living creatures. Humans should not turn this plentiful and beautiful source of our livelihood into something full of pain and misery by disturbing nature's balance. Islam encourages a clean environment and forbids damaging actions. Islam recognizes the environment as the friend of all creatures. According to Islam, humans are the best among all creatures, and they are the representatives of God to lead the world and guide all creatures along the right path. God says:

"And indeed We have honored the children of Adam, and We have carried them on land and sea, and have provided them with At-Tayyibat (Lawful good things)" (17:70).

Everything in this world exists for human benefit and use but it must be used properly. In this sense, it is a human right to smell fresh air, have a clean home, eat healthy food, drink soft water and, above all, enjoy a clean and healthy environment. According to Islam, everything polluting air, water, food, and the environment is disrespectful of humankind. In order to be respectful, humans have to abandon all actions, which cause pollution. Islam encourages many ways by which to achieve a clean and healthy environment. The most accessible ones will be discussed in the following parts of this chapter. All Islamic commands are easily followed and are in accord with the capabilities of each individual.

Encouraging Agriculture

The study of the verses in the Holy Qur'an may be summed up as follows: "Cultivating land with different types of plants and fertilizing it with good deeds was a main goal of all religions throughout history and this goal was one of the reasons God created humans. Moreover, God intended this world to be healthy and clean, not dead and full of misery". God Says:

"He brought you forth from the earth and settled you therein, then ask forgiveness of Him and turn to Him in repentance. Certainly, My Lord is Near (to all by His knowledge), Responsive" (11: 61).

Agriculture is one of the most vital activities on earth, converting land into a green blanket, with the end of improving all life on earth.

The Prophet Muhammad (pbuh) encouraged people to plant the earth. The Prophet (pbuh) Says:

"Whoever converts a dead land to a live one by growing and taking care of it makes it his own" (Al-Bukhari, part 2).

As a result, Muslims are very much interested in plants and flowers, and their sayings and poems clearly express this interest. Around their homes they have cultivated beautiful gardens.

Islam and Negative Factors Affecting the Environment

There are many negative factors causing damage to the environment. Islam fights against these and tries to keep them minimal. These factors include: *poverty.*

Poverty could easily be the most dangerous force threatening the environment and it is the most difficult enemy inhibiting environmental efforts. Moreover, poverty played a main role in causing weakness, anemia, hunger, starvation and diseases all over the world. From the ancient times up to now, hunger and starvation resulted in a huge number of deaths.

The Prophet (pbuh) Says:

"Oh my lord (God) I ask you for refuge from poverty, need and depression" (Al-Nasa'i, 2467).

Also, the Prophet (pbuh) Says:

"Oh my Lord (God) I ask you for refuge from hunger. It is the worst mate" (Abu-Dawood and Al-Nasa'i, 2469).

It is of little surprise that wherever poverty is found, environmental damage is the greatest. For these reasons, Islam fights poverty and hunger in different ways. The most important one is its support and encouragement of a work ethic and its inherent condemnation of laziness. According to a well-known Islamic principle, the best thing man can eat is that which comes from his/her own hands' work. Islam describes poverty as the devil's method to prevent humans from taking care of their environment. God Says:

"Satan threatens you with poverty and orders you to commit sins; whereas Allah promises you forgiveness from himself and bounty, and Allah is All-Sufficient for His creatures' need, All-knower,"(2: 268).

A commanding principle in Islam is that humans work in order to improve their lives and to not stay behind.

Overuse of Environmental Resources

Any use of the environmental resources, which exceeds the reasonable limit, is forbidden in Islam. Regarding food and clothes, it is a sin to live in abundance. Abundance is a devilish act as it causes damage to resources. God Says:

"O children of Adam! Take your adornment (by wearing your clean clothes), While praying and going round (the Tawaf of) the kaba, and eat and drink but waste not by extravagance, certainly He (Allah) likes not the extravagants" (7: 31).

The depletion of the environment's main resources, such as underground water and petrol, is most dangerous. It is narrated that the Prophet (pbuh) passed by one of his companions (Sa'ad Bin Abi-Waqas, may God bless him) while this companion was receiving a cleansing (wodu'o) in preparation for prayer. And the Prophet (pbuh) Said:

"Oh Sa'ad do not overuse water! Just use whatever you need exactly. Sa'ad replied, Is there any misuse of water? The Prophet (pbuh) Said: Yes, even if you are on the shore of a river" (Zad Al-Ma'ad, 1-48).

Using Environmental Elements in Jest

The Holy Qu'ran forbids using environmental resources irresponsibly. It is also forbidden to behave in a random and irresponsible way with all environmental resources and creatures. It is a sin to kill animals, cut down trees, or use birds for target practice. Clearly, as God's representatives on earth, humans have responsibilities. God Says:

"And do not mischief on the earth after is has been set in order, that will be better for you, if you are believers" (7:85).

God also Says:

"And when he turns away (from you O Muhammad), his effort in the land is to make mischief therein and to destroy the crops and the cattle, and Allah likes no mischief" (2:205).

This extends to all animals and plants, which are of utmost importance to human life. The Prophet (pbuh) said: "Do not use anything with a soul as a target" (Muslim, 4076). This applies to shooting practice.

Islam emphasizes the necessity to abandon misuse of all natural resources. The first Khalifa after the Prophet (pbuh) Abu-Bakar Al-sideeq (may God bless him) advised one of his army leaders (Yazeed Bin Abi-Sufian) of ten rules:

- Do not fight a woman, a child, or an elderly man.
- Do not cut down a fruit-bearing tree.
- Do not break or damage a building.
- Do not kill a sheep, a goat, or a camel unless you need to eat.
- Do not burn palms and do not submerge them in water.
- Do not give up before achieving your goal (Malik: 216).

In Islamic life, these rules serve as the pillar for developing the environment, while preserving its natural resources. These advices have become important rules in Islamic life as it is a pillar for developing the environment and keeping the natural resources in the right way.

In conclusion, irresponsible behavior of humans is the main reason for doing damage to the environment. The most painful example of human activities damaging environmental resources and causing tragedies on earth are nuclear explosions carried out underwater, which destroy one of the largest resources available to life on earth.

Prevention of Environmental Pollution

No one human being feels satisfaction from life and he/ she always tries to do his/ her best to live as long as he/ she can in this world. The most dangerous factor affecting this hope among human beings is pollution of the environment. Pollution is a messenger of death. How many people all over the world may have lost their lives because of pollution? How many are retarded in this world as a result of pollution, especially because of nuclear wastes? Environmental pollution not only threatens humans, but extends to animals, plants, water, and human activity. It causes anxiety, fear, and a huge loss of life's necessities.

Sources of pollution are difficult to count, among them dangerous gasses, chemicals such as insecticides, herbicides, pesticides and fungicides, nuclear radiation, toxic fumes from factories, human deposits, animal deposits, and dead bodies. These pollutants reach our organisms through air, water or food, and through the clothes we wear. Islam has taken a strong stand against pollution by applying the following rules: Hide away dead bodies in graves and cover them with soil. The custom of covering the dead bodies inside graves offers an efficient way to avoid chemicals and wastes resulting from the degeneration of dead bodies. Also, this custom reflects respect for humans. Moreover, it is a big sin to dig up newly made graves. God says:

"Then Allah sent a crow who scratched the ground to show him, to hide the dead body of his brother. He (the murderer) Said: "Woe to me! Am I not even able to be as this crow and to hide the dead body of my brother?" Then he became one of those who regretted" (5:31).

Islam has restrictions against the spread of disease and its causes. Small pox, cholera, and fever are examples of diseases which may spread rapidly among humans. It is important to fend against them. Traditions from the Prophet (pbuh) about this issue are plentiful. The Prophet (pbuh) Says:

"If you heard that an epidemic is spreading in one territory of land, do not enter it, and if it happens in your homeland, do not run from it" (Al-Bukhari and Muslim).

Also, Islam advises us not to have direct contact with persons having epidemic diseases, and to prevent contact between sick and healthy animals. The Prophet (pbuh) Says:

"Don't let healthy animals contact other sick animals" (Al -Bukhari and Muslim).

Islamic Applications of Cleanliness and Protection of the Environment

Personal Cleanliness

Cleansing of the body is a must before worship. One should either have an ablution before prayer or a shower at all times. Moreover, cleaning your clothes and the place of prayer is an Islamic law. God Says:

"O you who believe! When you intend to offer prayer, wash your faces and your hands (fore-arms) up to the elbows, rub (by passing wet hands over) your heads, and (wash) your feet up to ankles. If you are in a state of Janaba (i.e. had a sexual discharge), purify yourself (bathe your whole body)" (5: 6).

Also, it is not allowed to sleep with dirty hands or body, particularly after having touched fatty foods, as this will attract insects, which could harm you. The Prophet (pbuh) Says:

"Whoever sleeps while his/ her hands are contaminated with dirt and fat not washed off, and a bad thing happens to him/ her, he/ she has to blame none other but him/ herself" (At'termthi and Abu-Dawoud).

Cleanliness of Homes and Gardens

Humans are encouraged to clean their homes and gardens, otherwise these turn into environments suitable for rats, flies, and mosquitoes, which can cause illness in humans.

Cleanliness of Mosques

Mosques are houses of God and they are places for prayer and worship. Islam takes care of them and promises those who clean them a good deed in the Hereafter. God Says:

"In it (the mosques) are men who love to clean and purify themselves. And Allah loves those who make themselves clean and pure" (9:108).

Cleanliness of Roads

Streets and roads are important places to all people. To keep streets and roads in good and clean shape, Islam encourages people to clean them and pick up stones, rubbish, or any other dirty things. It is considered a good deed to do so. The Prophet (pbuh) Says:

"Collecting rubbish and dangerous things from roads is a good deed" (Al-Bukhari, 3-386).

Also, Islamic rules restrict the use of streets. It is not allowed to pour dirty water into streets. Moreover, Islamic rules forbid to have industrial sites that produce pollutants close to roads and streets.

Protect Food and Prevent Contamination

It is encouraged to eat clean and fresh food for a healthy body and the strength to worship and work. God Says:

"And eat of the things which Allah has provided for you, lawful and good, and fear Allah in Whom you believe" (5: 88).

This verse indicates that it is good to eat all healthy and tasty foods, which God permits us to eat, such as meat of birds, fish, sheep and goats, as well as milk, fruits, grains, and vegetables. On the other hand, it is forbidden to eat dead animals that were not properly butchered, or blood, and pork. Also, Muslims are not allowed to drink any alcoholic drink. This is due to the negative psychological and physiological effects of these foods and drinks. Peoples must keep foods and drinks in tightly closed and clean containers to not expose them to insects and other microbial pests as these will be poisonous to people. The Prophet (pbuh) Says:

"Close the food and drink container" and "If a dog drunk from it or licked a container, you should wash it seven times, first of them by using soil (dust) from earth" (Muslim, 1-167).

Caution with Fire

God created fire as a vital thing in our life, but humans should use fire properly. Fire is used in many life supporting activities. God Says:

"Tell Me! The fire which you kindle, is it you who made the tree thereof to grow, or are We the Grower? We have made it a reminder (for the Hell-fire in the Hereafter); and an article of use for travelers (and all the others in this world). Then glorify with praises the Name of your Lord, the most Great" (56:71-74).

Fire is a bifunctional thing, it may be used for benefit, and it may be used to cause harm and tragedy. It burns forests and kills humans. It pollutes the air by producing smoke and through dust spreading all over the burned areas. This causes acid rain to fall, which kills plants and pollutes rivers and lakes, causing problems for aquatic and plant life. The Prophet (pbuh) advised caution with fire and said when a house burned down:

"This fire is your enemy, so if you go to sleep, put it out" (Al-Bukhari and Muslim).

The Prophet (pbuh) emphasizes to use fire responsibly and to put it out if not in use. All sources that might cause fire should be handled with care, such as oil, gas, and electricity.

Islamic Respect for Birds

Islamic respect for birds goes a long way. God says in the Holy Qur'an:

"There is not a moving (living) creature on earth, nor a bird that flies with its two wings, but are communities like you" (6:38).

From the religious point of view, bird communities are like human society, and they are deserving of the same rights. Birds provide a vital element to the environment as they help preserve a balanced environment by decreasing the population of insects and other small creatures. As mentioned before, the Prophet (pbuh) has forbidden the use of birds for target practice.

Islamic Respect for Water

Water is the most important element in our life, as living creatures cannot stay alive without water. All civilizations during the long history of the world appeared in places where water was found, such as around the Nile river. Really, it is the best thing given to humans by God. God Says:

"And We have made from water every living thing. Will they not believe" (21:30)?

This verse shows that water is the secret of life. Water is mentioned in the Holy Qur'an more than 80 times and each time with a different meaning simply because there is no life without water. Sadly, most rivers and lakes around the world are no longer pure because of their misuse. Most dangerous causes of water pollution are underwater nuclear explosions. Compare this to the Islamic order against polluting water: it is not even allowed to breathe in water! The Prophet (pbuh) says:

"Do not make water in any stand water then have a shower of" (Al -Bukhari: 1-50). Why does the civilized world practice pouring sewage and other pollutants into rivers and oceans?

Other Aspects of Islamic Caring for the Environment

Other types of Islamic activities dealing with environmental care deserve to be briefly mentioned here. For example:

- Watching for butchers, who are not allowed to kill and slaughter animals in front of their shops so not to pollute roads with blood.
- Watching for cooks, who have to keep food inside tightly closed and clean containers.
- Watching for bakers whose bakeries should be clean with high chimneys and who should be without disease.

The Prophet (pbuh) indicated in many of his traditions that it is not ethically acceptable to belittle any of God's provisions given to mankind, even in a word or a tiny blemish. It is not allowed to speak badly of winds as they have many benefits for humans, including helping disperse seeds, carry clouds and rain, carry pollen to help pollinate and fertilize plants, which eventually leads to fruit production. God Says:

"And We send the winds fertilizing (to fill heavily the clouds with water), then caused the water (rain) to descend from the sky, and We gave it to you to drink, and it is not you who are the owners of its stores." (15:22).

Doesn't wind move ships on the seas? Isn't pollution a form of punishment sent by God to ancient disbelievers and disobedient nations? Polluting air and wind with poisons is certainly ignoring God's provisions.

Environmental Literacy Is a Religious Duty

A religious and Islamic principle holds that "what is necessary for any religious duty is a must." Therefore, environmental literacy is a must in Islamic religion and a crucial and vital activity for all Muslims to engage in. Environmental literacy is the gate leading to a clean and healthy environment. All Muslims must develop environmental literacy in accord with the Holy Qur'an, its commandments, and the Prophets' (pbuh) traditions. Achieving this literacy will surely help protect the environment from damages and promote the right feeling among humans towards their environment.

It is a positive thing to have a clean and healthy environment, as this will affect all economical, social, political and agricultural areas. As a result of a healthy environment, it will be easy for countries to offer a healthy lifestyle and enough food and water for all its peoples at all times. This, in turn, will reduce medication and other health care costs. God says:

"Have they not seen how We drive water (rain clouds) to the dry land without any vegetation, and there with bring forth crops providing food for their cattle and themselves? Will they not then see"(32: 27)?

Finally, we can conclude that the big goal of all Qur'an verses and Prophet (pbuh) traditions is to build and maintain a healthy and clean environment free from any source of pollution and misuse. Also, not one Muslim's faith would be complete unless he/ she acted to his/ her best knowledge to do good deeds, among them protecting the environment.

All praises and thanks be to Allah and (Blessings of Allah) upon the last (final) of Allah's Prophets and Messengers, Muhammad Ibn Abdullah.

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