

4th International Conference on Environmental Education

Abstracts

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CEE

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Abstracts

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Art, Design and Ecology

Ecovillage Design Education (EDE): The Gaia Way for Ethical and Sustainable Communities

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Gaia Education is an international team of educators developing curricula and courses on the Sustainable Development of Urban and Rural Settlements. Their team of leading edge educators, called the GEESE (Global Ecovillage Educators for a Sustainable Earth), has developed the **Ecovillage Design Curriculum**, which provides the basis for a four week comprehensive course on the fundamentals of ecovillage design. The Ecovillage Design Curriculum has a wide range of practical applications and is full of innovative materials, ideas and tools that have been developed and tested in ecovillage communities worldwide. This Curriculum has the endorsement of the United Nations Institute for Training and Research – UNITAR.

Characteristics of EDE

- A thorough and objective assessment of the state of the planet is followed by regional, community, and place-based solutions.
- It empowers individuals and communities with the knowledge for shaping their worlds and becoming more self-reliant while engaging in bioregional as well as international cooperation.
- It is universal in scope but local in application, directed towards preserving precious cultural diversity.
- Investigative theory is followed by practical application.
- It imparts useful and instrumental life-skills as part of the curriculum.

- It is relevant to people in rural and urban regions.
- It promotes and facilitates healthful planetary evolution, as well as the well-being and quality of life of individuals and their communities everywhere.
- It explores and expands the perceived limits of human potential.
- It informs, enables and inspires community-based visions of a sustainable human civilization as well as the means to turn such visions into reality during the course of the 21st century.

Auroville, an international spiritual and ecological community in Tamil Nadu, India, conducts courses in ecovillage design in partnership with Gaia – these courses are adapted to the specific ecological and cultural context of south India. The Auroville curriculum embraces four keys crucial to sustainability: worldview, social, economic and ecological perspectives. The course shows how to incorporate sustainable values as we try to transit from a post-industrial society to a sustainable society. It encourages hands-on exercises to promote experiential learning within the local and Indian ecological and cultural context. Visits to several demonstration sites within Auroville in the fields of renewable energy (solar, wind, biogas), reforestation, natural building, organic farming, rainwater harvesting, experiential education, comparative philosophies, deep ecology, healing, and yoga, are part of the curriculum.

After describing and analyzing the Gaia EDE, the paper will provide a brief overview of how EDE is being adapted in the local India-specific ecological and cultural conditions in Auroville.

New Media in Reorienting Higher Art Education Towards Sustainable Development

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The current discourse of art education in the university provides a rich theoretical and experiential base for ensuring learner-centered educational environment. This paper discusses contemporary particularities of higher art education in the context of the Decade of ESD. The paper also emphasizes the role of new media in higher art education and the relevance of the educational process to the needs of the learners in higher education. It concludes with a description of the status of higher art education in Latvia.

Biodiversity

Awareness about India's Biodiversity among Bangalore's School Teachers and Students

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This study attempted to gauge the awareness levels about India's biodiversity among the school teachers and students in Bangalore. The study was carried out through questionnaires administered to teachers of Environment Science and students, through visits to different schools in Bangalore. In the first part of the study, the biodiversity education needs of school teachers were evaluated by giving each school teacher a questionnaire with 52 questions. The first part of this questionnaire explored their awareness about biodiversity and their use of the internet to search for biodiversity related information. The different kinds of biodiversity content that teachers were looking for as well as the format in which they preferred to have such content were analysed. The second part of the questionnaire examined the creative approaches used by school teachers - like art, craft, storytelling, drama, songs, riddles, verses, games, field trips, projects and information from the media - to facilitate learning about biodiversity among students.

The biodiversity related learning needs of students were also explored through a set of 22 questions. The questions attempted to pinpoint areas of biodiversity information that students wanted to know more about. Preferences for different formats of creative communication like games, songs, riddles, craft, drawing, drama, films, posters, books and field trips were examined. This study highlights the lacunae in biodiversity education, both from the perspective of the

teacher as well as the learner. Based on the observations obtained from this study, and drawing on some creative inspirations, this study also field tests some creative methods of communication in biodiversity education.

Sustainable Development in Nigeria through an Enriched Gender Based Environmental Education

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Attaining gender equality is a major developmental goal in Nigeria. The National Economic Empowerment Development Strategy (NEEDS) and the Environmental Renewal and Development Initiative (ERDI) of the nation recognise the participation of both men and women as central for sustainable development. A major effort in engendering sustainable development in Nigeria is the developing of a National Policy on Gender and establishing a National Gender Machinery which has the responsibility of integrating gender concerns and perspectives into policies and programmes for sustainable development.

Despite all these, very little progress has been made in articulating practical strategies that would ensure proper integration of gender concerns into managing and conserving biodiversity. It is essential to recognise that men and women have particular needs and make different contributions to the conservation and sustainable management of biodiversity. It is therefore necessary to bring to light, gender differentiated practices and knowledge of men and women in their relations to biodiversity resources, through an enriched Environmental Education Programme that addresses community participation in natural resource management. This paper, which draws from a study conducted to improve the design of CIDA's forest related programme in a state in Nigeria, focuses on a detailed gender situational assessment of community forest management in Nigeria with special reference to Cross River State. Qualitative methods were used to assess the implementation of Gender Equality concerns in Cross River State Forest Management Project. The qualitative evaluation was based on Canto's Discrepancy Evaluation model integrating the Gender Analysis Framework. Field visits were undertaken to make first hand observations about the various activities, as well as focus group discussions and interactive workshop sessions. The implications of the study for developing an enriched gender based Environmental Education for Sustainable Development, were highlighted.

Role of Invertebrate Fauna in Sustainability of Ecosystems

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Our wildlife conservation efforts are mostly centred around larger animals i.e. the vertebrates. We tend to ignore smaller members of the animal kingdom, the invertebrates. In fact, the urgency of their protection has been only lately realised and therefore, invertebrate conservation is a newly developing concept.

We often ignore the fact that much of the diversity in the living world is due to invertebrates. For instance about 41,000 vertebrate species have been described while the reported number of invertebrate species is 9,90,000. In terms of biomass, invertebrates constitute 90 to 95% of animal life. Invertebrates form significant links in almost every food chain and their depletion will obstruct the food chains. If invertebrate decomposers are lost, our planet will be covered with garbage. While man is at the apex of the pyramid of life, invertebrates are near the base. If man disappears much of the pyramid will survive, but if the invertebrate fauna is depleted the pyramid will collapse. According to E.O. Wilson, "We need invertebrates but they don't need us." A necessary step in invertebrate conservation is to develop general awakening among the masses about invertebrates, their ways of life and their significance. So while designing / revising the syllabi of environment studies at various levels, we should emphasise the importance of invertebrate conservation.

Establishing conservation parks with provisions for the study of diversity in the different invertebrate groups, and combining these with such lucrative projects as vermiculture, aquaculture and shrimp farming, could be feasible activities. The tragic loss of a large number of invertebrates may be minimised by working towards the prevention of general habitat destruction. In brief, the general tendency of protecting those animals and plants which are of direct use to man and ignoring / destroying others has to be countered.

Community Outreach: Using Radio for Biodiversity Conservation in Lao People's Democratic Republic

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The Wildlife Conservation Society and the National Radio of Lao People's Democratic Republic initiated the *Friends of Wildlife* radio program to disseminate information about conserving the country's important biodiversity, both in the urban and rural areas.

Lao People's Democratic Republic (PDR), located within the Indochina Biodiversity Hotspot, has a rural population base that is reliant on natural resources. Due to the limited media infrastructure available, print and television media are not viable ways to reach rural people. Recognizing this, the Wildlife Conservation Society, in cooperation with the National Radio, developed the *Friends of Wildlife* radio program. Aired weekly, each program addresses high priority problems and threats to biodiversity and integrates conservation messages into it with entertaining songs. To evaluate the program success, staff members used structured interviewing techniques to interview 2,380 people in five provinces. Survey groups consisted of government officials, traders, rural villagers and urban dwellers. Qualitative indicators revealed that the listening audience gained new information from the program. We found that 67% of the respondents listen to the radio; 18% of respondents listen to the *Friends of Wildlife* program; and among the various demographic groups interviewed, rural villagers listened to it more than any other.

Density of White-backed Vulture *Gyps bengalensis* around the Buffer Zones of Corbett Tiger Reserve Forest

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The study under discussion was carried out in the outer/buffer areas of Corbett Tiger Reserve Forest, Ram Nagar, Nainital in the years 2005 and 2006. The maximum density of White-backed Vultures has been observed in the nearby villages, due to sufficient availability of food resources. During the two years of the survey, the maximum sightings have been recorded near

carcasses dumped by villagers outside their villages. Vultures feed on carcasses regularly with some additional partners in the process like crows, egrets, kites and dogs. A total of 108 individuals of White-backed vultures have been recorded. Year 2005 shows good density with 74 individuals as compared to 34 in Year 2006. The fluctuation in the density of the vultures indicates that some disturbances are responsible for the same. In the last few months of the year 2006, a lot of conflict among vultures and domestic dogs with crows has been recorded. Scarcity and/or low availability of food has been concluded as one of the factors responsible for lesser sightings of White-backed vulture in the study area.

Climate Change

The Green pack: A Case Study in Bringing Practical Environment and Development Education Materials into the Schools of Transition Countries

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The Central and East European region has experienced a dynamic, yet difficult, transition since 1989. Many of the countries that were formerly part of the Soviet-bloc have become new members of the European Union or are coming to terms with years of social and economic transformation and even inter-ethnic conflict. The education sector has also experienced this transition and the Regional Environmental Center for Central and Eastern Europe (REC) has worked together with local stakeholders in a number of these countries to develop new education tools focusing on environment and development issues. The Green Pack is a multi-media teaching kit for teachers, which is targeted towards pupils aged 11 to 16 years. It has been launched - or is being developed - in more than ten countries of Central and Eastern Europe, and Central Asia (ranging from Albania to Poland, Russia to Azerbaijan) and has been selected by UNESCO for its brochure *Highlights on DESD Progress to Date* (April 2007).

This case study looks at the key practical lessons learned in developing and implementing the Green Pack successfully. As the project is implemented within a wide grouping of stakeholders - from national government, education institutes, environmental organisations, teachers, NGOs, filmmakers, designers and artists - the study focuses on the importance of the partnership of stakeholders involved in adapting and integrating the materials nationally and the development of local ownership of the product to ensure sustainability and upgrading. In addition, the variety, structure and design of the materials - such as the hierarchy of the components from the international (European context) to national and local issues - will be demonstrated through

those parts of the Green Pack focusing on climate change. Finally the lessons used in the classroom from the pack are also covered by showing the process of national dissemination and teacher training adopted to enable the use of the different multi-media elements and the new interactive approaches within the kit.

Educational Strategies for Overcoming Misconceptions about Global Climate Change

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Sustainable development requires community and civic leaders who are literate in scientific principles and can make informed and balanced decisions about the environment. However, over the past two decades, research has demonstrated that people lack a solid comprehension of environmental processes including those leading to global climate change. In particular, multiple studies have shown that ozone depletion is often confused with global climate change even after direct instruction in these topics. Our main objective with this study was to examine the way particular educational strategies overcome such misconceptions. In particular, we wanted to compare the conceptual understanding of college students receiving direct, lecture, teacher-centered instruction on climate change to those participating in a student-centered constructivist series of lessons. We designed and implemented a new activity for teaching about climate change aimed to encourage students to construct their own knowledge rather than passively receive information through teacher-centered approaches such as lectures. Using an instrument specifically developed for measuring conceptual understanding of global climate change, we found that students who were encouraged to construct their own knowledge showed greater gains in conceptual understanding and maintained fewer misconceptions than students who experienced teacher-centered instruction. This study underscores the need for student-centered, experiential classrooms for environmental education, particularly in areas where there are strong misconceptions. Given that global climate change is a topic that is unlikely to leave the arena of public and political discourse for the foreseeable future, such educational innovations are critical to successful environmental education for sustainable development.

Climate Capabilities and ESD

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How can we develop educational skills concerning the teaching of climate change values in the context of Education for Sustainable Development (ESD)? The aim of this paper is to present the research project *Climate Capabilities: An Ethical Analysis of Anthropogenic Climate Change* (2008-2010), which is funded by the Swedish Research Council Formas, and to initiate a discussion concerning the pros and cons of launching the concept of climate capabilities as a conceptual framework for addressing climate change ethics in ESD. The paper highlights the theoretical and practical conceivable need for universal climate change values versus the phenomenon of contextual moral outlooks. Is it possible to develop a comprehensive global climate change ethic in the context of international and cross-level climate change responses? And, how can ESD deal with this tension and with the value dimension of anthropogenic climate change in general? Facing post-2012 climate negotiations, this paper contributes to further knowledge on the nature of intrinsic values threatened by climate change. Thus, the paper contributes to a critical debate on foundational ethical climate change values for global and local climate change justice in political practice. Accordingly, the paper will add to the theoretical development of social justice theory and will contribute to ESD-research and ESD-education by discussing teaching aids for ESD and Climate Change values.

Carbon Trading: India and the Domestic Markets

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Carbon trading is an umbrella term that includes the trading of Greenhouse Gas reduction credits that were defined in the 1997 Kyoto Protocol of the Climate Change Convention, first drawn up in 1992. It advocates the concept of the creation of a carbon market which enables emissions to be cut with the minimum price tag.

The concept of Carbon Trading can be used at the domestic level within India where the large corporates can be given a certain amount of carbon credits and whoever exceeds the same can be penalised. The entire model would be elucidated upon in the final paper.

It is imperative that the carbon trading being done at the domestic level has a completely different and separate system so that the national carbon units and the international carbon units are not combined and confused, which would otherwise lead to a mockery of the trading system. The fundamental thought behind this is that trading would take place at two parallel levels that do not intersect or interfere with each other.

Therefore to conclude, the research paper would be dealing broadly with three things:

- The feasibility of the concept of carbon trading at the domestic level
- The model and infrastructure needed to implement the plan at the domestic level
- The possible benefits of this domestic model

Community Leadership

Changing Public Behavior – Increasing Citizen Involvement through Use of Target Audience Information

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A new USDA Cooperative Extension project, *Changing Public Behavior*, focuses on preparing water resource professionals to apply education and social science research in new and creative ways to encourage the public to adopt environmentally friendly habits. If the goals of outreach are to 1) effectively change public behavior in ways conducive to the better management of water resources, and 2) provide communities with the skills required to manage water resources themselves for the long term and/or know where and how to seek help in doing so, then it follows that outreach educators need to develop a familiarity with the individuals and communities with which they work. This project, coordinated by the University of Wisconsin Extension, provides online and workshop resources to help water educators focus on local interests and conditions when encouraging people to take environmentally appropriate actions in their home, business, organization, or community. Project resources build on a previous analysis of research findings about education with relevant audiences, and include an analysis of social assessment tools with potential for application by natural resource professionals. Social assessment strategies outlined on the Water Outreach Web site at <http://wateroutreach.uwex.edu> are new to most Western educators, but will be familiar to educators in other parts of the world, especially in developing countries. One purpose of this presentation is to generate discussion among experienced professionals on how to most effectively collect and apply information about audiences when developing an outreach or education initiative. Discussion outcomes will help inform Water Outreach Web site content.

What Works? Quantifying Social and Ecological Effects of Capacity Building Interventions for Community Forest Management in the Bolivian Amazon (Poster)

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Community Forest Management is just beginning to boom in the Amazon region of Bolivia. As a result, various institutions are providing educational, organizational and economic support to communities that demonstrate interest in formally managing their forest-based activities. Government agencies primarily focus on writing management plans and building storage facilities so that communities have the basic foundation to engage in forest management according to the law. NGOs and cooperatives engage the communities in a spectrum of participatory processes that attempt to improve the communities' ability to design and update their own management plans and autonomously manage their forest resources once external support wanes. The various types of interventions affect the way community members perceive community forest management and eventually engage in land use. This poster will present a research design that attempts to link the effects of cognition and capacity building processes on land use behaviors in eight Bolivian communities. The results of this research will increase our understanding of how conservation and development organizations can best support community-based natural resource management as a sustainable development activity.

Educational Value of the Venezuelan Community Councils for Sustainable Development

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The recent creation of the Community Councils according to the Venezuelan Community Councils Law (Ley de los Consejos Comunales, 2006) generated opportunities for reducing poverty effectively and achieving sustainable development through education and participation. The

communities rely on universities for the construction of equity in our society, by using this innovation effectively as a tool. A learning program was developed for achieving participation and, the development of projects related to the improvement of the community environment. The program was based on building awareness and understanding of the environment with a consciousness-based-education view to promote the sustainable use of nature and natural resources. The experience that is being applied in Margarita Island as a pilot shows that the Consejos Comunales are a very valuable tool for achieving participation of all the citizens in the process of social responsibility, justice and sustainable development. The partial conclusion we have made is that the Community Council is a beneficial tool for achieving effective participation, articulation, synergy and integration of communities in the construction of sustainable development.

Corporate Social Responsibility

Role of Indian Banks in Mitigating Climate Change

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Climate change is one of the greatest environmental challenges facing the world today. Research shows that the average global temperatures could rise by up to 6 degrees C within the span of the next century, leading to severe ill effects on our environment, health, and economies. This paper investigates the special role that financial institutions and banks can play to reduce CO2 emissions and hence mitigate climate change, in a fast growing economy like India.

There are two types of emissions being caused by banks: direct emissions (caused by the bank operations) and indirect emissions (bank's investment in projects which produce GHG emissions). Banks, being major drivers of the economy, can play a big role in reducing emissions by integrating climate change mitigation in its policies and considering environmental costs at the proposal evaluation stage itself.

India is one of the fastest growing emitters in the world. GHG emissions in India grew at a staggering rate of 57% for the period 1992-2002. Its energy intensive GDP growth (and consequent emissions growth) is being fuelled primarily by its financial institutions. As per our estimates, Indian banks have assets worth nearly US \$ 270 billion, thus generating around 200 Megatons of CO2 per year. This represents some 0.75 % of annual global CO2 emissions, or 20% of Indian economy's total CO2 emissions, which is around 1025 Megatons. Thus, it is imperative that Indian banks take up a policy stand, and start making efforts to mitigate climate change. Encouragingly, India's largest bank, SBI has recently come up with plans to create financial instruments to aid carbon credit trading and management and to fund and advice clients

in eco-friendly businesses. This paper will formulate a generic strategy for Indian banks to reduce direct/indirect emissions. It will compare Indian banks' climate change mitigation policies with those of major international banks, with respect to their lending policies, business planning and strategies, and portfolio management.

Corporate Social Responsibility and Environmental Ethics: The Indian Context

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Corporates are traditionally known as engines for driving the economic performance of an entity, its success being measured in terms of high returns on equity at the individual plane and its contribution to the nation's economic growth on a collective plane. Do they have any social or environmental responsibility? This paper begins with an attempt to define the concept of Corporate Social Responsibility (CSR) with relation to the newer concept of environmental ethics, and extending its boundaries to that of corporates involving themselves in the international carbon trading market. Having defined the concept as it is commonly understood or as propounded by the theoreticians of CSR as an applied concept in the context of the environment, the paper seeks to examine the position in the Indian context, with some historical background, and the current practices, including the setting up of the National Authority, under the provisions of the Kyoto Protocol, laid down by the UNFCCC, and its compliance. The generally accepted principle is that if a company has caused some damage to the environment, be it in the form of air or water pollution, it owes a debt to the society to make up for it. The issue on hand is: how to chalk out a peaceful way of harmonising the corporate world with ecology and environment, in our march towards becoming environment conscious and socially responsible.

Culture Heritage Interpretation

Our Festivals – Celebration for Us and Curse for the Environment

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A festival is a day or period of religious celebrations. The festivals display a rich vibrancy and reflect the cultures and traditions of different groups of the society. They give us a chance to remind ourselves of brotherhood, unity and the meaning of life. Today, with the fast changing and expanding lifestyle with its crippling levels of stress, festivals are a wonderful escape for social and cultural interaction between different cultures, castes and communities.

India is a diversified land of various cultures, religions, rituals and traditions. There are a number of festivals celebrated in India during the whole year. Change of seasons, historical events or agriculture growth are the main reasons behind most of the festivals. Deepawali, Holi, Lohri, Ganesh Chaturthi, Navratri, etc. are some of the festivals commonly celebrated in India.

Somewhere during the celebrations of these festivals we harm our environment consciously or unconsciously. Various natural resources are used (wood, flowers, water) for celebrating them. Many harmful resources are utilised (chemicals, poisonous colors, clay) which have strong negative effects on the environment.

“Environment pollution” or “environment degradation” has become a matter of major concern globally. Human beings are continuously disturbing the ecological balance in many ways. Festivals are one of the reasons the atmosphere being polluted.

Therefore, the major agenda at this point of time is to create awareness among the people about safeguarding our environment from the harmful effects of our celebrations through “Environment

Education” while also reiterating the importance of celebrating our rituals and customs which will help us be rooted to our culture for years to come.

This paper attempts to conceive various alternative strategies for celebrating our festivals in an extensively eco-friendly manner. Further, the authors also stress on the recommendations for various religious groups/bodies to promote these new suggestions and alternatives for our festival celebrations.

Interpretation in Dadra and Nagar Haveli Wildlife Sanctuary: Current Status and Future Prospects

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The interpretive facilities in Dadra and Nagar Haveli Wildlife Sanctuary were opened to visitors with the object of facilitating a better understanding of its conservation efforts for the wildlife and forests. The interpretation programme of the wildlife sanctuary can be divided into Nature Education Centre, Lion Safari and Satmalia Zone. Tourist data was collected from December 2006 to June 2007 for assessing the existing interpretive facilities and also to compare the number of tourists visiting different interpretive facilities. The interpretive support involves audiovisual products, exhibits, personal services, publications, trails, wayside exhibits, nature education centre, etc. Significant differences were observed in the number of tourists visiting the Lion Safari, Satmalia Zone and Nature Education Centre. The Lion Safari is the most preferred facility (52%) followed by Satmalia Zone (35%) and Nature Education Centre (13%). The interpretation programme helps visitors move from tangible experiences to understanding systems, relationships, processes and meanings. The challenge for interpreters and planners is to help visitors experience landscapes in beneficial, enjoyable and sustainable ways, and help them relate experiences to more intangible values, meanings and traditions.

Interpretation as a Disciplinary Interface in Sustainable Education

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The field of interpretation has grown out of the perceived need to conserve and sustainably manage natural heritage, and to enhance the experience of visitors and tourists. An important role of environmental interpretation is to attempt to educate visitors (in informal, free-choice learning settings) to the complex natural resource issues associated with national and local protected areas and sensitive ecotourism settings. As well as its educational and recreational functions, environmental interpretation can also contribute to public relations and people management. During the 30 years after the Tbilisi declaration, the field of interpretation has developed in parallel with environmental education. Even before Freeman Tilden wrote his oft-quoted definition of interpretation, people tried to distinguish between environmental education and interpretation. Although this debate seems to have slowed in the academic literature, our observation is that we should reconsider it with reference to the transition from environmental education to the new era for education for sustainable development. In particular, in view of the United Nations Decade of Education for Sustainable Development, the concept of environmental interpretation is viewed as critical, to connect the ideology of sustainable development with environmental education. Interpreters and environmental educators should cooperate to ensure the success of education for sustainable development. This article reviews different research approaches to understanding the ways interpretation could facilitate sustainable development with an emphasis on identifying the strengths and weaknesses of existing studies. Finally the review highlights promising new directions in recent studies, and also makes several concrete suggestions regarding how researchers in this field can refine existing methods and broaden their approaches.

Disaster

Potential Benefits of Wildfire Education Program

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Education is an important aspect of any disaster preparedness initiative. In addition to providing information and creating awareness, education programs can empower residents, change community norms, build community support, and enhance social capital. This paper presents the results of two studies that use the context of community preparedness for one type of disaster — wildfire — to examine the role of education in reducing vulnerability to disasters.

The first study uses an analysis of community preparedness activities in 15 communities at risk of wildfire across the United States to look at the role of education in enhancing community preparedness by providing:

- Information to reduce risk and change attitude and behavior
- Opportunities and experiences to change social norm

Educational programs that fit the goal of changing social norm may also affect community characteristics — relationship between homeowners and agencies, people's sense of place, and participation in community activity — collectively referred to as social capital. It is associated with increased disaster preparedness (*Jakes et al.*, 2002), alleviating poverty (Collier, 1998), fostering economic growth (Putnam, 2000), and increasing child academic achievement (Coleman, 1988; Israel *et al.*, 2001).

The second study explores the relationship between wildfire education programs and perception of social capital. It attempts to delineate components of an educational program that may successfully involve residents in taking actions to reduce risk and may be associated with enhanced perception of social capital. Educators who wish to improve preparedness could focus on delivering messages through existing community groups (where social capital might already exist) and through formats that encourage community engagement (where social capital might be nurtured).

Climate Extremes and West Africa Safer Air Transport

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The knowledge of climate and weather extremes is necessary for the development of economic and social systems for a sustainable future. Therefore, an important aspect of sustainable development is associated with weather- and climate-related man-made or natural disasters such as air accidents which are recurrent phenomena.

This paper investigates the recent climate extremes in West Africa like the squall which is a member of the thunderstorm family, and whether there is a solution to air accidents occasioned by bad weather? The present study shows that there is an extremely high fluctuation in the year to year air accidents in Africa. According to the IATA report, it is ten times more dangerous to

fly in Africa than in Europe, North America or Asia and four times more dangerous than in Latin America. In particular, the paper reveals that the broader problems of extreme weather, poverty, war and corruption also have had a damaging impact on Africa's air industry, contributing to numerous crashes over the past decade.

The socio-economic implications discussed include lapses in the pre-disaster, disaster and the post-disaster phases (*Ehikhamenor Edeaghe et al, 2006*). The paper finally discusses the problems related to the issues of climate extremes, Nigeria's experiences in air safety and air accident, the contribution of the Nigerian Meteorological Agency to extremes in weather and safer air transport. And the way forward.

Traditional Disaster Warning Index in Bangladesh

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The continuous loss and damages from natural hazards is causing a slow down in the impact of development programs in Bangladesh. Different projects and institutions have been working towards an early warning disaster system. In rural Bangladesh, people still follow the behaviour of some animals and plants in this context. Behavioural ecology of some animals and plants are an index of hazards to the rural people of Bangladesh. The study under discussion was conducted in the eastern and northeastern districts of Bangladesh. A few examples of the traditional index: a good harvest of tamarind indicates high frequency of storms. The ants moving to a place on a higher level is considered a symptom of flood. The egrets flying destination-less is a sign of *Kalbaishakhi*, a form of monsoon storm from the northwest. There are also proverbs based on the traditional warning signals.

The local communities have been using these indices for hundreds of years. These beliefs have evolved from ethology and ecosystem interaction. But they are now losing this traditional

knowledge, as there are gaps in the process of knowledge transfer from the elderly to the younger generation. The proposed poster aims to describe the traditional early warning indices found in eastern and northeastern Bangladesh with eco-ethological analysis and scope for knowledge dissemination.

Scope of Climate Change Education in Bangladesh

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Bangladesh is recognized as one of the countries most vulnerable to the adverse impacts of climate change. The majority of its 140 million people are poor, living each day on less than a US dollar. Adaptation to climate change requires that the poor and the vulnerable be able to secure their access to necessary services and resources timely, adequately, and in accordance with their needs. The vulnerable communities should be able to secure access to the right to information to make decisions and to build necessary resilience, in the most cost effective way. The climate change issue is dealt with in the textbooks of Bangladesh only very briefly compared to the present requirements. SDRC and Action Aid Bangladesh have developed a board game as part of a co-curricular activity for the secondary level. School awareness programs can be used to promote and enable a culture of climate resilience at the community level. The learning kit, when utilized by communities, can play an effective role as an entry point into the raising of awareness on climate challenges in general, and in demonstrating how risks can be addressed and managed in community specific contexts. To achieve effective results, such a co-curricular activity may be a useful tool but not enough. Introducing climate change issues in the textbook is a must for the country considering the present circumstances. Hyogo Framework for Action (HFA) has also suggested the introduction of the issue in the community in a non-formal way. The change agents of society are the best movers for this. Knowing HFA is not enough; it entails that good governance is practiced and the society becomes aware of its basic right.

Poverty Alleviation - Natural Disasters and Education for Sustainable Development (Poster)

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St. Leonard's College is committed to the concept of Education for Sustainable Development and has implemented a project that has used the *Boxing Day Tsunami* as the context to discuss poverty alleviation and ESD. It could be adapted to other situations.

The Boxing Day tsunami in 2004 was one of the major natural disasters that have occurred in this decade. I have written and published a booklet outlining the science of the tsunami. The booklet is written for a non-scientific audience and using this as the major fund raiser, students, teachers, parents and the college community is engaged in a variety of projects to help Sri Lanka and its education.

By engaging in these projects, students have realised that poverty is one of the major vulnerability factors in a natural disaster. It provided them the opportunity to actively involve themselves in poverty alleviation activities. Further, the opportunity to respond to traumatic public events like this has helped them to mirror the ways they respond to traumatic experiences in their immediate world.

This poster highlights four different aspects of this project.

1. **Bursary program** – which supports 34 Sri Lankan students who lost their parents
2. **Helping schools to build their resources** – which supports Sri Lankan schools to build resources, including access to technology
3. **School in a shoebox** - which helps to promote cultural awareness among Sri Lankan and Australian students
4. **Teachers helping teachers** – which focuses on Sri Lankan teachers' professional learning

This project has helped students in their learning about the world as it really is, in all its complexity and with all the challenges it faces. Further, it provided the opportunity for students to work collaboratively with other community organisations. This learning is a major component of ESD.

Disasters Induced Gender Based Vulnerability in Developing Countries

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Disasters are more destructive in nature and disaster risk often accumulates historically through inappropriate development interventions or shortcomings of development policies. The way that men and women become vulnerable to disasters will also vary based on their gender. This paper analyses in depth the differences in capabilities and vulnerabilities which are at the heart of a gendered perspective on disaster management.

Development of the Implementation Mechanisms for an Effective Education for Natural Disaster Preparedness in the Context of ESD

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The International Workshop on Education for Natural Disaster Preparedness (ENDP) and its Implementing Mechanism in the Context of ESD was convened by the National Institute for Educational Policy Research (NIER) and the Asian Cultural Center of UNESCO (ACCU), Japan in 2006. Twenty professionals from the country and outside attended the workshop. The goal of the workshop was to achieve education for a sustainable future by: (1) building the capacity of education providers in planning, designing, developing, implementing and evaluating teaching-learning and promotion materials on education for natural disaster preparedness and its implementation mechanisms in the context of ESD - for advocacy, literacy, school subject integration, and professional development; and (2) setting-up a core of experts forming a regional network or e-group of education providers for natural disaster preparedness and its

implementation mechanism with the basic foundation provided by the Hyogo Framework for Action (2005-2015) and the United Nations Decade of Education for Sustainable Development (UNDESD, 2005-2014).

At the workshop, several papers and case presentations on education for natural disaster preparedness were shared, which include: concept building; curriculum development; materials development and their utilization; teacher training and educator training; institutional arrangements and policy linkages. Then, based on UNDESD International Implementation Scheme (2005-2014), Tbilisi Framework and Hyogo Framework for Action (2005-2015), the workshop formulated two frameworks and guidelines for the effective development of ENDP in the context of ESD, i.e. objectives at individual level and implementation mechanisms in the context of ESD. The guiding principle of these frameworks and guidelines is to develop and use knowledge, innovation and education to build a culture of safety and resilience at all levels as stated in the Hyogo Framework. At the paper presentation, the frameworks, guidelines and findings from the collective works of the workshop will be reported and discussed.

Climatic Changes and Communities' Response to Hazards Case study from Northern Pakistan

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Chitral - the northern most district of Pakistan - is located in the remote isolated region of the Hindu Kush mountain range. Firewood is the main source of energy for cooking and heating for around 400,000 people (50,000 households) inhabiting the 32 different valleys. Absence of alternative source of energy has been a significant factor of persistent poverty and environmental degradation in the area. Firewood is used for cooking, space heating, and to heat water in cold winters. Harsh climatic conditions, negligible forest covered area, low per capita income, limited and costly availability of alternative energy sources are important characteristics of the area, forcing the poor communities to spend a sizable amount of the family budget on purchase of firewood every year. Poor households are therefore overusing the scarce and sporadic natural vegetation on the mountains. The thick juniper forests on the mountains in most of the valleys seen in early 70's are now depleted and the mountains are cleared. Coupled with climatic changes in the region, the vegetation-less mountains have started causing flash floods every year resulting in the multiplication of the number of people falling below the poverty line and exposing many more to high risk and vulnerability. Since 2004, there have been unexpected snowfalls, snow avalanches, land slides, glacier outbursts and flash floods in Chitral resulting in the loss of hundreds of human lives and thousands of livestock; besides the washing away of forests and

fruit trees, cultivable land and houses. The emerging development challenges due to the effects of the degradation of NRs and climatic changes in the region, have worked as a stimulus for the local communities to re-think their traditional approach of collective action. In the period some three decades ago, there were traditional local institutions to help the mountain communities manage their limited resources and respond to the external shocks, whether these were invasions from outsiders or natural disasters. Then there was an institutional vacuum in late 70s to early 80s putting the scarce natural resource and other communal properties at high risk of extinction or degradation. Given this social context, the Aga Khan Rural Support Programme intervened and organised the local communities around Village and Women Organisations (V/WOs) to reinforce the forgotten strength of Collective Action that sustained the mountain communities for centuries. In the wake of the climatic changes and increasing vulnerability in living a rural mountain life in North Pakistan during the last couple of years, the V/WOs platform played an important role in the conceptualisation of a second generation of community institutions as Local Support Organisations (LSOs). The LSOs are now larger valley level institutions with a pyramid structure in which the V/WOs and other CSOs are the base.

The local government and developmental organisations have a strong faith in working with these LSOs for socio-economic development and preservation of natural resources in the area. The LSOs organise Multi-Stakeholders Forums (MSFs) to discuss the key issues of concern, formulate strategies and plan interventions for five to ten years ahead. During this year, in view of the recent incidences of natural calamities in the area, the Multi-Stakeholders Forums brought forward the climatic changes and the degradation of natural resources as the major developmental challenges to focus upon. Though this paper might not seem to be directly related to Environmental Education, it helps in documenting the tacit knowledge of the local communities which will in turn contribute to the knowledge base of the world. This model of Civil Society Engagement through LSOs is therefore worth sharing with the world's communities and replicating in other similar mountainous areas of the world.

Reaching Communities Affected by Coastal Disasters

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India supports one-sixth of the world's population on just 2% of its landmass. It suffers heavily from natural disasters of various types that kill the poorest of the poor and which is why the consideration of disaster safety deserves prime attention. The disaster is an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity for adjustment of the affected community.

An average annual impact from natural hazards is mortality of about 3000 people, crop area affected is 1.42 million hectares and property loss is 2.36 million dwellings. The economic damage is about \$ 23.6 million. Between the year 1900 and 2004, out of 133 cyclones, the average population killed was found to be 1226 and average affected were 686,635. Out of 158 floods, an average of about 323 people were killed and 4,197,388 were affected. In 2004, a tsunami hit the east coast of India and affected about 3,415,000 people and killed about 9700 people. About 110,829 dwellings were affected.

Coping with disasters, depends on the preparedness. Though it includes a lot many things, the use of innovative and indigenous methods of educating people play a vital role in reaching the community. One such work has being carried out by Centre for Environment Education, Bangalore by establishing an interesting and interactive mobile exhibit vehicle. The vehicle will help create awareness about the coastal disasters and provide an opportunity for the community to access a ready resource for the short and long term mitigation measures and disaster preparedness. Similar work has been initiated in different parts of the world for various purposes and themes such as the "*Prakriti*" environment education exhibit prepared by CEE, Ahmedabad in 2005; the Mobile exhibition van of Indian Museum, Calcutta, in 1987; the Art exhibition bus in Midland, Michigan; and others. In 2005, CEE, Bangalore has initiated a mobile exhibit bus on environment for school children, and others on urban environment and on small scale industries all of which have been found successful in reaching a wide range of population with a variety of environmental issues and themes.

Education for Sustainable Development as a Safeguard for Environmental Refugees

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The 2004 tsunami in Asia provided an indication of just how destructive tectonically induced sea-level rise could be for people living in poverty; the 2005 Hurricane Katrina in USA displaced thousands of people who eventually had nowhere to go. Environmental refugees and climate exiles are people who can no longer gain a secure livelihood in their homelands because of drought, soil erosion, desertification, deforestation and other environmental problems, together with the associated problems of population pressures and poverty. Sustainability represents a sound way to deal with the environmental refugee issue, through greater policy emphasis on environmental protection, together with efforts to address associated problems of population growth, poverty, landlessness, and basic human needs. The key to this difficult prospect is education. Education for Sustainable Development is particularly important to ensure a clear understanding of sustainability among the local decision-makers, stakeholders and the general population, and it would prove a payoff and long-run investment in fostering sustainable development in developing or developed countries.

Audio-Visual Media Tools for Community Based Disaster Risk Management

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The apparent increase in the number and severity of 'natural' disasters in the South of India is anything but natural. Natural hazards are not synonymous with disasters. Disasters only occur when a hazard arises in vulnerable conditions. Hazards occurring in uninhabited areas or in areas where economic activities and settlement patterns are not vulnerable do not cause disasters. It is above all the growth of vulnerability that is responsible for the increasing impact of disasters on development, which in turn further increases vulnerability. Understanding what vulnerability is and how it arises is a key therefore to the disaster paradigm for effective disaster management.

Community participation has also been recognised as the additional element in disaster management necessary to reverse the worldwide trend of increasing frequency and loss from disasters, build a culture of safety and disaster resilient communities, and ensure sustainable development for all. This paper aims to review the disaster management system in Tamil Nadu, India and the capacity of a local community to respond to natural disasters, and to propose a strategy using audio-visual media for the dissemination of tsunami knowledge while raising public awareness of tsunami and other coastal disasters with respect to the 'two-step flow' model of media influence.

Natural disasters take a huge toll of human lives and property and severely hamper development. It may not be possible to prevent natural disasters totally, but an effective pre-disaster planning and preparedness through audio-visual tools could be done in order to reduce the adverse effects of the hazards and the consequent economic loss.

E -Learning

Strengthening Electronic Knowledge Base for Sustainable Mountain Development in Asia and Pacific

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Realising the vital role of information and knowledge management in securing sustainable mountain development, APMN, the Asia regional node of the Mountain Forum, has developed an electronic platform where it manages members' database, online library, discussion lists, e-conferences, conservation dedicated web-portals and some other online and offline resources. With over 160 organisational and 1100 individual members from the region, APMN is refining the existing knowledge base. Globally there are around 3600 individual and 450 institutional members in the Mountain Forum.

APMN extensively uses emails, email discussion groups, online chats, Skype, communities of practice, etc. and produces e-newsletters and some print publications. Expertise and lessons learned by APMN in the last more than one decade can be of great use to many institutions and individuals in the region. APMN can also be taken as a reference model of networking and development initiative.

Energy

Climate Change: Impacts on India's Energy Sector and Options for Adaptation

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Climate change is expected to result in more extreme temperatures and more intense weather events. These climatic changes will adversely impact several essential sectors in India, including energy, agriculture, water, and human health. This paper will focus on the energy sector in India. It will explore the impacts of climate change on energy supply and distribution, and suggest some preliminary policy and planning strategies for adapting to climate change.

India's energy sector is particularly susceptible to the impacts of climate change. Frequent and extreme weather events could make supply and distribution systems more vulnerable to disruption and/or failure. On the demand side, greater air-conditioning usage and cooling activities due to prolonged summer seasons and higher temperatures will increase energy requirements. Moreover, freshwater shortages will result in greater energy expenditures for water supply, pumping, and treatment. On the supply side, extreme weather events such as floods and droughts could adversely impact hydropower operations, and sea level rise could disrupt offshore petrochemical operations. These climate change impacts are expected to increase energy demand and strain the energy supply situation compared to 'business as usual'.

Some potential options for adapting and preparing for these changes include energy efficiency measures to decrease total demand, demand-side management to help shave off peak load, distributed generation to increase diversity and reduce vulnerability of supply systems and robust electrical grid infrastructure to reduce transmission and distribution losses. Energy adaptation policy and planning measures are important to ensure India's future energy security.

Gender Education, Energy and Environment Interface in Rural Income Economies

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The study under discussion examined the role of women in domestic energy management and consumption in Nigeria. The findings reveal that gender roles are culture derived where fuel wood is primarily used for cooking and females were exclusively responsible for its collection. Similarly females were responsible for taking decisions (70.8%) in the cooking energy system. Therefore, a key factor in transiting to “clean energy” would be tackling the cultural barriers through the “Location Specific Approach”. Variables limiting efficient and effective domestic energy management identified were dwindling access to energy sources that is compounded by inadequate access to education, extension service, income, credit and time. This is further segregated by the distinct roles played by males and females in the total rural energy management system. Therefore the need for education and training for sustainable handling of natural resources and consumption is crucial in the study area. The study concluded tentatively that to ameliorate the time and energy available to females for both productive and reproductive tasks, extension workers and policy makers alike should seriously consider the policy, initiatives, design and implementation of programmes, the multi-faceted roles of females plus the responsibilities, tasks, expectations and constraints associated with such challenging roles, in concrete terms.

Renewable Energy Resource: Indian Scenario of Bio-fuels

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Man kind is perturbed about the oil crisis, the hindered economic growth, increasing temperatures and many more related issues. With the population growing disproportionately to the resources supporting it, renewable energy resources seem to be the only viable option.

The renewable energy resources and the viable technology to tap the same being adequate, the bio-fuels seem to be one among the felicitous solutions, with a vast area of degraded and marginal land available especially in India. A study carried out on the Indian scenario of bio-fuels gives an overview on the bio-fuel market which can be considered as capable of tackling the problem

on four different fronts – viz. increasing the employment opportunities, improving the economy of the country by being energy independent and giving way to sustainable development; going green, and availing carbon credits by reducing the emissions and fixing the carbon dioxide.

Design and Fabrication of Solar Air Heater

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Modern civilization is yearning for cheap and abundant energy. Solar energy is one of the non-conventional energy resources that has the advantage of being pollution free and available in plenty. Putting solar energy to work involves converting it to another, more useful form of energy. The simplest conversion process is the conversion of sunlight to heat. This straightforward process happens all the time in nature as in the sunlight striking the earth, being converted to heat, and the atmosphere getting warmed from the heat of the earth. Near the equator, this natural solar heating of the atmosphere is sufficient to maintain a comfortable temperature for the human population year round. Further towards the poles, days become too short and the sun is too low in the sky during the winter months to keep the air heated to a comfortable level; heat losses overtake heat gains and shelter becomes essential for survival.

In the research under discussion, a solar air heater has been constructed to make winter sunlight adequate for providing a significant portion of the heat for shelter. It is constructed so as to let sunlight in and prevent as much heat loss as possible. The shortness of winter days can be compensated for by reducing the heat loss that occurs during long winter nights. In other words, the solar heating of air is accomplished by maximizing light gain and minimizing heat loss.

From the collected data, tables, graphs, figures and finally from the analysis and discussions, it has been concluded that

1. The fabricated solar air heater is working efficiently. As the construction is very simple and locally available low-cost materials are used in construction, it could be manufactured

in any workshop. Due to its low-cost and simple technology, it is affordable to the people of Bangladesh with respect to cost, operation and maintenance.

2. The temperature mount in the room is noteworthy. In forced circulation, the maximum room temperature obtained was 45.5°C and the maximum difference from ambient was 12.25°C . In case of natural circulation, the maximum room temperature obtained was 41.75°C and the maximum difference from ambient was 8.5°C .
3. The room temperature is higher in forced circulation, because the total volume of air circulates more number of times in this case. The difference between ambient and room temperatures is also higher here.
4. The efficiency is higher in case of forced circulation than in the natural.

Formal Education - Pedagogy

The Status of Environmental Education in Bukidnon Public Schools

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Environmental education (EE), particularly in the primary and secondary levels of formal education, has been deemed an important tool in promoting sustainable development in society. Bukidnon province in Mindanao, Philippines, being a crucial watershed area, is experiencing undue stress upon its resources due to the increase in agricultural activities, population growth and urbanization. To avoid major problems and to achieve sustainability, an effective provincial EE programme is crucial.

The paper aims to determine the status of EE in Bukidnon public schools. In order to do this, three main groups were looked into: the school principals, the teachers and the students – each group having its own indicators.

Results showed that the level of EE among the Bukidnon schools as assessed through the school principals was *moderately adequate*; *highly adequate* as assessed through the teachers; and *adequate* as assessed through the students. Tests of variance showed that there was no significant difference between the results of the primary and secondary levels.

Based on the five objectives of EE as stated in the Tbilisi Conference, Bukidnon public schools have only satisfactorily achieved two out of the five: Awareness and Knowledge. Work still has to be done on achieving the three other objectives: Attitudes, Skills, and Participation.

Overall results of this study show that the status of EE in Bukidnon public schools is *moderately adequate*. For EE to be an effective tool for sustainable development in the province, its status in the public schools should be improved to *highly adequate*.

The Effect of an Environmental Education Program Based on a Systemic Approach at Mu'tah University

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The study under discussion aimed to investigate the effect of a program on environmental education based on a systemic approach on the achievement of Educational Sciences students at Mu'tah University/ Jordan. The study sample comprised of 113 students (male and female). They were chosen from the students of the first semester of the environmental education course during the scholastic year 2006/2007. They were divided into two groups. One group was taught using a systemic approach program, while the other group was taught by the conventional method. The study tools were (a) the systemic approach program which was tested for its validity, and (b) an achievement test consisting of 50 multiple choice items. The reliability and the validity of the exam were also tested.

The results showed that there were statistical differences at the level $\alpha=0.05$ on the achievement of the students post-test in favour of those who were taught by the systemic approach program. No significant statistical differences at the level $\alpha=0.05$ were found attributed to students' gender or educational level. The study recommended further investigations to be conducted on the effect of the systemic approach program on the teaching of other subjects and courses in the college.

Institutionalising Climate Change Education in the Secondary School Curriculum of Southwest Bangladesh

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Bangladesh is one of the most vulnerable countries to climate change effects due to its geographical position. Her geographical location has created risks of extreme events of climate change like sea level rise, floods and droughts. The natural environment, ecology, biodiversity, agriculture, water management and above all, lives and livelihoods of the people have become highly vulnerable.

It is therefore essential that the people inhabiting this most vulnerable region be imparted the knowledge to adapt themselves to the coming changes in their physical environment. The people here can face overwhelming challenges, and are capable of adapting to environmental circumstances. But knowledge is the key to overcome all problems.

Students have been targeted in this context because they are the future citizens of the country. In the long run, in their adulthood, they have to face the effects of climate change and because of their education, they will also be the leading citizens in their communities, and thus capable of motivating the masses to adapt. Accordingly, "AOSED" implemented an awareness program for secondary school students in the southwest coastal region of Bangladesh between March 2003 and March 2005.

Under this project, two illustrated easy-to-read booklets, two flip charts for different levels and Teachers guidelines were developed to support the teaching method. Awareness of Climate Change has been enhanced among 15,000 students of 65 schools and their families and neighbours through this initiative.

AOSED wants to share the methodology and learnings of this highly successful project with a broader audience so that others may be motivated to implement similar programs.

Comparative Study of Different Models of Informal Environmental Education in Nepal

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An analysis of the effectiveness of non-formal environmental education initiatives by NGOs revealed that the effectiveness of such activities depended very much on the institutionalization of the activities. Selected indicators showed a trend of diminishing interest in projects lacking institutional support even if they were extremely successful in sensitizing the people in certain activities. Activities supported by institutions ensuring continuity showed consistent results.

EE Models:

Young Student Close Camp: In this model, the program districts, schools, and a few young students were selected and kept in environmental camps. In these camps, different environmental issues were taught in addition to some hands on activities.

Involving entire school in environmental education activities: This model comprised a three day environmental fair in all selected schools in the selected districts, involving all the students, teachers and local communities.

Involving local NGOs in school environmental education activities: Here volunteers who were placed in selected schools taught the theoretical as well as practical aspects of EE and also provided institutional support to the schools.

Teachers, NGOs and journalists involved in environmental education: A couple of NGOs conducted training of trainers for local school teachers, local NGO volunteers and local news paper reporters.

Mixed groups (women, students, teachers, forest workers, etc): Various conservation NGOs and the Royal Bardiya National Parks provided funds for projects to the schools and NGOs operating in the vicinity of the national parks. These projects also had the components of sanitation, plantation, ecological education, etc.

It was found that institutional support is vital for the continuity of the projects. Even the activities that involved all the students and teachers together with the community were found keeping the momentum to some extent, but with institutional support, were found to ensure continuity of the projects. The involvement of the whole school and community in an environmental fair is a good way to arouse the interest of the people in new interventions. The goal of EE is to direct the change in human behavior towards natural resource management and consumption patterns. To achieve this goal, the EE intervention should be conducted in such a way that it elicits sustained effect. One single intervention in EE may not be sufficient to achieve the EE goal; thus institutionalization of EE is the most important aspect to be considered for ensuring that the goals of EE are achieved.

On Preparing Sensitised Teachers of Environmental Education for a Sustainable Future

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Despite repeated commitments at the highest levels since the 1977 Tbilisi International Environmental Education Conference and the 1992 Earth Summit, the world has not advanced very far towards sustainable development. At the global level too, the environment continues to

degrade. A significant proportion of the world population continues to live in extreme poverty and the gap between the rich and the poor, as well as within and between nations continues to widen

Education for a sustainable future places education at the heart of the quest to solve the problems threatening our future. Education at all levels is not only an end in itself, but is also one of the most powerful instruments for bringing about the changes required to achieve sustainable development. It is therefore the role of educators to help learners in gaining a better understanding of the world in which they live and to help them know how to address the complex, interconnected problems that threaten our common future. In this regard, teacher education emerges as the key aspect for ensuring a sustainable future

The pressures of the contemporary world to educate its citizens call for capacity building in pre and in-service teacher training. It may require refocusing on the existing curriculum and training policies to create a vision for society that is not only environmentally sustainable, but also one that is socially, economically and politically sustainable. Skills, knowledge, values and attitudes in teacher education programmes should be oriented towards this goal, eventually leading to capacity building in life skills, managing resources and community development.

In order to make the teacher education programme realistic and practical oriented in nature, and to ensure a controlling role for education for sustainable development (ESD), the curriculum may consist of personal development as well as socio-cultural themes. Personal development themes may include self-identity, courage, conscience, competence, fidelity, caring, love, decision-making, self-respect, compassion, sexuality, health and respect for others whereas socio-cultural themes may include parent relationships, citizenships, human-values, gender equality, religious beliefs, freedom, environmental conservation, children relationships and civil rights.

A Framework for Environmental Strategies

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Environmental education (EE) includes a broad range of teaching methods, topics, audiences and educators. EE professionals have worked over the last 30 years to provide distinct definitions, guides, objectives, and standards that will help educators know how to differentiate environmental education from other educational efforts and how to deliver it effectively. This paper incorporates several recent frameworks of educational strategies into one that has usefulness to formal and nonformal educators as well as communicators. Our purpose is not to redefine EE, but to provide a framework that can help practitioners consider a suite of possible purposes and interventions that can belong under the umbrella of EE. We define four categories of EE according to the educator's purpose: Convey Information, Build Understanding, Improve Skills, and Enable Sustainable Actions. The category *Convey Information* represents **one-way** transmission of information in order to provide missing facts or data, to increase access to "how to do it" instructions, or to build awareness about a specific topic. The category *Build Understanding* describes a **two-way** transmission of information that aims to engage audiences in developing their own mental models to understand a concept, values, or attitudes. *Improve Skills* includes activities that facilitate the **practice and enhancement** of skills and *Enable Sustainable Actions* encompasses activities that **transform** the learner, the issue, the educator, and perhaps the organization through the process of critically addressing problems. The paper provides a figure to represent the nested nature of these categories and a table of example activities for both formal and nonformal educators.

Developing Environmental Education Standards in Mauritius: Enhancing Quality Education

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With the advent of scientific and technological innovations, Mauritius, like many other countries of the world, is undergoing curricular reforms. A lot of emphasis is being laid on quality education with a view to enhance the employability of young Mauritians, especially in the new sectors of economy, to have more fulfilling jobs and to be more competitive at international levels (Ministry of Education, 2006). The Ministry of Education is aiming to implement a curriculum which takes into account environmental and sustainability issues. Environmental education is a process that aims to develop environmentally literate citizens who can compete in the global economy. It is essential in promoting a sustainable environment for future generations and to find adequate solutions for the damaging patterns of consumption and production.

There are presently no standards for the educational sector in Mauritius. It is essential to develop standards, especially Environmental Education standards; they will help to serve the field of education by articulating the knowledge, skills and values necessary for environmental literacy. These standards will also demonstrate the link between environmental education and the traditional disciplines in our curriculum reform.

These standards are the basis for the development of curriculum materials. They will help curriculum developers produce high quality lesson plans, activity guides and other pedagogical tools. They will also provide meaningful guidance for teacher training.

These standards will be developed through a process of critique and consensus from all stakeholders. They will be grounded in a framework of common understanding of effective environmental education.

Beyond Nature Deficit Disorder: Strategies for Reversing the Worldwide Trend

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Throughout the world, particularly in urbanized societies, a trend has emerged in the past 20 to 30 years in which people of all ages — and particularly children — are disconnected from direct experience with the natural world on a daily or even monthly or longer basis. Richard Louv, author of *Last Child in the Woods* (Algonquin, 2005) has called the condition “nature deficit disorder.” When a direct connection with the natural world is absent from people’s lives — learning how it works, appreciating its wonders, adapting to its rhythms, and learning to observe, predict and understand the impacts of human activities on ecosystems’ health and functioning — the very foundations for a diverse and sustainable world are at risk. Research consistently supports the view that direct experience with the natural world — most often guided by an adult mentor — leads to lifelong interest, expertise, and activism to conserve and protect the world’s natural resources, both cultural and ecological. The movement to reconnect people and nature is fundamental to the goal of achieving a diverse and sustainable world for the long term, a world currently at risk. This session will focus on the indicators of the growing deficit, the benefits to people of all ages from the people-nature connection, the implications for participants in TbilisiPlus30, and strategies for building a world-wide effort to reverse the trend.

Transformative Effects of Schoolgrounds Programs: Five Teacher Stories

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A significant number of Australian schools are implementing greening projects. Grant and Littlejohn describe this as “transforming barren expanses of asphalt and frayed grass into exciting natural spaces for learning, playing and socialising” (2001, pg.2). The benefits of greening projects have become increasingly more convincing to schools especially with the advent of supporting research and funding increases for this area (Sterling, 2001).

This paper reports the stories (research) of five teachers' experience with a recently developed program, *Schoolgrounds for Learning* which was designed and delivered by the Gould Group1 (Cutter- Mackenzie, 2007). The teachers researched their schoolgrounds practice over 6 months. They were given a research pack containing a journal, camera and research tips. Each teacher researcher was also supported by a mentor (Monash researcher). The teachers' research revealed significant insights and findings about the program and about school greening projects more broadly. Their research showed that the program acted as a springboard leading to other sustainability initiatives, in addition to providing an impetus or driver for teacher enthusiasm, commitment and change in adopting environmental education / sustainability teaching and learning pedagogies. In short, the paper outlines the transformative effects of schoolgrounds approaches on teaching and learning, and the social and ecological culture of schools.

Pupils' ideas about reducing air pollution

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It is widely accepted that human activities, practices and lifestyles play a significant role in maintaining environmental quality. Understanding the relations between human behavior and environmental quality is a precondition for assuming changes in daily practices and lifestyles towards a sustainable future. Environmental Education (EE) is one of the effective means for confronting this challenge while one of its basic aims is to make individuals understand the complex nature of environmental problems and empower them to participate in a responsible and effective way in anticipating them.

In this framework, a study was carried out which aimed at exploring pupils' understanding of air pollution, its sources and impacts on the environment as well as their ideas about the

development of human actions to reduce the problem. This paper reports on the results concerning the latter.

The sample consisted of 132 Greek pupils aged 7-13 years. Data were collected through semi-structured interviews. The results showed that pupils recognize practices and actions at both individual and societal level towards the reduction of air pollution. They referred to sustainable and technology-based measures involving industrial pollution prevention, land planning, transportation control, protection of forest, sustainable use of energy and waste management. They also referred to the necessity of changes in lifestyles relating to consumer habits or use of transportation and energy. Finally, they recognized that raising public awareness is an important factor for effective participation towards the reduction of air pollution. The findings of this study allow for the formulation of educational implications that draw on pupils' ideas of how humans interact with the environment.

Multinational EE Learning through On- line Discussion Groups and Hands- on Inquiries in the Topic of Bio-invasions in the Mediterranean Sea – A Case Study

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The proposed paper will present results from a multinational EE project that took place throughout the year of 2004. The project relied on a theoretical model of combining together best practices in the field of EE and implementing them in a multinational setting which allows for multi-

culture interactions and inquiries into a common environmental problem. By doing so, it was expected that social aspects of SD and EfS would evolve naturally and be addressed as a natural inherent part of the learning process rather than as a topic addressed externally. This occurs through the obvious cultural and social differences between the participating students and teachers - differences that must be addressed since the framework of the project requires intensive interactions, debating and problem solving in order to achieve the goals set by the project.

The project involved 10th grade students from Israel, Cyprus and Greece. The 210 students were divided into working teams of six students each, with members of mixed nationalities - two students from each country. The project's core topic was bioinvasions to the Mediterranean Sea, in particular Lessepsian migration – the migration of species from the Red Sea to the Mediterranean Sea through the Suez Canal. Students in the three participating countries simultaneously collected data along the Lessepsian migration route. The data was analyzed by each team in accordance with the teams' specific research questions. Thirty five multinational teams presented their final results in papers composed by each team. The project's implementation model included an internet site which was constructed for communications among academic supporters from the fields of education and marine ecology, high-school teachers from the three Mediterranean countries, high-school students from the three countries, and a facilitator who coordinated the multi pathways communications and interactions.

Results from the study indicate a high acquisition of scientific skills and environmental knowledge among the students but a rather low acquisition of skills and knowledge that might be attributed to EfS.

The New Lines of Transmission: Children as Energy Guards

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The *Bal Urja Rakshak Dal* Programme, initiated by GEDA in 2005, endeavours to mobilize school children as Energy Guards. It is designed to help students and teachers acquire energy skills as life skills and build their capacities to play a leadership role as the energy conscience of society. *Urja Rakshak Dals* (literally - squads of energy guards) undertake various awareness drives and action programmes to motivate responsible, rational and restrained use of energy in their homes, schools and immediate community.

Children are groomed as ‘energy consultants’, so that they can conduct energy audits and provide voluntary energy services that result in energy savings and promotion of green practices. They participate in district and state level *urja utsavs*, energy celebrations, to learn about energy through games and hands-on activities. The “*hari urja, hariyali dharti*” campaign draws on the positive power of festivals and rituals to engage children in small acts that can save energy and resources and safeguard our earth.

Today the programme has a squad of 50, 000 children and 7200 teachers in Gujarat State, India, drawn from 3600 schools (1800 secondary, 1800 primary) across all 25 districts of the state.

This paper analyses the programme design, information modules, capacity building and delivery strategies with special reference to the advantages and constraints of a ‘large footprint’. It evaluates the changes made with a view to increase the effectiveness of the programme and streamline governance.

ICT-based Environment Education Project: A Modernisation Context for the Education of Minorities

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The National Knowledge Commission (NKC) as well as the Prime Minister’s High Level Committee on Muslims (Sachar Committee) has recommended better “access to knowledge” as a major area of the ‘knowledge paradigm’. Madrassas are often the last recourse of the very poor sections of the Muslim community in India, especially those who lack the economic resources to bear the costs of schooling. At the same time, ICT is rapidly being incorporated into education that is also significant from the viewpoint of environmental education (EE) for its ability to connect people with nature and society from a distance, considering the transboundary nature of environmental issues.

Assam has around 1200 Madrassas that include both government funded and private non-governmental Madrassas. Educational researchers have a role to play in finding out ways to synchronise the needs of modernisation in terms of both curriculum and infrastructure and the acceptance of such an initiative by the community itself.

This paper presents an innovative ICT-based Environment Education Project (IEEP) being piloted in Assam that is primarily focused on using an institution's surroundings and environment as a framework within which students can construct their own learning, guided by teachers and administrators using proven ICT driven educational practices. IEEP uses Environment as the integrating context for learning, designates pedagogy that employs natural and socio-cultural environments as the context for learning, and shares some fundamental educational strategies that may be replicated elsewhere and inspire other researchers to develop similar programmes.

Environmental Education for Sustainability in Macedonian High Schools: An Analysis of the New Curriculum Content

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The objective of this paper is to describe the current situation and a vision of the future as regards environmental education for sustainability in the new curricula in the Republic of Macedonia. From this, the paper attempts to answer the question: what is actually happening in the field of environmental education for sustainability in our country? All this is in the context of The Decade of Education for Sustainable Development (2005-2014).

Content analysis has been used to examine the extent to which environment and sustainable development issues are addressed within the curricula. The analysis is fully comprehensive in so far as we investigated the entire curricula for all subjects and at all levels in the new secondary schools in the Republic of Macedonia.

Results have shown a lot of weaknesses and gaps in the new curricula. Ecological concepts and principles for sustainability must be included in the curriculum in a thorough and comprehensive manner. We believe in our national capacity and willingness to overcome the current situation. Now it is time to make a clear movement towards education for the environment and sustainable development by putting in place a sustainable development education strategy for The Republic of Macedonia.

Sustainability Initiatives in Education Queensland

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Imagine a corporation that has 1,350 public contact points; 50,000 employees; 493,000 customers; 1,000,000 shareholders; turnover of \$5.2 billion per year - one could ask the question "Can a corporation like this focus on being sustainable?" This corporation is Education Queensland (EQ).

EQ has a very long history of significant achievements in environmental education for sustainability in both the curriculum areas: through the production of the P-12 Environmental Education Curriculum Guide for Schools and its implementation of and through the support services of a comprehensive network of 25 Outdoor and Environmental Education Centres across the very diverse and decentralised state of Queensland.

However we cannot rest on our laurels. With sustainability being a significant global, national and state issue, the Queensland Government, through the Smart State Strategies, has given comprehensive priority to 'Protecting the environment for a sustainable future'. EQ has taken this as a challenge and is currently addressing the sustainability issue as a system wide priority. The following projects are currently being addressed to assist in progressing EQ towards a more sustainable future.

- Significant EEfS Stakeholders and the EEfS Agenda since 1986
- National Curriculum Development
- Queensland Government priorities
- Education Queensland Policy and Curriculum
- National Environmental Education Network (NEEN)
- Queensland Environmentally Sustainable Schools Initiative (QESSI)
- Representative role on the international Environment and Schools Initiative (ENSI)
- Education Queensland's Charter for Sustainability (draft 2002)
- Collaborative ESD (Environmentally Sustainable Development) Research and Implementation Team (CERIT)
- Coordination of the international Earth Dialogues Student Forum
- Bunya to Bay Eco Adventure that is a regionally significant student participation program focused on the middle phase of learning.

- Ministerial Advisory Committee on Educational Renewal (MACER) working group on Education for Sustainability

All these initiatives are centred on the UN Decade of Education for Sustainable Development 2005 -2014 as tangible examples of outcomes-focussed processes on the pathway towards a more sustainable future that will benefit students, schools and the broader community.

Socio-environmental Perceptions of Children and Teenagers: Environmental Education Proposals - La Huacana (Mexico)

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The development of new approaches in Environmental Education and the use of innovative methodologies may improve knowledge about social interests and people's perceptions towards the environment. In the present study, drawings, questionnaires and participatory use of Global Positioning System (P-GPS) were employed to obtain children's and teenagers' socio-environmental perceptions about their community. The results can be used to formulate proposals related to environmental education and environmental decision making processes in a regional and local context.

The study area is located in the municipality of La Huacana, in Michoacán State (México). The sample is formed by 284 pupils from elementary and secondary schools, aged from 5 to 17, who are living in small rural villages around the Natural Protected Area of *Volcán el Jorullo*.

The result obtained from the statistical analysis show that the place of residence (rural or urban) is the main factor that influences differences in children's and teenager's socio-environmental perceptions.

Building a Birch Bark Canoe – A Look at the Past for Solutions to the Future

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This presentation is a story about how Sandra Mayberry's grade six students, their parents and volunteers built an authentic fourteen foot, birch bark canoe - one of the most sustainable and oldest methods of technology.

The birch bark canoe has a beautiful and storied past in the woodland regions of Ontario, Canada and as part of the Ontario grade six Social Studies curriculum on Aboriginal People. She integrated this with lessons in environmental/sustainability education.

Sandra has deep concerns for the negative effects of diminished opportunities for children to experience the natural world, its wonders and its lessons for building healthy, respectful and fulfilling physical, mental and spiritual relationships with the Earth. With today's growing ecological crisis and the marginalization and extinction of indigenous knowledge that holds secrets to sustainable living on the planet, this innovative project served more purposes than imaginable.

The involvement of the local First Nation community was important to Sandra. Students, parents and volunteers witnessed the traditional teachings and heard the stories of a culture that is so closely connected to the Earth. This project was not just about building a canoe. It was about building relationships and understanding. The skills and knowledge for building birch bark canoes are disappearing, so research and practice were challenging. Both non-Aboriginal and Aboriginal participants worked together in discovering how to bring back the traditional knowledge and skills of building a birch bark canoe by reading books, searching the internet and talking to elders. All in all, a diverse group of people came together and discovered many wonderful things about history, technology, the Earth, Aboriginal culture, non-Aboriginal culture and the connections of all this knowledge to the importance of environmental/sustainability education and the future of our lives on the planet.

Sandra's presentation takes the form of a power point show with the canoe displayed, some raw materials for demonstration, photos, questioning and discussion.

The emphasis is on the importance of the commitment to integrating DESD values in the elementary school curriculum as evidenced by this project and that these types of projects help to broaden the possibilities for finding solutions to world climate change problems because they make us examine alternative knowledge and skills.

Quality Criteria for ESD-schools and Development of Action Competence

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On the basis of information collected from 13 country reports on implicit and explicit criteria guiding Eco-schools' development processes in whole school plans in OECD countries, a comparative research study was conducted aiming to analyse trends and divergences in the Eco-schools' programmes and conceptualisations of learning-teaching processes (Mayer & Mogensen, 2005). Inspired by this analysis, the publication "Quality Criteria for ESD-Schools" (Breiting, Mayer & Mogensen, 2005), which is now disseminated and translated into 12 languages, proposes a non-exhaustive list of 'quality criteria' for schools that wish to work on developing Education for Sustainable Development. The proposed list is considered as a starting point for reflections and aims at facilitating discussions within the school and with all stakeholders to clarify the main aims and changes to orient school development to ESD and to develop the school's own list of quality criteria, adapted to the school's own situation and its plans for change. The list is thus not considered as a tool for 'quality control', but as an opportunity for 'quality enhancement', open to ongoing debate in a participatory way. The proposal is one of the outcomes of the COMENIUS III European network 'School Development through Environmental Education' (SEED). The work of SEED is one of the activities of ENSI, a decentralized network of national authorities and research institutions. ENSI is a UNESCO partner within the UN Decade for Sustainable Development. The philosophy behind the quality criteria is closely linked to current research initiatives in Denmark related to the development of students' 'Action Competence', which deals with their ability, motivation and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development.

Environmental Education for Evergreen Future: The Spiritual Dimensions

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About 80 to 90 percent of the world population belongs to one of 10, 000 or so existing religions. About 150 or so of these faith traditions have at least a million followers each. Therefore religious practices and spiritual wisdom can play a vital role in bringing about changes within individuals and across society. (Worldwatch Paper 164). Hence unless religious and spiritual dimensions are included in the system of environmental education, the goal of sustainable development would be difficult to attain.

Spiritual values could be imparted to students in three stages. The first stage consists of imparting information about the religious practices, rituals and traditions. Several traditional and aboriginal societies of the world followed nature worship and associated activities which were quite in tune with natural forces. Some of these societies even now possess many of these practices.

The second stage consists of imparting knowledge about the environmental impact of these practices. This needs an analytical study of the traditional religious practices. For example, the worship of trees in India and the practices associated with it prevented deforestation to a very great extent.

The third stage consists of imparting wisdom about the environment which is an inherent and inevitable part of traditional spiritual practices. The philosophy of 'Universal Oneness' and the consequent feeling of interrelatedness and interrelationships will certainly help a society to attain an evergreen and sustainable future.

The spiritual information, knowledge and wisdom, if imparted to the younger generation through environmental education, can help change the attitude of individuals more effectively. This process touches the heart of individuals. Already we possess the modern scientific studies and methods in environmental education that touch the head. If the head and the heart are combined through proper restructuring of the curriculum, sustainable development will not be a distant dream.

The Need for a New Approach in Environmental Education

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This paper presents findings from research about the moral reasoning on environmental issues with emphasis on the wellbeing of wildlife in Malaysia. The study focused on 13 and 16 years old school children along the Perak River in the District of Perak Tengah in which The Bota Kanan River Terrapin Wildlife Conservation Centre run by the Department of Wildlife and National Parks is located. Moral reasoning regarding wildlife provides a relevant locus for exploring pupils' environmental ethic and in formulating environmental education in Malaysia. The results of a structured survey and open ended questions regarding wildlife dilemmas offered insights into the way the children react toward environmental issues. This study demonstrates that Malaysian children were more likely to choose a teocentric perspective in dealing with environmental issues compared to the anthropocentric or biocentric point of view. However an analysis of the way the environmental issues are presented in the textbooks show that it adheres more to an anthropocentric view. This is a glaring conflict that this study has been able to bring to light. The paper argues that to create an effective environmental education, it must be based on the actual way that pupils interpret their experiences, and their feelings towards environmental issues should be its central focus. This study concludes that environmental education in the Malaysian context should be presented through a teocentric approach to produce better and more effective results.

Methodology for Constructing Critical Thinking among Young Children to Address Air Quality Issues in the Local Context

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Empowering human society to participate in the process of finding solutions to environmental problems requires improving the methods by which we gain our understanding of the impact of human activities on the urban environment. Historical criteria – from Stockholm, through Tbilisi, and more recently Rio de Janeiro – have shown that awareness is not the only component of

environmental education; there is also the need to develop knowledge, skills and attitudes towards current environmental issues. This can be attained by fostering critical thinking skills to emphasize the complexity of environmental problems, such as urban air quality. Therefore, it is important to study innovative educational methodologies that can make the educational process comprehensive and robust enough to support future development of critical thinking skills. To address this need, this study proposes a methodology based upon the main steps of the scientific method and constructionist educational theories. The methodology is called “Constructing Environmental Understanding” (CEA) and it suggests generating an adequate learning environment in which children are able to observe their local environment, choose a specific problem related to air quality, study that problem through research and interaction with the physical environment, determine its causes and effects, and then construct personal ideas on how to address that problem. The methodology was implemented as a pilot study at a High School with 37 children from the 11th grade. Results show that most of the children participating in the study have gained a deeper understanding of air quality issues and have been able to address those issues in a local context.

Center for Environmental Education through Participatory Action Learning (CEEPAL)

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The pilot project was launched in the Overseas Pakistani Foundation (OPF) Girls College, Islamabad in 1989 on a voluntary basis by Attia Ayub Qutub. It involved the students in environmental awareness and conservation activities by forming an environment society in the school. It initially began with a cleanup and tree plantation campaign within the school, which then extended to the nearby markets. It was learnt that children enjoyed and gained more from practical activities such as schoolyard clean-up campaigns. Children could convey strong messages to parents and with proper motivation, teachers and students even picked up the courage to demonstrate waste management to shopkeepers in the neighbourhood markets.

Later it was realized that the environmental message was needed as much, if not more, in Urdu medium schools in low-income areas farther from home. Thus the programme was introduced in such schools which later spread to Lahore, Quetta, Peshawar and rural areas of Kabirwala Tehsil of Khanewal district.

The sustainability of the programme lies in the growth of EEPAL into CEEPAL. The establishment of the Centre for Environmental Education through Participatory Action Learning (CEEPAL) in January 2006 has resulted in the involvement of the most environmental education-experienced schools and their teachers in disseminating the ESD further to likeminded educational institutions reiterating the need for such a programme nationwide.

Role of Map Literacy in Environmental Education

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Maps are defined as a two dimensional, geometrically accurate representation of a three dimensional space. It is the graphic representation of a set of features whose relationships are shown by size, position and time. A map is a tool by which we can view, measure and understand our environment. It is also probably the best tool for establishing any environmental dialogue. It has generally been observed that basic knowledge about maps is rather low among the people of this country, even among the formally educated. Map learning can help people handle geo-environmental information of local, regional, national and global levels efficiently and more accurately. Science Communicators' Forum, a Kolkata based NGO is pursuing a map literacy programme in West Bengal since 2004. The organisation had implemented this programme in 40 rural schools of West Bengal where 3000 students were given training in understanding, using, updating and creating maps of their local area. The exercises had given them a better idea and understanding of their local environment. They learnt how to observe the changes that occur in terms of demography, social patterns, natural resources, pollution and biodiversity. Environmental mapping programme can be a part of environmental education where the learners will learn to prepare local area thematic maps based on different environment related themes and develop a local environmental database. In an advanced stage of map learning, other geo-informatics tools like GPS, remote sensing and GIS may be introduced. A systematic curriculum can be prepared for this incorporating all information required for making it an effective environmental education tool.

How Modern Pedagogies Can Conflict with Conservative Values: A Case Study of a School's Attempt to Investigate Sustainable Energy Use

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Australian schools are encouraged to support effective student learning and engage in authentic pedagogies in all areas of the curriculum. Environmental Education and Education for Sustainability meet these modern pedagogical requirements admirably but there are many barriers both explicit and implicit which adversely affect the ability of schools to engage in quality learning activities for sustainability. This workshop explains the obstacles a Sydney primary school encountered when it attempted to allow students to research the benefits and disadvantages of employing nuclear energy using authentic pedagogies dictated by the state education department. Ironically when the school followed these guidelines, the community was concerned because the school was asking students to examine a current controversial political issue. This was fueled by the local media and augmented by some outrage from a local politician, comprising two of a range of barriers that the school encountered. Less obvious barriers included the nature of the education system's framework, an ageing teaching population and the perception of the importance of Environmental Education in the total curriculum, all of which play implicit roles in hindering the teaching of energy as a current social, economic and environmental issue. The paper will offer strategies for resolving these problems in the context of how modern schools operate and in trying to come to grips with new subject matter relating to sustainability and the pedagogies that teachers are asked to employ.

Food as a Means of Learning for Sustainable Development

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Skåne in southernmost Sweden is an agricultural and food producing region. Issues surrounding the production and consumption of food are important for local and global sustainability. Food is also a key issue pertaining to social welfare, culture and public health. There are great opportunities to improve the supply and demand of food in Skåne, which could have a major impact on environmental, social and economic sustainability.

The local municipalities in Sweden are in charge of the formal education in the area and are also offering a school-meal every day to all students in compulsory school. The municipalities in Skåne have high ambitions of serving wholesome and organic food in the school restaurants.

Coupling organic, locally produced and well-prepared school meals with classroom education on different aspects of food is one useful way of connecting learning for sustainable development to the everyday life of the students.

The aim of the project is to evaluate and further develop educational material and tools on food and ESD and to evaluate the results of the education, eg. insight and action competence.

It is a concrete, practice-related, research and development project on food as a means for learning for sustainable development in order to transform and improve the education and to strengthen the cooperation among different actors in formal as well as informal education in Skåne.

The Storyline Method in Education for a Sustainable Future: Building Attitudes and Empowering Students for Future Citizenship

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There is no one 'best method' in teaching any school subject or topic. Variation is always a good principle. The purpose of this paper is to introduce a teaching method called storyline and

discuss its relevance to education for sustainable development. As the name storyline suggests, the students engage in creating a story. A fictitious world is created in the classroom and this invented world is used to explore the real world. The storyline method may have much to offer when it comes to engaging students through personal involvement and creative thinking. In storylines, the students are always dealing with questions of great concern to human beings and to the society. Therefore, the more general aims of environmental education can be achieved with the storyline method, in addition to the specific knowledge prescribed in the curriculum. If young people are to succeed, to contribute to sustainability and to make society a better place to live for the future generations, they need to develop skills like problem tackling, working cooperatively with others, debating, communicating in many different ways, etc.

This method has turned out to be more successful than other kinds of problem-oriented methods and seems to be a valuable approach to topics related to environmental challenges and questions concerning development and the future of society. The students find the method meaningful and exciting. The method seems to be adaptive in different contexts and cultures and to different kinds of students. (<http://www.storyline-scotland.com/>) The paper will describe details of the method and give examples of how it has been applied for topics related to sustainable development in schools as well as in teacher training in the Nordic countries.

Theory of Instruction in Environmental Education: Reflections on Action Research Pedagogy

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Environmental education has claimed a privileged place in the curriculum over the last 30 years. Its practice, based on a broad education theory, has contributed greatly in reflecting on the meaning, problems and possibilities of our relationship to the environment. However, considerable evidence exist to show that the discourses and practices in this field have not particularly managed to empower most learners to positively participate in maintaining or improving environmental quality and in using environmental resources sparingly, which would have brought about sustainable development in their schools, homes and communities. This is attributed to the use of teaching strategies that are not based on relevant and sound pedagogy. This paper underscores the need for an instructional theory in environmental education based on our current understanding of pedagogy. Guided by Bernstein's pedagogic device, as the most relevant to the philosophy and goals of environmental education, the paper proposes a pedagogic

model that may contribute to this theory. The model is based on the experiences in the classroom with pupils across the school system. It is hoped that this paper will lead to further research and dialogue in this critical area of practice.

Green School Project in Taiwan

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Environmental Education has not been promoted much in Taiwan. However, it became the synonym for “recycling” and was always considered somebody else’s business. To face this challenge, the Green School idea was initiated and integrated with the existing environmental education efforts in schools. The name ‘Green School Partnership Project’ is similar to projects in other countries. However, it is an encouragement-oriented one with the evaluation and comments given through the website, rather than through a certification system. Most elementary and middle schools in Taiwan participated in this project. The hope tree mechanism and project publicity are key factors that induced a large number of schools to join and share their learning on the website. In the successful cases, it was observed that the principals always donned unconditional leadership in leading and facilitating the school members to involve themselves in the environmental activities with a whole school approach. The schools obtained high achievements in environmental teaching that emphasized the hope tree system. The school managements gave due weightage to ecological principles while building their green schools and also procured resources from external sources for the same. The challenge of this project is that not every teacher and student knows they are partners in the Green School project. The project had been used by the Ministry of Education as a monitoring tool to assess the status of environmental education in schools, so that some schools were forced to join this project and influenced the project’s voluntary spirit.

Formal Education – Teacher Training

Turkish Preservice Science Teachers' Activities on Environmental Education for Primary Schools and Decisions on Actual Environmental Issues

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The knowledge of environmental issues and skills in environmental action strategies - consuming natural sources carefully, protecting the ecosystem, reducing the environmental pollution, preventing extravagance and affects (e.g. environmental sensitivity, environmental attitudes, environmental awareness, etc.), which have also been categorized as psychosocial variables - have not been adequately converted into human behaviors. The ultimate goal of environmental education is definitely the acquisition of responsible environmental behavior. From biology to environmental sciences, biotechnology to agriculture, in every scientific area, transmitting ecological and environmental knowledge and awareness is definitely the mission of educators. Therefore the instructional activities for environmental education should be constructed meaningfully so as to give clear messages for environmental awareness.

We have designed an experimental study for pre-service science teachers to develop environmental activities (e.g. water saving, erosion, waste conversion, global warming, environmental pollution, ecology) for primary environment lessons. Pre-service science teachers have worked in experimental groups of four and designed activities based on student projects, educational materials, drama, painting and drawing. We have also constructed a productive group interaction among the them during the designing process. Pre-service science teachers in the control group learnt the subject traditionally. Data was collected by the qualitative analysis of designed activities and a scale on environmental knowledge, awareness, ethics, environmental lessons and environmental action strategies. The results of the study showed that adequate

preparation in teacher training decides the success or failure of environmental education. The paper discusses the results of the study, makes suggestions and presents activities designed by the pre-service in a theoretical and visual mode.

Considering a Core Focus of Quality Education: Teaching Mathematics in the Context of Sustainable Development

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Formal education is seen in most countries as a critical element in their continued development. Indeed “the first priority of education for sustainable development is improving the access to and quality of basic education” (*United Nations Decade of Education for Sustainable Development: Improving access to quality basic education*). Although the variations in the number of compulsory years of education, accessibility to education, drop out rates from education, etc. are all crucial issues to consider, there are other issues that are also important. One of these will be explored in this paper.

Quality formal education tries to capture what a society values and wishes to pass onto its next generation. Clearly such education in schools is not the only mechanism that a society uses for this process, but it has become one of the most important for most countries. It is argued in this paper that if a new emphasis is to be added to the way a society operates, then not only will the formal education curriculum have to change, but the core of the curriculum will also need to change. If this does not happen, then the new will simply become an ‘add on’ to the core curriculum, and will be easily discarded in due course as other pressures for change arise. Hence there is a need to embed the ethos, concepts, and practices of sustainable development into the core curriculum areas, including that of mathematics. Embedded within formal education, mathematics is seen to be a core element.

Notions of mathematics pervade much of what has been taken to be quality education (*United Nations Decade of Education for Sustainable Development: Quality education*). Although an argument could be made that mathematics impinges on all nine aspects of this term, the argument developed in this paper will only address some of them specifically. Others not dealt with here, such as values and critical thinking skills, go beyond just using mathematics to calculate small particles of pollution, or the immense wastage in modern western societies, although these are legitimate uses of mathematics. There is much more that goes to the heart of what mathematics is, that needs to be rethought if it is to play its role in having children think through the crucial

issues of sustainable development. Mathematics needs to play its role in providing children with the abilities to clearly think through complex issues that involve numerical, spatial, measurement, statistical and probabilistic questions and data.

Three themes from mathematics education will be explored in this paper, with examples from the quite distinct societies of Australia and Papua New Guinea. Each theme will link directly to what quality education is defined as being.

- Students should be encouraged to think through mathematical issues in their home language, even when the teaching language maybe different. In this way the mathematics of their culture and heritage will become more easily accessible, particularly when their community is actively involved (Clarkson, in press; Clarkson and Kaleva, 1993; Setati and Adler, 2000).
- Although the spread of knowledge is being promoted through our globalised world, principally through ICT, yet the notions of ethno mathematics should be the foundation for developing school mathematics in the students' own lived context, either at classroom or system level. (Clarkson, 2006; D'Ambrosio, 1984; Matang and Owens, 2006).
- To complete the paper, the way mathematics is being woven into students' dealings with real environmental issues faced by two rural clusters of schools in Victoria, Australia, at the present time will be described, thus ensuring that mathematics being used as a tool for problem solving is noted as a legitimate but not its only role.

Recognition of Excellent Teachers in Environmental Education

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Since the 1990s, professional teaching associations have commenced the process of developing teacher and/or teaching standards and associated professional learning and assessment models in the key discipline areas in Australia and abroad. The intent of this approach is to capture the depth and range of accomplished educators' teaching. Despite the increasing work on teacher standards in Australia, currently there are no professional teacher standards in environmental

education [*education for sustainable development*] (Cutter-Mackenzie, 2006). Up until the recent implementation of the Sustainable Schools Initiative, there was little or no recognition of environmental education practice in Australia. Through an accreditation process, the program recognises schools as 'sustainable schools'. However, such recognition focuses upon environmental management, rather on students' or teachers' '*understanding of, and concern for, stewardship of the natural environment, and the knowledge and skills to contribute to sustainable development*' (Ministerial Council on Education Employment Training and Youth Affairs, 1999).

To these ends, this paper is about the recent, yet early, developments (*thinking*) in environmental education concerning the advance of professional teaching standards and learning in Australia. More specifically, Monash University, the Australian Association for Environmental Education and the Gould Group are in the early stages of developing *draft professional teacher standards* and *an accompanying assessment model* in environmental education [*education for sustainable development*] with and for *accomplished* Australian primary and secondary teachers. This study is a **1 year** pilot study. Building on the knowledge learned from the successful development of both the Mathematics (AAMT) and English (STELLA) standards, a highly consultative research/practice approach is being applied in meeting these ends. The development and recognition of excellent teachers in environmental education should be one of the urgent priorities for Australia (and internationally), and the most appropriate professional learning is that which would occur within a framework of professional teacher standards. This project focuses on the shift from policy to practice, supporting teachers to work towards educating a population able to contribute to an environmentally sustainable Australia. There has been no previous attempt to research or develop professional standards for teaching environmental education in Australia.

Implementation of the Fish Bone Diagram on Pre-service Science Teachers in Terms of Solving Environmental Problems

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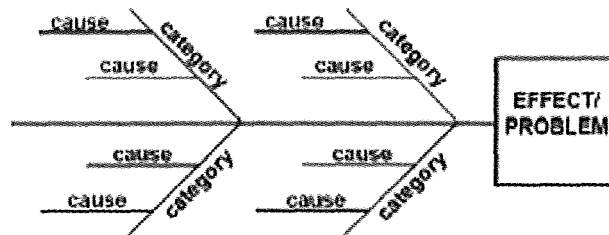
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This experimental study is designed as a pre-test, post-test group model. The sample consisted of 102 students in the program of Science Teaching at Gazi University, Faculty of Education, Department of Primary Education (Ankara/Turkey). The problem solving method was adopted in the experimental group, while traditional teaching methods were implemented in the control group. As a data collection instrument, an environmental achievement test was employed.

The stages of the problem solving method were as follows: identifying and defining the problem, collecting the relevant information, analyzing and interpreting the information, determining the possible solutions, determining the most effective solution and writing a report, and evaluation.

Through the first stage, the Fish Bone Diagram was used in order to identify and define the actual environmental problem. This type of cause-and-effect diagram is one of the most important tools to identify and define the causes of a particular effect. In other words, it is used to find out the potential factors affecting the result. The following is the tool, the Fish Bone Diagram, which is sometimes called the Ishikawa Diagram.



The benefits of the method are:

- It improves the skill of active management of problems.
- The preparation process of the diagram reinforces communication among individuals and

makes them focus on a particular subject.

- It improves the individuals' knowledge base.
- It requires individuals to collect information through a scientific approach.
- It tests the individuals' authority on the subject which is studied.
- It can be applied to all problems.

As a result of this experimental study, it was found that there was a significant difference between the post achievement test scores of the control group, in which traditional teaching methods were implemented and the experimental group, in which the Fish Bone Diagram was employed. Therefore, it can be concluded that being able to identify and define the problem has a positive effect on academic achievement.

Reorienting Teacher Education towards Sustainability: Critical Success Factors

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Teacher education is widely recognised as a key strategy that is yet to be effectively utilised to embed education for sustainability in schools. This paper reports on a research study that examined a range of pre-service teacher education initiatives that were seeking to reorient teacher education towards sustainability. Our examination of these initiatives identified three main approaches to achieving this re-orientation, along with six factors that were critical to the success or otherwise of these approaches. These factors related to (1) the nature and length of funding; (2) the range and quality of partnerships and networks; (3) the curriculum focus and the teaching and learning processes used; (4) the levels at which the initiatives were seeking to bring about change; (5) the incentives used to engage participants in professional development; and (6) the use of evaluation as a tool for learning and ongoing improvement. This paper discusses why and how each of these six factors proved critical to an initiatives' success. We argue that close attention to these six factors will improve the scope and longevity of change that can occur through initiatives seeking to reorient teacher education towards sustainability.

Educating Pre-service Science Teachers with Environmental Knowledge and Values

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To achieve the objective of education for sustainable development, the teaching and learning process must succeed in bringing about changes in the environmental values of the students. Pedagogical knowledge plays an important role in the process of conveying values, skills, perspectives and ethics meaningfully. Hence, teachers need to be educated with the knowledge of environmental issues and ways in which it can be incorporated into their teaching. To this end, an attempt was made to increase the awareness and knowledge of our student teachers about environmental issues and values. An integrated approach was adopted in a chemistry methods course offered to third year prospective chemistry teachers enrolled in a teacher education program at the university. Lectures included pedagogical knowledge necessary for teaching chemistry as well as concepts on education for sustainable development. In addition, students were involved in active learning activities such as writing, role play, simulated teaching and practical work involving green chemistry experiments throughout the entire semester (14 weeks). A questionnaire on environmental values (QEV) was administered three times: at the beginning, middle and end of the semester to monitor the changes in their environmental values. The questionnaire consists of items for three categories of values: egocentric, homocentric and biocentric. The findings showed that the integration of active learning and green chemistry experiments into the chemistry teaching methods course enabled students to be more aware of the environmental issues, which in turn brought about a change in values. The students' values have moved to the biocentric in the continuum. It is proposed that the incorporation of green chemistry into the curriculum should be extended to the science/chemistry integrated curriculum (KBSM) as well.

Environment and Sustainability Issues in English Language Teaching in Botswana Secondary Schools: Killing More than One Bird with One Stone

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English language teaching in Botswana secondary schools is based on the Communicative Approach. Under this approach, teachers are encouraged to draw the content from other subject areas and a variety of sources in order to facilitate learning and provide meaningful and creative experiences in all aspects of language. This means that teachers have to use authentic teaching materials that address topical issues such as HIV/AIDS and the environment. As a language educator, I encourage my students (in-service and pre-service teachers) to infuse/integrate environment and sustainability issues into their language lessons. My paper illustrates how the infusion/integration can be done. In addition, the paper also identifies some of the challenges teachers would face as they infuse/integrate environment and sustainability issues into language teaching. The infusion/integration enables the teacher to teach language skills, and at the same time also raise awareness on environment and sustainability issues – thereby killing more than one bird with one stone.

A Module to Equip In-service and Pre-service Teachers in Transacting ESD: Development and Implementation

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Education for sustainability requires an understanding of the interdependence and interconnectedness of human beings and the environment. To teach these concepts one requires knowledge of global socio-geopolitical disciplines, biological and physical sciences, and human socio-economic systems. Today, educators are facing challenges in assimilating and adopting these concepts in their practice. Several recommendations have been made by the National Policies and Commissions on Education to strengthen the curriculum, to develop and use innovative modules and materials to face the up coming challenges of the educators and for effective transaction of the ESD concepts.

This paper deals with the efforts taken to bring in different approaches and techniques which are needed to teach multidiscipline subjects, concepts and cross cutting issues of 'Sustainability'. In order to realise this, a module has been developed as a part of SIDA's programme "Education for Environment and Sustainability in Formal Education" to support ongoing efforts to strengthen the role of educators. The module introduces pre/ in service teachers to a wide range of options they can use to face the new challenges in teaching ESD concepts.

The module is currently being tried out in schools, teacher training institutes and validated for its effectiveness. The module also serves as a strategy to achieve the goals of ESD and as a tool to reach the community by encouraging the active participation of teachers, students and the school as a whole.

An Experiment for Implementing Integrative Approaches against Subject-based Curriculum in the Formal Education System

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Responding to the current global challenges, every nation has to develop and implement a variety of educational policies and strategies to help students to properly understand and handle complicated issues like environment problems and sustainable society. It is a very important mission for a nation to provide its members with quality teachers trained to appropriately apply integrative and interdisciplinary approaches to those complex issues, usually within very limited time and space.

Korea is, if not the only, one of the very few nations that have a national curriculum including a separate, selective subject named 'Environment' at the middle- and high-school levels. This unique national curriculum was first notified in 1992 when the UN Conference on Environment and Development, otherwise called the Earth Summit, was held at Rio, Brazil. Since the Belgrade Workshop of 1975 and the Tbilisi Conference of 1977, an integrative approach has been considered the most fundamental guiding principle for environmental educators and curriculum developers. But the current situation provides evidence on how difficult it is to apply integrative and interdisciplinary approaches against a subject-based, content-centered, segmented curriculum.

Every year about 100 qualified teachers majoring in 'Environment' emerge from the five colleges of teacher education in the Dept. of Environmental Education. Now about 20% of the 5,000 middle and high schools in the Republic of Korea select 'Environment' as a subject, which is

being taught by almost two thousand teachers. Among them only 56 teachers had majored in environment, passed the exam and been appointed by the formal education authority. In pre-service as well as in-service training programs for environment teachers, it is not easy to find well-designed integrative teaching methods and materials which are necessary for maximizing the benefit from designating 'Environment' as one of the several separate subjects in the formal school curriculum.

Many interesting and meaningful experiments are being designed and conducted by the teachers who had majored in 'Environment' at the college of education. What do we need to make our teacher education program more effective in terms of integrative approaches to environmental crisis and sustainable development? I suggest three factors: Communication, Network, and Problem-Solving.

Broadening Teachers' Views on Sustainability in Educational Action Research

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This paper contains the analysis of a particular educational action research that was carried out with an aim to: (1) serve as a realisation of the goals set for the Decade of Education for Sustainable Development; (2) promote the reorientation of teachers' education towards the aim of sustainable education; (3) promote the implementation of the guidelines for teacher education.

This paper discusses the case study that was carried out in order to determine and broaden teachers' individual views on the contents that is most significant for sustainable development. Teachers were asked to evaluate specific elements, the contents of which reflect the dimensions of sustainable development. The participants of this educational action research evaluated the significance of the said elements on the basis of their personal views of sustainability.

In this study, we singled out the characteristics that were accepted by the research participants as the essential basis of sustainability. It also treats the pedagogical strategy that might foster the broadening of teachers' professional views.

Quality Ecoschooling for Sustainable Environment: A Study from Cuddalore District of Tamil Nadu, India

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With the aim of promoting knowledge, attitude and skills on environmental concerns among elementary teachers, ecoschools are being developed in Cuddalore district of Tamil Nadu. In 30 of the 53 ecoschools developed till the academic year 2005-2006, a study was carried out from August 2006 to March 2007 by taking up several interventions. Tools such as “test”, “attitude scale”, “rating scale” and “application inventory” were administered to 59 female and 51 male teachers from the ecoschools taken up for the study. In the component knowledge, the overall mean pre-test scores of male and female teachers was 63.6% and 61.64%, respectively. Among the five dimensions studied, namely Biology, Ecology, Water Resources, Pollution and Health and Hygiene, the overall mean pre-test scores ranged from 58.78% to 65.70%. After interventions considerable improvement in the overall mean post-test score was recorded and it was 87.40% for male and 88.43% for female teachers. Among the dimensions, the overall mean scores varied from 84.31% to 92.18%. In the case of attitude, the overall mean score before interventions was 84.06% for male and 85.35% for female teachers. After interventions, an increase of 7 percentage points over the pre-test score was recorded. A marked variation in the overall mean scores among the dimensions was recorded. The overall mean rating score for all the 30 ecoschools was 63.29%. Among the ecoschools studied, five, based on their performance, rated with below the 50% mark. A considerable number of teachers indicated that they practised desirable environmental skills among students. Efforts are underway to promote the concept of ecoschooling on a larger scale and make the schools perform with greater efficiency.

Education for Sustainable Development as Democratisation of Environmental Education

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Many key words in our language are ambiguous. As open notions, they may even oscillate between descriptive and normative meanings, like e.g. 'nature', 'environment', 'health', 'justice', 'democracy', and 'sustainable development'. Their meanings are contested and a key aim of education for democratic environmental education and education for sustainable development is to help people reflect and act on these meanings and so realize alternative futures in more informed and democratic ways.

In a way, this point has already been anticipated in the paradigmatic discussions about environmental education. In the traditional, dominating conception of EE, environment was mostly understood as nature, environmental issues were treated as ecological questions, and the aim was to change the behaviour and attitudes of the students towards more conserving and preserving directions.

In the more critical, reflective and action competence oriented conception of EE, as developed in our research programme, this is seen quite differently. Environmental problems are not understood as problems in nature or between man and nature. They are regarded as societal and cultural issues.

ESD fits this view and can be seen as stressing the democratisation of Environmental Education in several ways.

The main curricular challenge obviously is that the subject matter becomes extremely complex and contested. Therefore, we have to give up the conception of teaching as a process where teachers put prefabricated, objective knowledge into the heads of the pupils. ESD and EE will be meaningful only if it concentrates less on instruction and training and more on education and participation.

An Investigation of the Relationships among Teacher Attributes, Classroom Attributes, Instructional Strategies, and Namibian Junior Secondary School Teachers' Affective Domain

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This study investigated the relationships among teacher attributes, classroom attributes, instructional strategies and Namibian junior secondary school teachers' affective domain. The sample consisted of 221 teachers from 218 schools representing the four northern regions of Namibia. A multivariate analysis of variance (MANOVA) and path analysis strategy were used to test a hypothesized causal model that expressed the relationships among these factors. Overall, the MANOVA results were not significant and hence no follow-up analyses were conducted. However, when the causal model was re-tested in the absence of 13 variables which were incorrectly specified, the MANOVA results, although still not significant, improved considerably: The *p*-value decreased from 28.5% to 15%. Follow-up analyses were conducted at an inflated alpha level relative to this alternative model. The results indicated that science content preparation, syllabus use, and internet use had significant influences on teachers' self-efficacy, but none of the independent variables had a significant relationship with either of the other two dependent measures.

A follow-up exploratory analysis was also conducted using structural equation modeling (SEM) via *LISREL*. Findings suggest that: (1) the teaching of desertification can be improved by a stronger science content background as part of the teacher training programs; (2) teachers' age is a vital factor in teaching desertification; and (3) that textbook use, syllabus use, and internet use are important resources for teaching desertification and should be incorporated in teacher training programs. Most importantly, the findings suggest that to motivate teachers to teach desertification, we need to increase their self-efficacy and ensure they have the right attitudes toward desertification.

Introducing ESDA and the Importance of Socialisation Content: An Empirical Study which Defuses the Worry for ESD Teachers at School Level

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On an institutional level, governments and industries are using the concept of sustainable development, SD, to describe the process of change of society from the present exposed situation towards a more sustainable future. The role of education for sustainable development, ESD, is often at this level very instrumental and many educators hesitate to adopt the type of teaching arising from this view. At an individual level however there is no generally agreed or given concept of the change for the future (Hopkins in Sweden June 2007). As a conclusion from the results in this paper, one way of describing the path forward at an individual level is to use the concept of *sustainable development abilities*, SDA. To be able to develop these abilities e.g. critical thinking, reflection, learning to learn and so forth (Sterling, 2001), it is urgent to understand how these can be trained, practiced and supported in education in general, in all school subjects and in society as a whole. An entirely changed educational strategy which promotes the development of personal and collective abilities is needed for a future more complex and a rapidly changing global society. This education can be developed at senior school officials' level or at a school/NGO level and can be conducted through using an *education for sustainable approach*, ESDA. The main requirement of ESDA is for educators to understand the differences, as compared to ESD, in discussions at a policy level and the general need of education.

This empirical study of ten Swedish upper secondary teachers teaching environmental education, EE, explores the essence of ESDA by studying important educational aspects found in earlier research which together forms the socialization content (Sund, forthcoming). Socialisation content is here considered as not being necessarily normative. This more extended view of content can be described by using a concept from science education, viz. companion meanings (Roberts, 1998). These messages to students communicated through teachers' speech and other actions embed the subject matter content within an educational context. The subject matter in a context can be regarded as an offer of meaning to students (Ostman, 1995).

The study is focused on the difference between the school subject environmental education, EE, and ESD at a school level, and the main difference is not found in the amount of integrated subject content. Instead the vital difference is to be found in the socialisation content which is more concerned with how the often well integrated subject content is used by teachers and students in the context of teaching (Sund in progress).

A study of ESDA at a school level defuses a whole lot of worries for teachers who, often, in international debate, are expected to implement the renewed education which is needed for a sustainable future. ESD at a policy level strives to guarantee education to all people. All the people within a society are educated with a more general approach to teaching and learning (Breiting, 2000; Scott, 2006). ESDA promotes and develops the SDA which is needed at an individual level to develop personal competences as a pace of individual and collective democratic action for a sustainable future which leads to a good quality of life for all. This description can be seen as very simplistic and idealistic, which in many ways it is; however it is fruitful for teachers and other educators to understand and be able to discern their role in the contemporary common agenda for global change.

ESD as a Tool for Creating Development in the Local Community

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The aim of this paper is to present the experiences from a project aimed at introducing ESD in Mongolia using the NAGLO-model (National Governance and Local Ownership). This model is specifically designed to address two goals: 1) That ESD shall become a central tool for local communities to develop their standard of living in such a way that it becomes sustainable both in economic, cultural and ecological perspectives; 2) That all teachers and all personnel in a school will get actively involved in developing ESD as a central theme for their teaching and other activities at the school. In this paper, we will focus on the first goal and especially the experiences of trying to create a fruitful and creative encounter between the known and the

unknown, since this relation can be perceived as the key for learning and development, at least if one adopts a socio-cultural perspective on learning. During the working process it became apparent that there were three areas where this encounter was crucial:

- 1) Ways of organising schooling
- 2) Ways of distributing voices and responsibilities
- 3) The relation between the school and the local community

The first area concerns the need for creating collaborations between teachers from different subjects in order to create a holistic and an integrated approach to ESD, since in Mongolia teachers are commonly educated in only one subject. The second area concerns both the process of transforming local national standards to locally relevant curricula and the order of communication in the classroom. Thus, participation, ownership and deliberation are addressed. The last area concerns how the content of teaching is determined, since that decides how the relationship between schooling and the development of the community is handled.

In order to address these areas in a fruitful way we designed a specific model of in-service training built on the content of the national standards but starting from both the specific circumstances teachers work within and the specific economic, cultural and ecological conditions that prevail in the local community.

Developing Critical Environmental Literacy for Beginning Teachers

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Initial primary teacher education at the School of Education, University of Waikato, New Zealand includes a compulsory paper (TEPC120: Environmental Education) which is an introduction to education for sustainability. This cross department, thirty six contact hour paper has been running for four years and at the beginning of 2007 was reviewed to better address developing views of education for sustainability.

A review of university courses in environmental education and education for sustainability in New Zealand concluded that the educational outcomes from most courses did little to change peoples' perceptions and were certainly not transformational in nature.

In response to this critique as well as for internal quality assurance, the development of the paper has shifted away from a classical environmental education focus to one of focussing on developing beginning teachers' critical environmental literacies. Critical literacy in this paper is grounded in the writings of Freire where literacy is seen as functioning in terms of social and cultural liberation and/or oppression. By taking a critical approach to knowledge production, beginning teachers can find their own voices to become active participants in social change for the environment.

Fragile Ecosystems

Ballast Water Management Programme: Significance of Sustainable Development and Environmental Education

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Shipping industry, an economically flourishing industry in world scenario, is becoming a primary threat to the biological existence of marine habitat and natural resources. Marine pollution, and in particular, pollution caused by shipping, disturbs the various forms of marine life and upsets marine ecology. The introduction of invasive marine species into new environments by ships' ballast water has been identified as one of the greatest threats to oceans in the world. Such introduction of non-native species via the discharge of ballast water can prove detrimental to the ecosystems in innumerable ways. Unlike other forms of marine pollution, the impacts of this are most often irreversible.

In response to the threats posed by the discharge of ballast water, the IMO has come up with guidelines for the control and management of ships' ballast water, to minimise the transfer of harmful aquatic organisms and bacteria. Efforts are underway to frame effective ballast water management programmes and treatment methods. Scientific techniques such as onboard treatment of ballast water, open ocean exchange of the ballast water, etc. have been employed in the mitigation processes.

The measures adopted so far have failed to show 100% positive results. Technical solutions stressing more on the concepts of Ecologically Sustainable Development (ESD) and Environmental Education may prove much more effective. Ecological integrity should be a fundamental consideration in ballast water management programmes.

Climate Change and the Himalayan Glaciers: Problems and Prospects

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Climate change and global warming have emerged as major environmental threats for this century and many centuries to come. Glacier environments in the greater Himalayan region are likely to be more influenced by this phenomenon than any other parts of the world. Glacier melt in the Himalayas is likely to increase the intensity and frequency of various environmental risks including floods and avalanches, failure of moraine dammed lakes, etc. and affect the Himalayan water regime within the next couple of decades. The global e-conference on "Climate Change and the Himalayan Glaciers" was an attempt to identify the major threats and possible responses to tackle this issue. With the participation of 150 experts from 26 countries of Africa, Asia, Europe, Australia and North America, the event was successful in addressing various aspects of climate change induced glacier melting and glacier advancing as well as their implications on other ecosystems and environments.

Lack of baseline information; a poor mechanism to share data, information and knowledge; inadequate networking among the regional experts and poor coordination among research and development institutions in the region were identified as some of the key challenges during the discussion. The e-conference suggested the development of a network to fill-in this gap which should also then work with UNEP, ICIMOD, APN, MRI, WWF, IUCN, NTNC, Winrock, and other agencies.

Land use and climate change in the Himalayas: Choice of technology for adaptation and mitigation strategies

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The relation between land use in the mountains and climate is two ways. On the one hand, mountains play a very important role in determining the climate conditions and hydrological

cycles of any continent or local region and, on the other, changes in climatic conditions are likely to have a deep and probably devastating impact on the mountain ecosystem due to its fragility. Planning for climate change therefore needs to be two pronged: it should be able to evolve mitigation strategies to prevent adverse climate conditions and also prepare to adapt itself in case of such an eventuality. The two most important factors that directly relate to climate change is land and energy use and hence this is the focus of the planning exercise in this paper. A decrease in forest area would have an adverse impact on climate and hydrological cycles, both locally and globally. Increase in local forest area would have to be a primary goal to reduce the adverse effects of climate change. With regard to energy use, a switch over to non-conventional and renewable energy sources would reduce the emission of green house gases and the consequent severity of climate change.

One of the most important factors of the development process is the choice of technology. The paper argues that adopting a suitable technology for land and energy use can be an important aspect of local planning for climate change. It presents a case study of land-use and energy planning in a micro-watershed to illustrate how the land under forest can be enhanced and the emission of greenhouse gases can be reduced by the rational use of land and energy resources with a choice of appropriate technology.

The case study uses the optimisation technique for the alternative static allocation of land resources and available technologies. The model attempts to sketch the intricate relation between local land and energy use patterns and other issues like consumption habit and livelihood demand of the population, lifestyle, level of development, etc. Bringing about an alteration in land and energy use, therefore, needs to address the entire gamut of the development process in the region. The paper discusses these issues in the concluding section.

Importance of Traditional Indigenous Knowledge Systems for Environmental Sustainability in the Chittagong Hill Tracts of Bangladesh

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The upland watersheds of the Chittagong Hill Tracts (CHTs) in south-east Bangladesh are one of the most fragile forest ecosystems in the country. Clear-felling of natural forests has created serious environmental degradation resulting in severe soil erosion, deterioration of water quality and decreased productivity in traditional hill farming. The problem has further accentuated due to development workers' neglect of the traditional knowledge systems and culture associated

with local indigenous resource management practices. In some parts of the CHTs, community-managed '*mauza* reserves' or the Village Common Forests (VCFs), however, provide a glaring example of traditional indigenous practices. VCFs are crucial for watershed management as many of them contain headwaters of streams, natural springs and other aquifers. They are the homes of diverse animal and plant life providing food, wood and bamboo required for house building, medicinal and other sustainable biomass needs of hill villagers. In a study of some of these VCFs in Rangamati and Banderban districts, higher amounts of undergrowth consisting of many herbs and other plant species compared with the non-VCF area were observed which indicated better VCF site conditions, in terms of soil and water conservation. VCF communities carefully maintain perennial streams on which they depend for their year round water requirement. Their conservation practices such as terracing, minimum tillage, controlled burning of debris, mulching and gully control by vegetative cover demonstrates a positive impact on soil and water conservation. Therefore, the VCF knowledge systems may be adapted in natural resources management plans to secure environmental sustainability in the CHTs.

Degrading Wetlands - Intervention for Sustainable Development: A Case Study of Silsako Wetlands of Guwahati

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This paper intends to understand the importance of environment education in preserving degrading wetlands through a case study of Silsako Beel. The main objective of this study was to analyse the importance of environment education and the government's conservation policies and programme in protecting the wetlands.

It has been found that the major problems of the wetland are encroachment, siltation, overgrowth of aquatic weeds and over utilization of bio-resources, resulting in decreasing area of the wetland from 1758.5 hectares (1912-13) to 340.21 hectares (2001). The study showed that lack of public awareness on the importance of wetland ecosystem for sustainable development, laws and acts related to wetland conservation, scarce land resources for habitation and industrial purposes, unplanned urban growth, ineffective implementation of conservation plans, policies and acts are responsible for the degradation of the wetland.

It has also been found that the existing formal environment education through the school curriculum has not been effective in conserving natural ecosystems including wetlands as it does not provide enough understanding about the importance of wetland for sustainable

development. Moreover, there has been little evidence of a wetland community education programme, resulting in lack of community ownership of the wetland. It has also been found that lack of participation of the community in the planning and decision-making processes like Master Plans has worsened the situation.

Hence, it is necessary to (i) enact and enforce Government regulations through community participation (ii) make necessary modifications in the formal school curriculum to ensure better understanding of students on the relation between wetland ecosystem and sustainable development, (iii) initiate Community Environment Education Programme through the involvement of civil society organisations to save our wetlands.

Biodiversity as a Tool for Conservation and Sustainable Development Education

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Western Ghats is one of the global hotspots of biodiversity. Its biotic wealth is depleting, and urgent measures are required, at the grass root level and at the policy level, for conservation and sustainable utilisation of these resources.

A participatory approach for biodiversity research was initiated by Prof. Madhav Gadgil, Indian Institute of Science, Bangalore, in 1994. The first author was associated with the programme since its beginning. In 1998 the Dept. of Biotechnology sanctioned a project "Biodiversity Monitoring through Colleges" which enabled the authors to select a Panchayath, a fragile ecosystem area at the foothills of the Western Ghats in Ernakulam District, Kerala, India for the study.

The extent of the Panchayath is 40 sq. km and its population is > 15000. The study was based on the Landscape Ecology approach. Eleven major Landscape Element Types (LSEs) were identified. The five-year study (1998-2003) resulted in documenting the ecological history and the richness of flora and fauna of the area. A People's "Biodiversity Register" was also prepared by the LSG with the help of the research team. This was an eye opener to the local people and acted as a good tool for community education. The people are now associating with the Forest Department and have initiated a programme for the sustainable utilisation of the biological resources in the area, which can be expanded further by the cooperation of the academic and research communities. The best way to overcome the present extinction crisis is through a collective effort by the academic, research and local communities as shown in the present work.

What is ailing the Dal Lake?

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The world famous Dal Lake of Kashmir (34°07'2 N, 74°52'2 E, 1584 m above MSL) has undergone tremendous changes due to various anthropogenic pressures. The present ailing condition of the lake is an outcome of the no-coordination approach adopted by the government agencies, various developmental authorities, NGO's, ecologists, economists and the common people, particularly the Dal Lake inhabitants. Lack of proper education about the ecological and economic importance, as well as the proper conservation strategies has led to the failure of all conservation efforts adopted to restore the lake. Dissemination of education regarding all the aspects of the lake is the need of the hour.

Fragile Freshwater Ecosystems of Western Himalaya: Past Conservation Strategies, Achievements and Failures

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The Western Himalaya, which was known for its clean environment and natural freshwater ecosystems - springs, streams and lakes with crystal clear water and rich biodiversity - is losing

its paradisiacal charms due to various environmental changes. Among these freshwater ecosystems the lakes are the most threatened ecosystems of the area. In recent years, visible changes have appeared in these freshwater ecosystems as a result of eutrophication and sedimentation leading to their shallowing, decrease in water surface area and overall ecological degradation. The problem of ecological degradation is mainly due to addition of major plant nutrients, particularly nitrogen and phosphorus, derived from human wastes, detergents, fertilizers, agricultural activities, etc. at an accelerated rate. The nutrients have been chiefly responsible for an increase in organic production, particularly in the form of dense macrophytic growth and are also responsible for the deterioration of water quality which in turn has reduced the recreational and aesthetic appeal of the lakes, besides other economic benefits. From the last two decades, hundreds of projects worth millions of dollars were conducted with the aim of conserving these ecosystems, and so far completed by various governmental and nongovernmental organisations. But the outcome of all these efforts is a topic of hot discussion at all levels of administration, intellectuals and the local community with a big question mark – why were we not able to conserve these ecosystems? When analysing the case study, it can be summed up that the main cause of our failure to conserve these ecosystems was the lack of basic technical and scientific knowledge of ecosystem management. It also seems that all these conservation projects were deficient in environmental education and awareness programmes among the masses, which is the basic tool and weapon used in ecosystem management and sustainable development.

Health

Environmental Education and Nanosciences/Nanotechnology Development: Nanoeducation for Sustainability Education

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Nanotechnology is a word describing a collection of technologies which enable manipulation of materials at the nanoscale - between 1 and 100 nanometres. Many aspects of nanotechnology pose no threat to human health. However there are some aspects of nanotechnology which are potentially hazardous to health which the International Society of Doctors for the Environment (ISDE) does have concerns about. The important mission of educators, environmentalists and medical doctors is to raise awareness of the new Health and Environment issues presented by nanotechnology: the benefits and dangers, and the possibilities for responsible use. Nanomedicine raises high expectations, but the safety of nanomedical products, and their ethical and legal issues concern us. Therefore, because a number of products on the market, including cosmetics, already contain nanoparticles, there is an urgent need for nanoeducation, especially among the medical sector. The reason is simple: medical doctors have grown more concerned about the issue as it becomes clear that both nanomedicine and nanotoxicology topics are almost absent from today's medical universities' curricula. On the basis of the fundamental Noosphere concept of a prominent Ukrainian scientist and philosopher Volodymyr Vernadsky, we have developed the concepts of the 'Integral Health and Sanosphere' to create an integrated conceptual framework for Education for Sustainability. According to this framework, we create an integrated curriculum of nanoeducation in all medical and also other non-technical disciplines, and are also creating an international network on nanoeducation for non-technical specialists and the general public.

Dynamics of Climate Change and its Health Impact

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Climate change and infectious diseases threaten wildlife, livestock, agriculture, forests and marine life, all of which provide us with essential resources and constitute our life-support systems. The impacts of climate change could increase incrementally over the decades. This paper analyses how climate variations allow disease organisms to thrive where they previously could not live, leading to adverse effects on human health because of the spread of opportunistic organisms.

HEAL: Action-based Research Elicits Responses from Government

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With a view to creating awareness about the close linkages between health and environment, HEAL: "Health and Environment: Action-based Learning" programme of the Homi Bhabha Centre for Science Education (HBCSE), TIFR, Mumbai, was conducted in Navi Mumbai. The study conducted in 2003-2006, covered an area of 344 sq. kms. Nearly 1000 National Service Scheme college students and their teachers - trained at HBCSE - monitored, collected and analysed data about different environmental parameters (air, water, soil, green cover and domestic solid waste) and their impact on the health status of people in the study zones. Navi Mumbai's topology combined with its large industrial and residential areas makes it an interesting study site.

Among the more significant results, the air quality of the studied zones ranged from bad to dangerous and the quality of water (in open water bodies) was poor. On checking the health status of nearly 10,000 people, the upper respiratory tract (URT) disease symptoms and vector-

borne diseases like rabies and malaria were present among a large percentage of people throughout the year.

In this action-based research programme, the academic community of the city was sensitised to the importance of a clean environment and its linkages to public health. Equally important, HEAL has had a positive impact on the policy making decisions of Navi Mumbai Municipal Corporation (NMMC), our active partners. Subsequently, several public health measures like new sewage treatment plants, scientific solid waste management, monitoring of air pollution with new equipment in different areas and upgradation of NMMC's environment research cell have been undertaken.

Dolomite Risk Awareness Program for Learners in Schools

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Dolomite-related sink holes are one of the most immediate natural disasters which threaten the historic gold-mining area of Ekurhuleni Metropolitan Municipality, situated on the outskirts of Johannesburg, South Africa. As a consequence, raising the dolomite risk awareness in people is increasingly seen as a key priority in the densely populated residential areas which are situated on top of these gold mines. In an attempt to improve residents' knowledge and understanding, an education programme was designed to assist community members with the early identification of warning signs and provide them with information about the disaster management process to be followed in the case of sinkhole formation. This paper will provide a brief overview of the programme that was developed from a practitioner perspective, and will touch on the background, the process, the challenges experienced, as well as the lessons learned, so as to reflect on how practice could be improved in future.

This programme attempts to keep the learners interested and focused on the activities each step of the way. This is one way of showing how complex and diverse the Environmental Education Processes are today. It is also important to understand the target group so that the program can be properly pitched and enhanced with appropriate activities that suit the target group.

Higher Education

Research and Capacity Building in Meteorology as an Environmental Education Course in Nigeria

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This paper gives a general overview of research and capacity building as they relate to meteorology as an environmental educational course in Nigeria. Definitions of some common terms will be presented. The social and the 'Impact of Meteorology as an Environmental Educational Course' models will be examined while action plans for different levels are recommended. At the individual and national levels, training and information sharing are considered crucial to ensure sustainability and equity. At the government level, allocation and timely release of funds and other resources to the Impact of Meteorology as an Environmental Educational Course project is crucial. The paper further recommends that a multidisciplinary and multi-locational research and development strategy should be adopted for this course.

Latvian Case of Reorienting Higher Education towards Sustainability

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This article introduces the experience of the Institute of Sustainable Education, Daugavpils University, Latvia that is committed to a holistic approach and education for sustainable development. It evaluates this experience on the cultural, social, environmental, management, and research dimensions. The paper asserts that only a higher education that welcomes a holistic understanding of human beings and the spiritual dimension of education can be committed to sustainable development of society. It also seeks to highlight that the aim of higher education is not simply to hand down the experience and achievements of humanity but to rise beyond the traditional norm-oriented approach and modernist world-view and create a democratic community both inside and outside the higher education establishment taking into consideration the goals of the UNESCO Decade of Education for Sustainable Development.

Education for Sustainable Development (ESD) for Environmental and Biodiversity Conservation: The case of 'ITBC Frog Museum' Kueh Boon-Hee

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The Institute for Tropical Biology and Conservation (ITBC), Universiti Malaysia Sabah has always been fully aware of the importance of then, Environmental Education (EE) and now, Education for Sustainable Development (ESD), for perpetual environmental and biodiversity conservation. One of the most feasible strategies for environmental and biodiversity conservation is through the implementation of ESD that prompts people to collectively envisage a sustainable future, realize the effects of individual actions on the environment and biodiversity, assume responsibility, and forge continual partnerships among stakeholders. The 'ITBC Frog Museum'

epitomizes an ESD project undertaken by ITBC aimed to (i) instil the concept of environmental and biodiversity conservation, and its imperativeness into people's minds, and (ii) instigate people to bear higher conscience in their daily undertakings – all these using frogs and toads (Amphibia: Anura) or anurans as a model of the environment and biodiversity. The museum highlights various facts on frogs and toads, in the form of posters, reading materials (journals, books, proceedings and magazines), documentaries, (wet and dry) specimens, and tailor-made replicas. The museum also proffers activities for young children to better understand and thereby appreciate the uniqueness and richness of the frogs and toads found in Sabah and Borneo in particular, and Malaysia and the world, in general, as well as their relatedness to the daily life and survivability of humans. As a complementary arm of the National Technical Sub-Committee of Faunal Biodiversity (Amphibia) Malaysia being led by ITBC, the 'ITBC Frog Museum' also brings together relevant governmental agencies, other higher learning institutions and NGOs in realizing the intentions of the museum. In order to integrate mass media into the mechanism to achieve the ultimate aims of the 'ITBC Frog Museum', the museum works closely with a local newspaper for wider dissemination of information and knowledge via the fortnightly publication of 'BORNEENSIS Corner' in *New Sabah Times*. Other mass media used are the Internet and several locally well distributed magazines. Last but not the least, the 'ITBC Frog Museum' includes the participation of the private sector, namely tour operators, through the running of two tourism products incorporating the museum: 'Anurans Tourism' and Campus Tourism. Hence, the private sector is provided a much needed avenue to also contribute, as other stakeholders, towards conservation by encouraging more people, both local and international tourists, to learn about and value the environment and biodiversity. Thus far, the 'ITBC Frog Museum' has received favourable response from various stakeholders. ITBC strives to further enhance the participation and collaboration of the stakeholders in creating a sustainable future for all.

Education for Global Environmental Change: The Role of Universities

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This paper will present a case for environmental education as a tool for effecting changes in the current local, regional and ultimately global trends in environmental degradation. It will argue that education for environmental change is a life-long process that begins from early childhood and continues throughout adulthood. Such a process necessitates the integration of the three modes of environmental education: education about the environment; education in and through the environment; and education for the environment, in an attempt to empower individuals to

think critically and act responsibly. To this end, the paper will posit that the lecture method is not entirely appropriate for critical thinking and problem solving, which are both indispensable to the formation of new attitudes and values that motivate individuals to make decisions that safe-guard natural resources and enhance the health of the environment. A call will therefore be made for the hidden curriculum (the University's practice) to demonstrate the application of theoretical concepts.

More importantly, this paper will critically examine the delivery of the BSc programme in Environmental Science that is offered at the undergraduate level by the University of Guyana. Specific themes will be used to guide the analysis, including the objectives of the programmes, programme content, interdisciplinarity in teaching, projects and research; pedagogical methods, and relevance and application to real world problems. Challenges to curriculum reform will be highlighted, including compartmentalization of knowledge, criteria for promotion at universities, the focus on 'making a living by means of certification' and resources for field exercises. The paper will conclude with concrete recommendations.

Looking with Different Eyes: A Gender Perspective to Climate Change in Environmental (Higher) Education

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Since more than a decade, scholars from around the world have tried to bring a sustainable development perspective into ordinary (higher) education curricula and courses. One of the main objectives has been to increase ecological literacy amongst students and professionals coming from non-environmental backgrounds. The actual and urgent challenges that climate change brings, are a very appealing manifestation of the context in which young (and older) professionals have to work. Instead of raising the question IF we should apply climate change as a priority area in our educational endeavours, the question is far more: HOW such a complex issue should be integrated.

In order to make climate change a useful subject of our educational systems, a gender perspective is essential. Climate change manifests itself not only as a complex environmental and ecological problem, but also as a societal challenge of unprecedented magnitude. If we are unable to see and integrate a social dimension in our mitigation and adaptation efforts, the burden will rest unequally on women's shoulders and their (local and global) leadership will be neglected. The need for and potential of a gender perspective in climate change education will be demonstrated

in this paper with some examples. It will be argued that bringing a gender perspective into our efforts to integrate climate change in environmental education, is of key importance. Only then a paradigm shift towards real sustainable development can be envisioned in the mindsets and capacities of (young) professionals.

Higher Education and Sustainability: A Critical Appraisal

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Currently, global society is delicately poised on a civilizational threshold similar to that of the feudal era. This is a time when outmoded institutions, values, and systems of thought and their associated dogmas are ripe for transcendence by more relevant systems of organization and knowledge (Davidson 2000). The foundations of the modern era (including modern educational institutions) are under sharp scrutiny and the fragmentation of nature, society and self is ample evidence of the cracks in the foundations. In times of crises, old questions often come to the fore. For example, as environmental problems reach unprecedented levels, the perennial existential question of *how we should live* is emerging once more. So too are educational ones such as *what and how we should learn*. But, times of crises also present new opportunities, create fresh imaginings, as well as alternative meanings, metaphors and languages.

In this paper I wish to appraise sustainability (and its epithets such as development) as a new language that emerged in the late 20th century in response to the psycho-socio-environmental crises of the time. I shall also examine the (in)capacity of disciplinary knowledge and traditional scholarship to respond to the complex and pressing problems of contemporary society. Finally, I will critically discuss the role that new modes of knowledge production, an expanded view of scholarship and alternative metaphors might play in (re)imagining the university's role in sustainability education.

Environmental Education and Education for Sustainable Development in Universities of the Russian Federation

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During the last decade, a comprehensive system of environmental education has been introduced in the higher education institutions of the Russian Federation. At present, more than 150 universities annually produce some 5500-6000 bachelors, specialists and masters in environmental sciences. The capacity building efforts required for establishing a partnership between EE and ESD is now under progress. In 2002, the Council on Ecology and Sustainable Development was organized to coordinate the activities aimed at the introduction of 'ESD into EE' idea in the universities of Russia. As a leader in the field of university education, the Moscow State University coordinates a wide range of activities of the Council. In line with the European Strategy for ESD, the National Strategy and Action Plan for ESD is now under elaboration by the educational community. There is an obvious shift from general EE to ESD in Russian universities. This is achieved by various mechanisms including the so called "penetrating education", i.e. integration of the ideas of sustainable development with the existing curricula. This integration embraces not only the learning in classes but also field training. The regulative mechanism of ESD includes the elaboration of new State Educational Standards in Russia within the framework of the Bologna process. As a result, the new course "Sustainable Development" was included in the Federal component of training in ecology, nature management and geoecology in 150 universities of Russia. The concept of ESD is becoming an important basis for the education process in all universities of Russia offering EE. Substantial work is still needed if EE and ESD have to play a crucial role in higher education.

Epistemological and Pedagogical Practices for ESD at Higher Education Institutions in Southern Africa

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The implementation of education for sustainable development (ESD) demands a review of the current epistemological and methodological practices and the **United Nations Decade of Education for Sustainable Development (UNDES)** practices in Higher Education institutions.

This paper explores possible epistemologies and pedagogies for ESD in the institutions of higher education in southern Africa. The paper highlights the themes and topics that may be of interest to the participants, most useful and suitable for teaching ESD and in contributing to the implementation of UNDES in institutions of higher education. It explores social, economic, political and ecological issues in the local contexts and their impact. The paper stimulates and invites debates on sustainability issues and their implication to research, community service and teaching and learning to promote social transformation.

Do University Students Value Education for Sustainability? (Poster)

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The poster presents a research investigating undergraduate students' perceptions of sustainability, its relevance to their studies and its place in the formal education system. It also explores options for student engagement in campus sustainability initiatives.

As the target audience of EfS initiatives, it is important to consider how students will respond to efforts to incorporate EfS into formal education. Undergraduate students were surveyed to establish whether or not they believe that sustainability is relevant to their lives and fields of study and if they feel that all students should be exposed to the concepts of sustainability through formal education.

The students surveyed were aware of the concept of sustainability and the majority of survey respondents indicated a belief that all students should be educated about the topic in the course of their formal education. However, only a small percentage of students felt that they are receiving adequate information regarding sustainability from the existing curriculum. The poster will present students' thoughts on the concepts of sustainability and analyse the sources of their exposure to such concepts (coursework, media, student organisations, etc.) and the relative importance of each.

Given student interest in the concepts of sustainability, the ANU has taken a number of steps to integrate sustainability into the curriculum and offer students a chance to actively engage in sustainability initiatives on the campus. The ANU Sustainability Learning Community for example, offers students a supportive network and a variety of opportunities to get involved in the campus community by providing exposure to local sustainability related issues and by linking classroom theory to "real life" problems faced at the ANU.

Developing a Whole-of-University Approach to Educating for Sustainability: Linking Curriculum, Research and Sustainable Campus Operations

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Institutions of higher education play a significant role in the search for a more sustainable future. Universities can optimise their role as agents of change with regards to sustainability by adopting a “whole-of-university” approach to sustainability. This approach explicitly links research, educational, operational and outreach activities and engages students in each of these aspects rather than confining their education solely to the classroom.

Throughout the world most universities are tackling sustainability issues in a compartmentalised manner; sustainability education is confined to specific courses, education is not linked to research, and both education and research are certainly not linked to sustainable campus operations. However, many universities are taking proactive steps towards reducing the environmental impact of their operations and these initiatives can positively benefit from student input. By encouraging a collaborative space within the curriculum for students, academics and managers to critically reflect on university performance with regards to sustainability, many positive benefits can ensue including improving campus performance with regards to sustainability and building the capacity of students to become agents of change.

Using action research methodology this paper quantifies and qualifies the teaching and learning and operational benefits that have arisen from student involvement in campus sustainability initiatives at the Australian National University (ANU). Through an iterative process of collaboration and transparency, the ‘Integrating Sustainability’ program at the ANU encourages students across a number of disciplines to conduct research into the ANU Sustainability Program (ANUgreen). This very successful collaboration has had far reaching effects at the ANU including raising the profile of university sustainability initiatives, providing solutions to sustainability problems, building trust between students, managers and academics and providing meaningful learning experiences for students.

New Erasmus Mundus Masters programs Sustainable Development: Opportunities and Challenges

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Since 2004-05, the European Union started a scheme to support a 2-year Master's program for non-EU citizens along the recommendations of the Bologna process (120 ECTS credits). According to this scheme, grants could be received only by consortiums of European Universities, and one of the conditions was that students should stay in at least two universities during these two years.

Very often, this was an excellent opportunity to enhance the existing Masters programs and build on existing partnerships. This was the case of the Central European University (CEU). Since 1994 CEU has a one-year Master of Science Program in Environmental Sciences and Policy. This program was validated by the University of Manchester, UK.

The new Erasmus Mundus program called MESPOM (www.mespom.org) consists of four partner Universities - CEU, Manchester University (UK), University of Lund (Sweden) and University of Aegean (Greece). It was supported by the EU in 2005, and the first cohort graduated this year (2005-2007). In the first year, this program runs parallel to the existing one year program at CEU. For the second year, MESPOM students go to the partner universities. This does cause a lot of problems for the partner institutions, including scheduling, planning, and course selection. Nevertheless the program is running successfully, and every year the number of applicants is doubling (this year we had 820 applications for 30 places). This paper will discuss the difficulties and challenges of introducing Erasmus Mundus program in addition to the existing one-year master program in environmental sciences and sustainable development.

Blending Scientific Spirit and Spiritual Wisdom for Sustainable Development: A Universal Model for Environmental Education at the University Level in the Context of the UNDES

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Human progress can be attributed to the scientific spirit and the consequent studies and research in the last two centuries. Thanks to the spirit and the consequent technological inventions and innovations, humanity is now confronting the darker sides of growth and progress. The two great threats faced by humanity in the 21st century are depletion of resources and degradation of the environment. Hence scientists and development experts all over the world are suggesting sustainable development as a viable alternative to modern mechanistic models of development. Sustainable development demands a holistic approach, integrated understanding and a comprehensive outlook in finding permanent solutions to the crises of the world rather than a temporary tackling of problems.

The acceptance of the UNDES in 2002 is a strong endorsement of the international recognition of the role of education, especially higher education in attaining the objectives of sustainable development. In this context, this paper is an attempt to suggest an integrated, holistic and all inclusive and basic model in Higher Education for protecting the environment and promoting development, simultaneously.

Part I of this Universal model for Environmental Education in Universities consists of the Information Induced Awakening Stage. Based on the information gathered through the scientific studies about depletion of resources and degradation of environment, the University population is made alert to the imminent danger.

Part II proceeds from the stage of information to a Stage of Knowledge based on scientific knowledge and technological inventions to tackle the problems temporarily, if not permanently. This stage also acknowledges the limits of modern science and the limitations of advanced technology in finding permanent solutions. The reasons for the resistance to SD policies from institutions and societies (eg. resistance of the US to sustainable consumption) are also analysed here and the common factors for failure are probed into.

Part III recognises a micro level change in the attitude of individuals towards environment and development as the fundamental factor for the success of sustainable development policies. It is here that besides the above information and knowledge, the relevance of a spiritual wisdom for sustainable development arises, so that the awareness generated out of the information in the

first stage and the knowledge about policies and programmes formulated and implemented at macro levels through various social, political and economic institutions in the second stage, become the real basis for change.

In this stage of spiritual wisdom for sustainable development, the traditional Indian wisdom of caring for and sharing of nature and natural resources is very significant. The concept of *Universal oneness* embodied in the *Advaita* philosophy and the interrelationship among the biotic and the abiotic along with the rituals and practices that protected nature, were not imposed from above as rules and regulations, but evolved as part of a lifestyle, culture and tradition. They are worth incorporating into the scheme and syllabus of studies in all the universities. By incorporating such spiritual wisdom, this model integrates the 'thinking' of the head (scientific spirit) and the 'feeling' of the heart (spiritual wisdom) and help in finding sustainable solutions to environmental problems through education.

Environment Education – Role of Higher Education

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Environmental deterioration has created a threat to the survival of mankind. This calls for an extensive analysis of environmental issues and challenges. World over people are working towards safeguarding the environment.

The present paper addresses the magnitude of environment deterioration and also highlights the roles of various social agencies in catering to these issues.

Educational Institutions play an extremely effective role in generating awareness and spreading consciousness regarding environmental issues to various sections of the society. Imparting Environment Education is one of the prime objectives of the majority of the educational institutions.

The authors would like to present the case of the Department of Extension and Communication, Faculty of Family and Community Sciences, The M.S. University of Vadodara, India. The Department is making exemplary efforts in contributing to this issue. The University has a three tier system of working: Teaching, Research and Extension. These three well defined components are successfully utilised in catering to Environment Education. The department has well designed courses imparting Environment Education offered to Undergraduate and Postgraduate students.

Apart from teaching, the department plays its role in conducting Research on various environment related issues: right from imparting awareness, to designing strategies for planning an effective programme to save the environment, to policy making.

The Extension and Community Outreach is a strong component of Higher Education. The focus of this area is on reaching the underprivileged sections of the society. Participatory communication strategies are planned and implemented for imparting Environment Education through various courses and projects with the collaboration of State and National organisations.

Finally, recommendations are made for each of the three components – i.e. teaching, research and extension - in further dealing with this crucial subject.

Modelling Institutional Change for Sustainability in Universities

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The University of Gloucestershire, UK, has been working towards more sustainable practices since the early 1990s, and was identified as a national ‘Trailblazer’ by the NGO Forum for the Future, in 1996. The University also won a number of national awards for promoting sustainable development locally and nationally. In 2005, it became the first English University to achieve full accreditation under the International Standard ISO 14001 Environmental Management System. The accreditation includes regular evaluation of estates, purchasing, transport, energy, waste management and other ‘housekeeping’ practices. Moreover, and more innovatively, it includes evaluation of the formal curriculum studied by students; all students have had an opportunity to study sustainability in theory and practice since 1992.

The development process has not, however, been straightforward, and over the last sixteen years there have been setbacks and periods when sustainable principles moved further from the centre of the University’s mission. The paper evaluates the complex process of organisational change against several theoretical change models, and identifies the critical drivers and barriers to progress. It highlights particularly the role that students can play in promoting sustainable practice, both within the University and in external communities during their Higher Education courses, and in their lives after graduation. Active styles of learning have been found to be particularly significant in developing the appropriate range of skills for sustainability, professional life in many economic areas and civic activity.

The Transformation of University-Level Technological Education: Engineering for Sustainability

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Over the past dozen years, technological education — applied science and engineering education — has slowly experienced a shift in its fundamental paradigm. Whereas technological education had previously been almost wholly technical in orientation, attention to sustainability has increasingly placed greater emphasis on the environmental, social and cultural context of technology. If disciplinary-based university-level technological education has been relatively late in arriving at the importance of sustainability, equally late in changing the design of curricula, and slow in recognizing its responsibility to address the subject by providing the well rounded, contextualized education the subject of sustainability requires, significant change is now occurring. Not only is sustainability becoming a core subject of the general education curriculum for technological education, but it has also led to the creation of specialized courses, curricula and degrees. This paper addresses the nature of this change, the forces that have promoted it, defines critical approaches that are being incorporated to address sustainability, and cites examples from North America and particularly from the National Academy of Engineering in the U.S.

Trend of Researches in Shivaji University: Towards Sustainable Development

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Sustainable Development is a term related to various disciplines at the university level such as Botany, Zoology, Chemistry, Physics, Biotechnology, Economics, Sociology, Education, etc. Recently the trend being observed is that researches directly or indirectly related to sustainable development under these disciplines are increasingly being undertaken.

It is necessary to see the trend of those researches and their relevance to the goal of sustainable development. It will help to critically evaluate the existing trend and to consider appropriate modalities for undertaking researches at higher education level so as to minimise the gap between

development and environmental conservation. This paper will reveal the trend of researches in various disciplines of higher education in Shivaji University, Kolhapur, India.

The Social Growth of University Students in the 3rd millennium

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One of the most important aspects of every individual's life is social contact and the establishment of desirable relations with other people. Man as a social being has to face a variety of situations and social contacts with others. Students constantly are in need of social conduct strategies; strategies which play an important role in establishing relationships with others.

Therefore, to improve one's behavior, especially in adolescence, one must know the answer to the following questions: what is social development and how is it achieved? The answer would help the adolescent identify his/her future goals through effective relationships.

The characteristics of the youth/student generation in the age of information explosion consist of: sensitivity, powerful feeling, intelligibility, curiosity, ambition and hopefulness to achieve their dreams and wishes as applicable in modern life. The prioritized needs of this generation include: knowledge, income, and financial affordability through employment compatible with their dignity and dreams, the need to get married and make a family, adaptability with the students, instructors and the society. In this context, the universities play an important role in social education. The objectives of a university education can be considered as:

- Mould expert and socially developed manpower in order to hold key positions in the future
- Study the pivotal role of universities in the social reconstructive trend of mankind in the 3rd millennium
- Study and rectify the educational deficiencies in teaching and research in universities which stem from a lack of students' social growth

Giving a Chance to Young Academics: Speak Up! (Poster)

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Although more and more people acknowledge the role of students as stakeholders in education, not all universities across Japan fully recognize this and realize this in their environment. While students can be more mobile and flexible to deal with new ideas than the often conservative university institutions, systemic and environmental backing is not often found.

The AGS-UTSC (University of Tokyo Student Community) is a student run organization, backed by a branch of the university promoting global sustainability. It works to connect students and acts as a stepping stone as students try to find their own way of making a difference. Among many of its projects is its sponsoring of students to conferences concerning sustainability and education. These projects provide students with the opportunity to present and report results from their various activities. Also, this endeavor helps students to access opportunities for ESD. While students may be supported to attend conferences and meetings directly relating to their research field, opportunities related to ESD are not widely understood by the traditional education system and are limited.

In the past year, AGS-UTSC has sent students to the APEID conference 2006 on ESD in Bangkok. Here students presented a case study showing enhanced environmental consciousness through a student run Sino-Japanese exchange program, and another presentation on their activities in raising awareness in their own campus. Through this, the students were invited to attend a United Nations University Global Seminar in Korea, to show how students can start making a difference.

We firmly feel that such opportunities help both the empowerment of students and also serve to let the voice of young academics be heard and their potential be known.

Innovations & Technology

Biosurfactant - A Pesticide Container Cleaning Agent

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When agriculture and public health services switched from the organochlorine (OC) pesticides to organophosphorus (OP) pesticides and carbamate insecticides, human and animal pesticide poisoning increased worldwide. Human poisoning from OC compounds has been reported but the OP compounds, being particularly more toxic to mammals, have greatly added new dimensions to the problem. Environment is a huge repository of pesticide residues, most of which is now beyond recycling, due to a number of limitations. Once the pesticides are decanted from the containers, these containers are thrown into the dumping ground and left to meet their fate. Pesticide container disposal is a demanding and serious problem for the developed and developing world. If the containers can be cleaned to remove the pesticides adhering to them and recycled, then it is possible that the pesticide residue would be eliminated. Sporadic attempts have been made using only synthetic surfactants as cleaning agents. However, these agents are themselves pollutants. So, there is a need to look for an environmental friendly washing solution which can remove the pesticides from the containers. In this context, the efficacy of the biosurfactant produced by *Bacillus subtilis* was tested to dislodge Fenthion from containers. The result demonstrated the efficacy of the biosurfactant to remove the pesticide residues to the extent of 100 %, 96% and 90% from plastic, glass and tin containers. The developed biosurfactant could offer the most promising way of overcoming pesticide residue in the environment.

Using Innovative Online Technology to Increase Children's Understanding of and Interest in Climate Change, Biodiversity, Natural Resource Use, and Other Sustainability Issues

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GLOBIO® uses innovative technology to increase children's interest in and understanding of climate change, natural resources, biodiversity, and other sustainability concerns.

GLOBIO focuses on children aged 7-12, because this is a formative period of development when they first learn causal relationships and begin developing life-long values. To manage resources effectively, ordinary citizens need a complex understanding of the interdependency of humans, animals, and plants. Often children do not understand how human activity impacts environmental quality; they do not appreciate the "cause and effect" link between air, water, and soil quality; and they do not adopt simple behaviors to sustain natural resources.

Research indicates that children aged 7-12 are highly receptive to new technologies, and they list animals, nature, and technology as top interests. By leveraging these interests and developing fun, engaging learning activities, GLOBIO inspires children to become environmental stewards and global citizens who use natural resources wisely.

GLOBIO is building Glossopedia™, an online "encyclopedia of life" for children. Glossopedia models an inquiry-driven approach to learning by providing children with a unique opportunity to independently pursue their own interests along individual paths and across multimedia. When children use Glossopedia, they explore connections. For example, by clicking on a hyperlink from an article on bears to a video of a sloth bear hunting for food to a news report on sun bear habitats in Borneo, children discover the webbed relationship between species, habitats, food supplies, the environment, etc. Guiding children to think through connections is the best way to teach deep environmental literacy.

Indoor Air Quality and Sustainable Built Environment

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Through the years, man has built increasingly elaborate buildings to protect himself from the elements, like rain and snow, warm air in summers and cool air in winters. However, such buildings do not always ensure the complete protection of their occupants. Over the years, construction techniques have significantly improved in order to make structures longer lasting and less problematic. However, problem events occur in buildings, which are classified as sick building syndrome (SBS) and building related illness (BRI), in which building occupants experience acute health and comfort effects that appear to be linked to the time spent in a building, but no specific illness or cause can be identified. The causes of problem events may be inadequate ventilation; chemical contaminants from indoor sources; chemical contaminants from outdoor sources; biological contaminants; psychological factors like perception of thermal, audio and visual environment; etc. Besides, the scientific evidences have also indicated that the air within the buildings may be more polluted than the outside air causing the problems associated with poor indoor air quality (IAQ). According to *The world health report 2002*, indoor air pollution is responsible for 2.7% of the global burden of disease. Therefore, there is a need to conduct IAQ studies in the buildings to improve their performance with respect to the occupants' well being as well as satisfactory indoor environment. Acceptable IAQ and ventilation are essential components for providing a healthy, satisfactory, and productive indoor environment. Technologies and strategies for achieving acceptable environments also need to make efficient use of energy. Research concerning the design and operation of ventilation strategies and systems, include: energy-efficient ventilation and energy-efficient heating and cooling systems, while the research concerning the influence of ventilation and IAQ on building occupants include: effects of IAQ and thermal conditions on the occupant, the effects of ventilation systems and air delivery methods on occupants and the effects of energy-saving strategies, such as load shedding, on occupants. The IAQ investigations include five different phases for either simple in house inspection or complex diagnosis. Now a day, the building owners, design professionals and architects are becoming more interested in conducting such IAQ investigations following the sustainable building concepts and technologies.

EIA

Environmental Impact Assessment as a Tool for Sustainable Development

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The developmental projects coming up in ecologically fragile areas are intensifying conflicts between the competing interests of development and conservation of the environment. In this context, the need for a new legal strategy to protect the environment led to the birth of *Environmental Impact Assessment* (EIA). The objective of this paper is to analyse the concept of EIA and its importance in the present era.

The need for EIA arises when a project can cause diverse effects. EIA can be defined as a multidisciplinary process that can direct a public or private agency to formulate an environmentally sound project so that the right of the citizen to live in a healthy environment is protected. It enables the environmental factors to be given due weightage along with economic and social factors. When it is felt that the best policy would be to prevent the adverse impact of the project rather than to counteract it, the courts in India have begun to stress on the importance of EIA. This view has been further strengthened with the occurrence of the Bhopal Gas tragedy that arose partly due to a failure to comply with this process.

EIA should not be considered as a legal and technical issue to be left to the bureaucrats and experts. Preservation of the environment is a task not only of the government but a social obligation that every citizen must undertake.

Fly Ash Management in the Panki Thermal Power Plant, Kanpur

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India has a total of 83 coal based, thermal power plants (TPPs) which supplies 67% of the total power (79427 MW/Day) generation of the country (Central Electricity Authority, 1998). Use of coal as fuel brings with it a number of problems such as generation of particulate matter (PM), gaseous emission (SO₂, NO_x, Mercury) and fly ash (FA). PM and gases are removed at the source by using electrostatic precipitators, flue gas desulphurization, selective catalytic reduction and carbon injection technologies etc. but generation of fly ash in large quantities in each TPP is a serious risk for public health and surrounding environment, and its remediation is a challenging task for TPPs authority. During the year 2004-05 (CPCB Annual report, 2004-05), a total of 116 million tonnes of FA was generated in India and nearly 36% of the total FA is being utilised in beneficial ways. FA contains considerable amount of heavy metals such as As, Pb, Zn, Cu and also plant nutrients like Ca, S, Mg, Fe and Mn. The major public health or environmental issue of FA is concerned with its uncontrolled dispersion in surrounding areas and prolonged persistence of untreated FA in the ash ponds. This paper summarises the environmental risk assessment due to fly ash generation in the surrounding areas of **Panki Thermal Power Plant, Kanpur** and the remedial measures for the bulk generation of FA. In this TPP, 3000 tonnes of coal are used per day, which churns out 40 tonnes of FA. Our field investigation shows that skin, eye, respiratory and gastric disorders were common among the residents of surrounding areas because the surrounding ground water and soil is laden with toxic metals (Cu, Pb, Na and Fe), which affect the skin, eye and stomach, while particulate matter in flue gas is causing the respiratory problems. Remedial efforts towards the minimisation of the environmental impact of FA were demonstrated in two ways: first, the bulk uses of FA in building materials such as bricks, concrete, cement and land filling in low lying areas in the vicinity of TPP which also reduces 0.85 tonnes of CO₂/tonne production of cement and erosion of top soil cover; second, the reclamation of FA dumpsite by using mycorrhizal (*Glomus intradices*) treatment and establishment of a vegetative cover on

top of the exposed fly ash surface which can provide a dust cover, prevent erosion, provide hydraulic control and more importantly sequester and precipitate metals *in situ*. Our results reveal that mycorrhizal treatment is found to be effective in minimising the plant uptake of heavy metals, especially lead, zinc, iron and arsenic and treated FA is found to be suitable as an amendment in agriculture to increase crop (15-30%) yield and waste land development. This case study proves that the project could be converted into a sustainable education tool for the popularisation of the beneficial uses of FA in bulk for the welfare of the local farmer.

Man and Biosphere

A Study on the Relationship between Positive Nature Conservation Activities and Environmental Experiences in Japan (Poster)

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This presentation lays emphasis on the research term “Significant Life Experiences” (SLE), which takes note of the significance of natural experiences as a factor that specifies sensitivity to the environment. SLE research has clarified that many of those who take environmentally friendly actions have also had some unforgettable experiences in the natural field in childhood, and that they also recognise that such experiences have strong relations to environmental responsibility in adulthood. Through the presentation, I describe the relation between positive natural conservation activities and a sensitivity to the local environment from the results of a research with members of two different environmental organisations in Ishikawa Prefecture of Japan.

Media

Taking the Media from News to Awareness in Villages

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Shashi Tharoor is quite right when he says that “the power of the media was its capacity to influence how people and politicians thought and acted”. That, in turn, moulded the impressions and understanding of audiences, whether they were in a small village in Gujarat, the teeming metropolis of Mumbai, or a hacienda in Delhi. However if we analyse further, the media has a far reaching effect in the cities but not that much in the village, where the urge for enlightenment related to environment protection is more.

Research shows that only 3 % of the news related to environment protection from the entire media industry reaches the rural areas. Actually, these are the areas where the scope of plantation and thus saving the environment are more. As producers of natural resources and much of the raw material, they should be guided as to how to mould development into saving nature. Hence this paper aims to try and recommend methods of increasing and diverting the use of media for awareness towards village and rural areas. This shall be done in steps.

Firstly, education, including formal education, public awareness and training should be recognised as a process by which human beings and societies can reach their fullest potential. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behavior, consistent with sustainable development and for effective public participation in decision-making which can be achieved through the transgress of the media where schools, weeklies and training programmes shall be organised.

Secondly, we need to recognise that countries and regional and international organisations will develop their own priorities and schedules for implementation in accordance with their needs, policies and programmes, along with coordination with the media cell to highlight village protection as grassroots protection.

Finally, we need to give higher priority to those sectors in budget allocations, protecting them from structural cutting requirements, so as to give them a separate identity in the sustainable development and environment protection goals as Article 21 now guarantees a healthy environment.

*If a Tree falls in the Media Forest,
Will Anybody See or Hear It?*

A New Communications Paradigm for Constructing High Impact, Creative Messages about Environmental Issues

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Environmental education towards a sustainable future faces an increasing challenge from the media: to reach its designated but diverse audience in a rapidly proliferating media landscape. In addition to traditional print and broadcast venues, the number of non-traditional outlets continues to rise, with video games, YouTube, blogs and other internet vehicles competing for the reader's and viewer's attention.

The more media resources, the more message clutter, and the more diluted the message impact. Consequently, it is important to find a message-generating technique that can deliver fresh, out-of-the-box expressions of environmental concepts that connect with the targeted public.

Creative Aerobics is an evolutionary ideation system that departs significantly from the creative process most often employed: information-gathering, examination of information, percolation as information is absorbed, the gestation period while waiting for an idea, and the "eureka" moment, when an idea surfaces.

First of all, Creative Aerobics is process-driven, rather than results-driven. Secondly, it is a series of four interrelated mental exercises that create individual, custom data bases of information for any assignment. Third, it allows users to come up with ideas they might never have uncovered using other processes. And fourth, it generates multiple solutions for every assignment.

How it works: let's assume that Creative Aerobic #1, the first exercise, extracts ten pieces of information. Working with this initial output, Creative Aerobic #2 can develop ten additional pieces of information for each, resulting in 100 pieces. Repeating this process, Creative Aerobic #3 can produce, in theory, 1,000 additional pieces, and so forth.

Creative Aerobics is easy to absorb - it can be learned in an hour or less. It is efficient, producing results in less than an hour. And it is effective, generating impactful solutions. This ideation system has been presented in the four continents in juried presentations to academe, and in invited presentations to industry.

Informing Better Practice – What Professional Journals Have to Bring to the Field

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The field of Environmental Education and its growth into Education for Sustainable Development needs a very strong base of solid research and evaluation. The professional journals around the world provide for the publication of such work and also provide stimulus as to what is working, what needs to be done, and the statistical evidence of its impact. This session would bring the editors of the journals around the world to discuss needs, results, innovation, and leadership. The focus would be on how to move the field forward into the fourth decade after Tbilisi and address the challenges and opportunities of reaching the required audience, print vs. electronic publication, what constitutes research that moves the field forward and what is the role of professional journals as compared to web portals and popular media.

Full participation would include journals published in UK/Europe, the U.S., Canada, Africa, Asia and Australia.

Environmental Communication - A Key Factor in Sustainable Development

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Media is a powerful tool having immense impact on the opinions of the state, the decision makers and the society as a whole. Hence regular dosage of environmental reports in media, the opinion leader in our global village, is necessary to inform and educate the society on a subject like environment and thereby foster sustainable development in their respective sphere.

Environmental journalism which is aimed at advocating awareness on environment to society tends to lose its potency, as the information trickles down from the environmentalist / experts to the journalists and later to the readers. The magnitude of the value of the information lost, decides the quality of a story and thereby its impact on society, thus hindering sustainable development on a particular issue. This paper looks into the process of 'information flow' - absorbing the complex scientific information obtained from the source (since not all journalists are from science background) and assimilating the complex information and presenting it as a comprehensible material for the consumers of diverse knowledge levels.

Genetically Modified crops have been an issue of dilemma for the farmers and the consumers due to their yield and health risks. This paper will study the whole scenario of communication flow with the case study of GM crops in Coimbatore, and also find out how this phenomenon has hindered the sustainable development in that region.

This paper will also analyse the process a journalist undergoes while reporting the GM crop issue and the strategies adopted in the process of information flow such as - absorption, assimilation and dissemination. Journalists working on environment beat were interviewed to deduce the potential obstacles they face during information dissemination. Articles on GM Crops were randomly selected from regional newspapers and based on them surveys were conducted with the readers and farmers in Coimbatore to deduce the clarity and understandability of the environmental reports.

Mobilising Knowledge

Education in Global Environmental Democracy: Participatory Decision-Making and Capacity Building

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Geo-political boundaries become abstractions when environmental law treads on an inter-disciplinary track, when applications like Chaos theory in ecology can explain how small random changes may affect large ecosystems in an unpredictable manner. The paper focuses on the real actors in a Global Environmental Democracy, which are not States or organisations but *individuals*, on the basis of the principles of natural justice, and, how the concept of awareness mechanism can be effectively implemented so as to inject more sense into the participatory decision-making process. The seeds of the relevant provisions of Stockholm and Rio Declarations, and their elaboration in various other documents, like the Aarhus Convention, Inter-American strategy, Dublin Declaration, Malmo Declaration, WSSD Johannesburg plan of implementation, are pointers to the will or intention to create a social attachment to fragile issues. Their half-grown trees in France (Conference de Cetoyens), England (GM Nation? debate) and India provide a sound foundation to bring out the concepts in this paper. The paper advocates an elaborate procedure for creating a knowledge base in the public domain and then chalks out a decentralised machinery for the consolidation of views. In this process, the capacity building of the professionals should take place by their active involvement at every stage in it. The paper also argues that only such localised involvement in issues, in which the individuals engaged in training participate, can be an effective, *collective* response to the issue of ESD today.

The implementation of the UNFCCC article 6 in Tunisia

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Within the framework of the UNFCCC, Tunisia established, in April 2001, the Information Centre on Sustainable Energy and the Environment (CIEDE). The centre's main mission is the implementation of UNFCCC **article 6** dealing with education, sensitizing, information and training in the field of climate change.

The CIEDE carried out the following activities:

- **Education:** Edition of a school manual on CC which deals with four topics: climate - basic concepts, greenhouse effect and global warming, CC impacts and the means to combat this phenomenon.
- **Sensitizing:** Edition of an information guide on CC for the larger public and a CDM manual, as well as the organization of sensitizing workshops on CC.
- **Information:** Edition of a CC quarterly bulletin and of a GHG emissions booklet, as well as the development of a website : www.changementsclimatiques.tn
- **Formation:** Organization of training workshops on GHG inventory elaboration, GHG mitigation, the CDM and its methodological aspects.

The main activities carried out by the CIEDE generated impacts on the national and international levels:

- Interest of certain countries to reproduce the school manual: Croatia, Turkey...
- Interest of the Tunisian scouts to organize awareness-raising CC activities
- Interest of the Tunisian experts and the national organizations towards the CC field
- Interest of the students to include CC in their research tasks
- Interest of the African countries to profit from the Tunisian CC experience

Recovering Traditional Ecological Knowledge (TEK): Is it always what it seems?

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Globalisation and its attendant acknowledgment of diversity have meant that Traditional Ecological Knowledge (TEK) is becoming increasingly prominent in many educational disciplines. Snively and Corsiglia (2001) define TEK as the “timeless traditional knowledge and wisdom of long-resident, oral peoples” (p. 8) acquired over thousands of years of direct human contact with local environments. They emphasise the ecological depth of the knowledge, its persistence, consistency and reliability, its specificity, its holistic view of an interconnected world, and its moral and spiritual nature. They also describe its narrative base, where encoded metaphoric stories were often used “to compress and organise important information so that it can be readily stored and accessed” (p.23), and “solutions to problems can be carefully preserved, refined and reapplied” (p. 13). Moreover, Snively and Corsiglia (2001) suggest that TEK and Western science are complimentary and overlapping, with each able to offer views not available in the other knowledge system. As such, they argue for a cross-cultural approach to environmental education that includes TEK and other indigenous knowledges (IK) alongside Western science to “better serve the needs of all students, both mainstream and multicultural students, who must solve problems during times of environmental crisis” (Corsiglia & Snively, 2001 p. 85).

While Snively and Corsiglia’s (2001) and others’ desire to promote TEK as a way of broadening the conceptualisations of environmental education, progress, and inclusivity, and to work towards ecological sustainable development is admirable, not all is as it seems.

This paper describes and critiques Snively and Corsiglia’s (2001) argument for TEK from a postcolonial perspective suggesting the picture is more complex than they would have us believe, and that we must be vigilant to avoid new forms of imperialism that may flow from how TEK is represented and appropriated. In particular, it identifies binary thinking, spatialisation and temporalisation as the unconscious colonial referents still lingering within the text even as it calls for TEK to become a resource for ESD. The paper goes on to develop this thinking further by exploring some of the newer ideas on border thinking, hybridity, and border epistemologies (see for example Beck, Bonass & Lau, 2003; Harding, 2006; Mignolo, 2007; Visvanathan, 2006) to see how they may contribute to the thorny issues of TEK and the West’s tendency towards imperialism. Such thinking is vital if the appropriation of TEK by Western imperialism is to be avoided and TEK is to really become a resource for ESD.

Mobilizing Knowledge for Sustainable Development

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To make an impact in a fast changing world, conservation and education for sustainable development (ESD) has to come out of its niche. Instead of talking to each other, we have to talk and engage with other sectors. We have to get out of our silos and put ESD intelligently on the agendas of other silos. Change is an individual and emotional event that depends on collective actions for success. If we want to provide leadership towards change in conservation and sustainability, we have to make an effort towards personal change that will inspire others. Our offices should be sustainable, the ecological footprint of our meetings minimal, and our activities a source of inspiration about how things can be done differently. If we want people to follow our scientific advice, we should walk the talk. Most of our communication is still based on the mistaken idea that knowledge will lead to change. Nothing is further from the truth. We have to understand that between knowledge and change sits a black box. Instead of concentrating on getting more knowledge, we have to start paying attention to that black box. The black box is the domain of communication and learning—communication in the sense of how to create word of mouth, how to frame the debate, how to find motives in the audience for change, and learning in the sense of how individuals, organizations and communities learn for change.

New Learning for Deep Change

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The World Conservation Union's Commission on Education and Communications (IUCN-CEC) has developed a strategic plan for deep change focused on education for sustainable development (ESD). Members of the Commission's Steering Committee will present for discussion the

major elements of the Commission's plan and its proposed agenda for 2008 – 2012, which will be considered for approval at the IUCN's World Congress to be held in Barcelona in 2008. The Commission members believe that the participants at TbilisiPlus30 and members of the ESD movement have a unique opportunity to capitalize on the organic nature of our collective networked knowledge. The Commission's approach uses the latest paradigms of decentralized network interaction and engagement through the application of principles of change management, knowledge management and learning management. IUCN-CEC uses the term "Deep Change" to indicate the lasting impact of "New Learning" on individuals and organizations. "New Learning for Deep Change" processes are derived utilizing tools and techniques from social marketing, constructivist education, strategic communications, knowledge management, change acceleration management, organizational development and innovation theory. "New Learning for Deep Change" is results oriented, where impacts can be measured by tracking behavior changes and organizational decisions that produce changes in lifestyles and support societal trends that are sustainable. The workshop will offer an opportunity to discuss the various forms and contents of knowledge networking in CEC for the coming years.

Accelerated Learning Pathways for Sustainable Development

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Accelerated learning pathways for sustainable development concern educational solutions for meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. It is about living well within the reality of one planet through cooperation, and creating the capacity to do so through knowledge sharing. The topic is also an invitation to be a part of organizations and systems of governance that are systems living in alignment with nature so that all life will flourish forever – nationally and around the globe. At its most fundamental level, it is about being responsible global citizens co-creating a positive, peaceful and sustainable future by choice. Drawing on the results of an ongoing learning initiative that explores pathways for accelerating formal, non formal and informal learning for life within the context of the UNDESD, this paper will *identify* the key drivers and trends that will influence UNDESD activities anywhere, *review* emerging social technologies that have potential to enable accelerated learning and knowledge sharing anywhere, *provide* reflections on learning experiences from around the world, and *highlight* recommendations and ideas for the way forward.

Promoting TEK in ESD: The Case of Arabs in Israel (Poster)

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While sustainable traditional practices are still found among the Arab population in Israel (in architecture and agriculture, for example), they are declining. This research aims to identify components of Traditional Ecological Knowledge and ways to use them in national ESD.

Israel is one of the most diverse nations in the world, with each of its cultures possessing a unique environmental literacy emerging from its particular history, environment, lifestyle and values. Our research is a part of an effort to promote multiculturalism in EE and ESD, aiming to ensure that each sector's unique cultural literacy will be strengthened, drawn upon in promoting core national environmental literacy concepts and practices, and its nature and values conveyed to other sectors.

The proposed poster will focus on the case study of the Arabs in Israel and their traditional ecological knowledge (TEK). About a fifth of Israel's population is Arab, a group that has lived on the land for generations. This group possesses sustainable practices such as climate appropriate architecture from local materials, rain fed organic agriculture, composting, consumption of locally and family grown food and ethno botanic knowledge. The use of these practices is in rapid decline, due to global, political and economic reasons, even as, similar practices such as mud building and organic gardening are being imported to Israel and used in EE.

The poster will include data about the TEK of Arabs in Israel. Data will be collected using qualitative methods (interviews and observations) as well as observations about the importance and feasibility of incorporating TEK within a multicultural approach to ESD. The poster will contain relevant policy recommendations.

Environmental Education for All

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Environmental Education and Awareness is essentially a relative approach towards understanding the dialectical relationship between man and environment. It is only recently that scholars have begun to search beyond their respective traditional disciplines for relevant philosophies, theories and models to explain the ever-growing problems of man-environment inter-relationship.

The behavioral approach has emerged as an attempt to examine man-environment relationship with a view to enhancing our understanding of problems and planning for human welfare. The situation, therefore, calls for individual and community participation in environmental improvement efforts and programmes. One instrument - public environmental awareness - has been identified as a viable medium for inculcating environment consciousness among the citizens of Nigeria.

The Ethnic Communities Sustainable Living Project, NSW, Australia

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Sydney, Australia has a population of 4.1 million people, of whom 36% speak a language other than English. The NSW Government has developed the Ethnic Communities Sustainable Living Project (ECSLP), in partnership with the Ethnic Communities' Council of NSW, the peak non-government organization for ethnic communities. During the last year, the program engaged with approximately 20,000 people from culturally and linguistically diverse backgrounds. The ECSLP has been developed over a number of years and is based on substantial social research commissioned by the Department that explored the environmental knowledge, attitudes and behaviors of the eight largest represented ethnic communities in New South Wales. At the core of the ECSLP is a team of bilingual community educators who work within the Chinese, Greek, Arabic, Italian, Spanish, Vietnamese, Korean and Macedonian speaking communities. The objectives of the project are to promote awareness, knowledge and understanding among specific

ethnic communities about ways to live more sustainably; to run education sessions in community languages to promote simple, practical ways for people from ethnic communities to change their behaviour towards living sustainably; to get people more deeply involved in sustainability issues by promoting community development activities for sustainable living to interested ethnic groups; to develop a greater understanding of the motivations, knowledge, skills, attitudes and practices of ethnic communities in relation to the environment and to help build the capacity of local government councils to develop and deliver environmental education to ethnic communities. This project has been rigorously evaluated and provides an insightful and highly successful example of the Department's commitment to improving the access of everyone in NSW to innovative and high quality environmental education programs.

Non Formal Spaces

Role of Bioresource Nature Park as a Non Formal Space of Learning in the Western Ghats of Kerala

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Kerala, situated in the Western Ghats region, is one of the hotspots of biodiversity in the world, with its rich plant and animal diversity, and some species that are endemic to the State. Conservation of such vast biological resources for the future, while continuing to utilise them to meet the present needs, is really a challenging task. In this context, *ex-situ* conservation of the unique plant and animal wealth of Kerala as well as education and awareness on biodiversity conservation, management and sustainable utilisation are significant. Thus, the Kerala Forest Research Institute (KFRI) has established a Bioresource Nature Park at the KFRI Sub Centre, Nilambur, as the first of its kind in India. The Park has several conservation theme areas for the lower groups of plants such as thallophytes (algae and macro-fungi), bryophytes, pteridophytes, plants found in specialised ecological niche such as xerophytes (cacti and succulents) and hydrophytes (aquatic plants), beneficial plants (medicinal plants), ornamental and aesthetic plants (orchids and palms) and other monocotyledonous and dicotyledonous plants, with special reference to rare, endangered and threatened (RET) species, and the endemic species of Kerala. The Bioresource Nature Park being visited daily by over 200 students, environment activists and nature enthusiasts, is playing an important role as a non formal space of learning the ecological, social, cultural and economic importance of plant wealth in the Western Ghats of India.

Non Formal Spaces of Learning and the Environmental Literacy of Schoolchildren: Findings from a Major National Survey in Israel (Poster)

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We discuss in this paper, the degree to which environmental literacy (knowledge, attitude, behavior) of schoolchildren is related to non-school experiences.

One of the more striking set of findings in a recent major national survey of environmental literacy in the 6th and 12th graders in Israeli schools is the extent to which such literacy is related to out-of-school experiences. Thus, when compared with a range of socio-demographic and school-related variables, the most powerful single predictor of overall environmental literacy is whether the students have a non-school related adult mediating their study of or time in nature. Other informal sources (experiences with animals, youth groups, family, friends, and the media) also have significant influences. This poster presents a multivariate analysis of these effects, compares their size with school-related factors, and distinguishes how these relations differ for the two grade levels, and for different religious, ethnic, and other sub-populations within Israeli society.

Non-Formal Education – A Step to Lifelong Learning

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Even after the good growth of GDP in India, there are certain underprivileged groups, which do not enjoy the benefits and opportunities that others enjoy. There are many sections or groups within our society that suffer from lack of access to schooling and formal education. It is here

that the effort of giving Non-Formal Education can play a vital function in creating awareness and a greater understanding among the people. Non-Formal Education programmes can be considered optimistic approaches to meet the above challenges. However, Non-Formal Education programmes need to be revitalised in a manner that they meet the requirements of the present day social environment and ensure a complete and positive solution to its objectives. At this juncture of understanding the social need, it becomes all the more important for educational institutions and organisations to contribute to a common cause with full vigour and to make this endeavor a success. These organisations will have to take the lead in transferring information and knowledge to the far-flung areas of our country using various methods, techniques and approaches. Representatives of these organisations will have to exert much more than anticipated for reaching out to the underdeveloped and underprivileged communities.

Extension and Communication Department, of the Faculty of Family and Community Sciences, M.S. University, Vadodara, India, is making an unending effort in this direction. The department teachers and students carry out various types of activities every year with deprived children of the age group of 6-12 years. The activities are planned out focusing on four major thrust areas, viz. Environment, Health, Literacy and Moral Education. Children are made aware of the importance of literacy, moral values, healthy living and the value of saving the Earth. Different types of teaching aids like – charts, posters, flash cards, chalkboards and flip charts are used in this programme. Four types of teaching methods are used for the whole programme, which includes Illustrative talks, Dramas, Educational Games and Demonstrations. After the completion of the programme, significant improvement is observed in the awareness and attitudinal level of the children. We can conclude that it is an effective programme from the feedback of the beneficiaries and key personnel of the various communities.

National Public Policies of Non-formal Environmental Education in Brazil: institutional management, educational processes, and international cooperation

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Environmental Education (EE) in Brazil is in tune with the course of environmental education in the world, and its development is guided by international references, like the Tbilisi Declaration and the Treaty on Environmental Education for Sustainable Societies and Global Responsibility.

After more than thirty years of experience, the Federal Government's policies have now come of age, and promote EE as a political action, operating in the field of the political and institutional management of EE, and the propagation of educational processes in tune with the concepts and practices of popular, critical and emancipatory education. The trajectory of EE institutionalization in the public scope has involved the creation of the Managing Body (MB) of the National Policy for Environmental Education, which brings the Ministries of Environment and Education together into the management process. Furthermore, the MB promotes the institutionalization of EE at other levels of public government, encouraging the participation of several sectors of society in the design and implementation of policies and programs, thus constituting a decentralized and democratic approach to EE. The development of formative, continued processes, which are contextualized within the diversity of Brazilian realities, is promoted in partnership with Educational Groups, which are groups of people and institutions that jointly plan and implement educational processes, specifically for their area and involving the totality of its inhabitants. The expertise and the experience obtained through all these processes have contributed to the creation of legal landmarks and to the institutionalization of EE in Portuguese-Speaking Countries.

Creating “Environmental Education Opportunity Spectrum” for Learning Sustainability – A Case of Taiwan

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In recent years, the discussions on environmental education have been focusing to a large extent on education for sustainable development (ESD). To this extent, it has been argued that environmental education should be characterized by pluralism, because there can never be a fixed connection between sustainability and development; the concept of ESD should be formed in relation to the local culture, geographical environment, social and historical circumstances in which the education is to be put into practice. Hence, this study argues that three traditional principles of environmental education: “Teaching in the environment”, “Teaching about environment” and “Teaching for environment” are worthy to be re-oriented and advocated for learning sustainability issues from a broadened spectrum of nature-culture interactions in non-formal learning settings, such as outdoor recreation resources. This study adopts the concept of the Recreation Opportunity Spectrum (ROS) to create a similar spectrum, namely “Environmental Education Opportunity Spectrum” (EEOS), to provide a wide spectrum in non-formal learning settings. Inspired by ROS which relies upon settings, recreation activities, and recreation experiences, then divides the range of recreation opportunities into several categories from

Regional Centres of Expertise

Regional Centers of Expertise (RCE) as Enabling Mechanisms for Sustainability: The Maloti Drakensberg Transfrontier Project Perspective

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Education for Sustainable Development (ESD), in supporting conservation across international, sectoral and institutional boundaries, requires innovative approaches and networks (such as RCE's) to mitigate the risk of institutional inertia inherent in organisations. An RCE as a network is designed to strengthen collaboration for ESD among various actors.

The MDTP, as a bilateral initiative between Lesotho and South Africa, aims to conserve the globally significant natural and cultural heritage of the region whilst contributing to sustainable livelihoods. Phase 1 of the MDTP (2003-2007) produced an Environmental Education programme with associated resources. This programme is aligned not only with the objectives of the MDTP but also with the goals of UN Decade of Education for Sustainable Development. Implementation and review of the programme throughout Phase 2 (2008-2013) is the responsibility of five Conservation Authorities for three provincial areas.

Practice shows that bureaucratic institutions are unlikely to be responsive to sustainability over an extended period of time. Mitigating this risk, the MDTP aligned its Environmental Education Programme with the recently established RCE in KwaZulu-Natal, South Africa.

This RCE functions at three different levels (local, national and regional) and is well aligned with the cross-boundary nature of the MDTP. As a network, the RCE provides a mechanism for conservation authorities to engage with partners across boundaries. This counteracts institutional inertia and assists institutions to mitigate the risk of processes remaining unsustainable. It is

envisaged that the Memorandum of Understanding between the MDTP and RCE will provide an enabling network to sustain the contribution of the conservation authorities to ESD.

Young People and Students as a Force for Change

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Many young people want to be a force for change towards more sustainable lifestyles, workstyles and livelihoods. Evidence for the interests and needs of young people and students will be presented in this paper. Some examples of youth-led and student-led initiatives will be used to illustrate social learning approaches to volunteering, work experience and internships supplemented by consumer, citizenship and media education. University student and recent graduate views will illustrate the social and environmental responsibility of both themselves and potential employers. Young people and students can be a considerable positive force for change towards a more low-carbon, sustainable society given the right support from educators and key decision-makers. The structure and activities of the RCE East Midlands will illustrate how social learning approaches to youth-led and student-led learning can be supported by a partnership of organisations at the regional level. Student Force helped to establish the RCE as the first in the UK with nearly 40 other regional organisations and is now encouraging this approach to be adopted across the UK with a strong focus on dialogue and engagement with young people and learners.

Research for ESD

Critical Constructivist Approach to Education for Sustainable Development

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Currently, our education system is embedded in a positivistic, modernist and mechanistic educational paradigm. Within this framework, calls to assert Education for Sustainable Development (ESD) have very limited viability because of the inter-cultural dynamics within our educational institutions. Efforts to make a shift towards ESD without considering these cultural sensitivities in our classrooms may end up with a notion which could be identified as 'Education about Sustainability'. In contrast, we suggest considering the social epistemology of critical constructivism, which addresses the socio-cultural context of the education system, as a referent for reform. However, our efforts should not be limited to changing 'Education about Sustainability' to 'Education for Sustainability'. We should attempt to go a step further and consider the notion of 'Education as Sustainability'. Critical constructivism, which draws on the social philosophy of Jurgen Habermas, argues that establishing a discursive culture of *communicative action* in our learning institutions is an important step towards achieving this.

St Leonard's College, Melbourne, has developed many initiatives embracing ESD as the curriculum theme. In some initiatives we considered *sustainability* as a separate curriculum subject. In Year 8 Science, *sustainability* is considered as the underlining theme. In our Cornish

Campus *sustainability* is the key concept underpinning the whole curriculum. By drawing evidence from these initiatives this paper argues that 'Education as Sustainability' requires a cultural shift of considering learning as a transformative process rather than an adoptive process. All educators are expected to work collaboratively as change agents in this cultural reconstruction process.

Environmental Education as the Most Viable Way towards Sustainability

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During the last decade, there has been a wide debate about the environmental education concept. One of the main results has been to consider environmental education as the best tool to work towards sustainability. It is a discipline that has developed in different contexts and it is making satisfactory progress but it is not enough. Environmental damage is not decreasing and natural resources are running out. For these reasons, we should weigh the influence of environmental education programs on the environmental problems. This is the main objective of this research and the sample constitutes whole Spanish regions.

Our research group has designed an indicators system which tries to study the relation between environmental education and the environmental situation within the territory of the Spanish regions. The main goal is then to analyze and look for trends that would be able to group the different regions according to this relation.

The indicators system has depended on the existing data that would be valid and reliable. It had fifteen variables that were measured during 2003 and 2005 within the regional scope. The processing of the data was a principal components analysis with a statistical software package (SPSS). The results identify three different trends associated with issues such as participation, rural territories or sustainability development education and the sample has been grouped according to its environmental education and its environmental situation.

Determinants of Willingness to Pay for the Benefits of Environmental Quality of Powai Lake in Mumbai

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The Powai Lake in Mumbai, India, spreading over 2.10 sq kms and 10-40 feet deep, is in the heart of the most crowded of India's premier metropolis. It used to consist of a rich ecosystem of considerable value and interest, supporting a wide variety of flora and fauna and providing a habitat for an equally wide variety of aquatic animals. Now, it is increasingly being impacted by human waste, pollution, silt and excessive growth of weeds which results in the choking off of the shoreline and the deterioration of water quality. In this context it is important to understand how to effectively protect the present status or improve the water quality of the lake. The benefits of improvement as perceived by the users serves as a critical input for devising a policy instrument based on economic principles.

This paper attempts to value improvement in the water quality through 'Direct Method' which is known as 'Contingent Valuation' approach. It is proposed to estimate the non-marketed benefits to the users and non-users of Powai Lake due to the hypothetical improvement in the environmental quality and to estimate the costs of the hypothetical deterioration in its environmental quality. Finally the paper analyses the factors determining the extent of contribution by the users for improvement in water quality. To achieve this objective, a random sample of 298 respondents living within approximately five kilometres' radius of the lake has been chosen to apply the Stated Preference or Contingent Valuation Method with open and closed ended referendum, to elicit their willingness to pay (WTP) to change the lake from its present state to a boat-able, fishable and potable state. The paper also attempts to analyse their willingness to accept (WTA) further environmental quality deterioration from its present state.

A positive "yes" response is obtained from 67% of the total number of respondents and the mean value of WTP is estimated to be Rs. 169.69 as one time payment. An analysis of the determinants of WTP revealed that education and income are the two most significant attributes in explaining the users' willingness to pay. On an average, households with an annual income of above 3 lakhs are willing to contribute 62% more than those below that income level. Education

is an equally important factor in explaining the willingness to pay. Graduates and post graduates are willing to contribute about 52% more than users with less educational status.

Ecocritical Encounters with Nature and ESD

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The aim of this paper is to clarify the ecocritical theoretical presumptions regarding the meaning of encounters with nature in literature and to outline a discussion concerning the relevance of these presumptions for education for sustainable development (ESD). The main question is: what does it mean to meet nature in literature?

The paper is part of a PhD project on ecocriticism and ESD. The PhD-project focuses on the question of the significance of encounters with nature in literature for environmental moral meaning making. Following this, the main aims of the PhD project are (a) to clarify theoretical presumptions regarding the meaning of ecocritical encounters with nature, (b) to clarify and outline a methodology for analysis regarding ecocritical environmental moral meaning making in school, and (c) to conduct an empirical ecocritical analysis of environmental moral meaning making in educational practice and in the context of education for sustainable development (ESD).

The paper contributes to research in education and sustainable development by clarifying the concept of nature in ecocriticism and the meaning of encounters with nature in literature. Thus it discusses the role and significance of fact and fiction in environmental moral meaning making in school. In addition, the paper contributes to ESD-research in that it clarifies in what ways the humanity can be integrated in research and education for sustainable development.

Human-Nature Relationships and Their Educational Reflections: Spanish and Turkish Cases

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Our conceptual place in nature defines our relationship with it. As we see ourselves apart from it, we build the necessary ethical, social and economical mechanisms to exploit it to the limits. We need to redefine our relationship with nature and develop sustainable approaches that would trigger understanding of the non-human world with empathy and respect, and that would complete the human identity as a more harmonious part of it rather than as its excluded dominator. A transition of this kind would then consider pure exploitation of nature – as it is often the case in modern times - as a direct offence to humankind. For the social transition to develop towards a more sustainable future, we would first need to look at our educational institutions as the justifiers and driving forces of our current practices towards each other and nature. Conventional educational institutions should be aware of the extensions of excluding the human from nature in a hierarchical manner which has served as the dynamo behind the most brutal and destructive actions of humanity. Therefore this study aims at taking a closer and deeper look at how we define self-identity in terms of our relationship with nature through some qualitative methods such as *content analysis of text in school books* related to human-nature relationships and *interviews with educationalists* about this issue. It would only be possible then for the worldwide efforts to accumulate in parallelism to the direction of a truly just society with more realistic self-understanding and awareness of its own actions.

Learning as Connection: Exploring Environment and Sustainability Education Contributions to Educational Quality and Relevance Debates

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A discourse of educational quality has risen to prominence in the last 5 years in the context of the *Education for All* agenda, as nations have realised that educational access is not enough to ensure equity and quality outcomes in education. This issue was foregrounded in the UNESCO

Global Monitoring Report in 2005, and again in the context of the goals of the UN Decade of Education for Sustainable Development, where access to quality education is defined as a goal of the UNDESD. While environmental education and technology education have been identified by UNESCO (2005) as two significant curriculum growth areas, *there has been little research to identify how environment and sustainability education contributes to educational quality*. This paper seeks to consider how we might begin to frame such a research agenda in the UNDESD in low-income countries. While the question of *relevance* has been defined as being a key dimension of a quality framework for education, it still appears to be defined mainly at a macro-outcome level. Drawing on research undertaken by teacher researchers in Southern Africa, this paper seeks deeper insight into *educational relevance*, as expressed by teachers, communities and as experienced by learners.

The paper argues that a closer engagement with socio-ecological issues and risks in learning processes can enable an interrelated set of dynamics that foster *learning as connection* (situated learning) which has potential to enhance relevance in relation to educational quality. These include: a) inter-epistemological dialogues between everyday and school knowledge, b) active learning and investigative pedagogies, c) ethical engagements that guide the purpose of teaching and learning, and d) improved learning relationships between schools and communities. The paper argues too that these dynamics can contribute to a re-orientation of thinking about educational quality, and can therefore contribute to a closer understanding of how the goals of the UNDESD might be linked, and can also contribute to broader discussions on educational quality relevant to the *Education for All* objectives in the MDGs and the Jomtiem Declaration.

Education and Sustainable Development: Learning to Last?

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Educational institutions and educators throughout the world are grappling with the awesome challenges presented by the sustainable development agenda. Whether it is delivering on climate change, poverty, HIV/AIDS, violation of human rights, or environmental degradation, all depend on a literate and skilled citizenry. This paper highlights the fundamental conflicts between the

existing western economic and political world view, based on exponential growth and technological innovation, short termism and unlimited consumption, and a more sustainable world system, based on environmental and resource limits, longer term planning and reduced consumption. National and international policy emphasises the role that education can play in both raising awareness about sustainable development as well as giving the skills to put sustainable development into practice. This paper explores current policy and practice in schools, colleges and universities, in developing the attitudes and capabilities of future citizens to practice more equitable social and economic development. It sets the educational agenda primarily in the UK and EU policy context as well as showcases some of the good practices developing in schools, universities and in training and employment. The role of active learning in the development of sustainability literacy in the professions and in society more generally, is featured as a way of dealing with the complexity and uncertainty surrounding the sustainability agenda. It also assesses the progress made since the publication of the World Conservation Strategy in 1980 which introduced the concept of sustainable development. It focuses on the skills, knowledge and attributes currently required of key professions in the work place, drawing on specific projects and programmes involving inter-professional practice and learning. 'Learning to Last' is a dynamic concept that inextricably links well-balanced development with considerations of the social, environmental and economic dimensions of an improved quality of life for the present and future generations. It is a new vision of education which should provide a valid framework for making decisions and taking action and, through action, learn to live more sustainably.

Targeting Behavior: Designing Conservation Education Programs

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Human welfare is inextricably linked to the welfare of Earth's natural systems. Ever-increasing environmental degradation threatens this balance, placing humans in a precarious position. Chapter 36 of Agenda 21 emphasizes that "education is critical for promoting sustainable development and improving [human] capacity to address environment and development issues". Education should be a driving force to achieve sustainable development; however most EE programs continue to focus on general awareness or school-based programs, rather than integrated initiatives targeting measurable behavior change. Best practices, particularly for non-formal adult education, are almost non-existent.

Conservation International (CI)'s *Targeting Behavior* methodology offers a systematic approach to designing strategic conservation education programs that focus on behavior change at all levels – including rural communities, businesses, government, and urban publics. *Targeting Behavior* uses a set of participatory assessment tools to determine:

- Conservation **problems**
- **Behaviors** that are root causes of these problems
- **Alternatives** that can replace unsustainable behaviors
- **Barriers** that hinder adoption of alternatives
- **Knowledge, attitudes and skills** needed to shift behavior
- Socio-economic and culturally appropriate learning **tools**

Through a step-by-step approach, CI will share how to use these tools to design programs targeting behavior change. A case study example from the Raja Ampat Archipelago in Indonesia will illustrate how Targeting Behavior was used for a marine conservation education initiative. Launched from a boat, this integrated education and social marketing program includes training for adults on sustainable economic alternatives, advocacy to the government to change conservation and development policies, teacher training, and children's games.

The Project for Excellence in Environmental Education

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The Project for Excellence in Environmental Education is an initiative of the North American Association for Environmental Education (NAAEE). Our goal is to answer the question "What does it mean to be environmentally literate?" The project is taking the lead in establishing guidelines for the development of balanced, scientifically accurate, and comprehensive environmental programs that can help citizens develop a society built on the foundation of sustainability and the equitable use of natural resources. These guidelines help educators develop meaningful environmental education programs that integrate across and build upon the high standards set by the core disciplines.

The Project was designed to—

- Support the development of quality environmental education materials and practices focused on issues of responsible action and sustainability

- Develop guidelines that help environmental education support the high standards set by the traditional disciplines
- Provide focus and direction to the practice of environmental education and to articulate a common understanding of what all students would know and be able to do by certain points in their educational careers.

At the Tbilisi +30 session, participants will—

- Obtain an overview of the philosophy and procedures of the Excellence in EE Program
- Engage in a series of hands-on activities, to identify key characteristics of high quality EE materials and high quality EE programs
- Learn how they can receive copies of the Materials, Guidelines and the Environmental Education Program Guidelines

Outdoor Education, Environmental Ethics, and ESD

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One aim of this paper is to clarify the environmental ethical content in three outdoor educational practices in Sweden; I Ur och Skur, Naturskolan, and the Radical Outdoor Education Tradition. A second aim is to discuss the environmental ethical content in the three outdoor educational practices in relation to the moral assumptions in education for sustainable development (ESD). The study is based on an analysis of authoritative texts, which are representative of each practice. This analysis is conducted on the basis of value and non value-oriented conceptual frameworks developed in international environmental ethical research, i.e. what is the nature of the environmental ethical content in the educational practice in question? The first part of the paper outlines the main educational purposes of the educational practices in question. The second part of the paper is a presentation of the environmental ethical analysis, and the third part of the paper relates the environmental ethical content of the practices in question to the moral assumptions made in ESD.

This paper contributes to international ESD research by introducing a combination of environmental ethical research and curriculum research to the field of ESD-research.

Developing Models of Environmental Education - An Indian Perspective

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As we are entering the next millennium, it is essential for our experts to review the environmental education curriculum and training modules and materials, and this will help in closing the gap between what environmental experts know and what the public and students need to know. Current environmental education and training programmes are stressed on controlling, remediation or cleaning up of environmental problems. Therefore, teachers need continuing awareness, environmental education and related training programmes to keep up with the complexity of environmental problems, and technologies and strategies to reduce environmental risks. The paper focuses on developing working models of Environmental Education (EE) in the formal sector and to evaluate and statistically analyse the EE knowledge perception of the different sectors of society through structured questionnaire surveys of teachers, students and literate citizens of the urban area. This paper tries to find out the barriers and strategies for the promotion of EE in India.

How the Brain Learns

Using Concepts of Cognitive Science to Create Unforgettable Programs

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What kinds of messages are best suited for different age groups? How do people subconsciously choose what is most important to remember? How can you shape your message to most effectively

inspire action? This working session will outline how recent advances in our knowledge regarding brain function can inform the design and presentation of effective, memorable programs. It will outline tools and techniques that can be used with a broad diversity of audiences in a variety of educational settings to facilitate learning experiences people will remember for a lifetime.

Greenhouse Effect / Planet Overheating: Cognitive or Sentimental Treatment of Predictive Information Concerning Climate Change

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The “greenhouse effect” theory about climate change is considered to be very popular these days: although it is based on simulations of general climate models, it is known to almost everybody¹ and we can easily assume that *there is a certain corpus of socially constructed and shared lay knowledge about it*. This means that, even if lay people don’t understand fully or partially the scientific basis about the assumptions made and the predictive power of the findings, they tend to comply either ideologically or practically with its major tenets.

In social psychology experiments, diverse researchers (i.e. Festinger 1967, Behm 1972 among others) have noticed that when a transmitted message is capable of provoking extreme sentimental reactions such as fear, terror etc. *the subjects, instead of treating cognitively the content of the given message* (informative influence), *give priority to sentiment and prefer to manage the negative impact of this message themselves by neglecting completely the content* (no cognitive change - mostly obedience or compliance). This means that, even if the short term effects are very strong (due to the state of fear and panic), neither medium term nor long term effects are traceable (no opinion or attitude change). Even more, if this source continues to transmit such messages, it will sooner or later lose its credibility and, it will be categorized by the supposed targets as “scary”, “repulsive” or even “insane” (psychologisation, Papastamou 1980). From this point and on, *this source will exercise no social influence*. A classic example of this kind of

¹ We must say: in the western world at least!

propagation tactics is, during the '70s, the school of Monte Carlo simulations which, by means of simulations, predicted the economic, ecological or even biological "end" of our world...²

In this study, a focus group (FG) of 12 post-graduate students³ was constituted. The FG guide contained a series of general questions (about their opinions, beliefs and practices) and a subset of affirmations concerning the greenhouse effect theory and planet overheating. *These affirmations (information) aimed to "destabilize" the participants cognitively for exploring the depth of cognitive treatment they have in case of contradictory evidence.*

The results indicate that even if students adopt massively the "greenhouse effect" theory and the deriving predictions about climate change (planet overheating), they don't consider themselves as capable of replying to contradicting evidence based on alternative theories: for instance, chaos theory which forbids long-term predictions... After that, *they question their practices and they begin to doubt the ideological frame of diverse ecological movements* (NGOs etc.). As a conclusion, *students were completely confused cognitively rather easily* (on a point of rejecting the "overheating of the planet" and doubting about the key-notion of "pollution") *but sentimentally, they were ready to continue acting as if all this was "true"*: they clearly agreed that "catastrophology" is the strong asset of this point of view (fear management). *Fear about the future is installed and the belief about the end of mankind or, even, the end of the world seems to be in front of them (It started... imminent hazard).* However, subjects rejecting the cognitive approach and adopting the sentimental management, has a rather pessimistic approach about the future of the ecological movement itself...

² We all know that during these years, researchers have predicted major changes (most of the time dreadful) which were highly mediatized but, just after five to ten years were strongly criticized and, in the end, they have seriously "wounded" the status of science itself concerning its capability of predicting the future and finding solutions...

³ All of them students of a Master in Economic and Occupational Psychology in Panteion University of Athens, Psychology Department. The Focus Group was carried out during the course of "Simulations: Methodology and Perspectives"

Review of the Main Approaches to Education for Sustainable Development in Russia

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Like in many other countries, ESD in Russia has grown from environmental education. It has developed a wide and diverse practice. Numerous theoretical researches have been undertaken in this field as well. In the last fifteen years, environmental education had become very popular. At the same time, no critical analysis of its effectiveness was carried out, and ESD inherited the problems of EE.

The announcement of the UN Decade of ESD has raised the popularity of ESD on different levels, but there is still a lack of real change in understanding ESD. There are some barriers for the true understanding of ESD in Russia which derive from the traditional environmental education, which stayed knowledge-focused and very academic. The major practice of EE in Russia can be described as a “rubbish collection campaign” on one side and learning classic scientific ecology on the opposite.

We consider the main approaches to ESD practiced in Russia and suggest a view on ESD that better reflects the modern international understanding of it. The approaches presented were formulated based on analysis of recent ESD conference papers and own experience in working with educational institutions in different regions of Russia, including the surveys conducted in the eight biggest cities of Russia.

The approaches described are:

1. Traditional **environmental education** renamed “Education for Sustainability”
2. Education through **practical actions**
3. Education **about** Sustainable development
4. Education for **solving environmental problems**
5. Education for sustainable development – call for **systemic change** in educational institutions

The last approach in the list is based on the idea that we should teach to **rethink** the systems we create and we live in.

Role of Livestock in Sustainable Development – A South-South Consultation

Sustainable Rural Livelihood and Food Security by Empowering Rural Women through Rural Friendly Technologies on Microlevel Poultry Production

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Nearly two thirds of the population in India live in rural areas and largely depend on agricultural and allied activities for their livelihood. Empowering the rural mass through livestock, including poultry farming, as a micro level enterprise would not only ensure sustainable livelihood security but also food and socio economic security. Intensive commercial poultry production lies in the hands of rich people who produce chicken and eggs on a very large scale. The issues and concerns in the current poultry industry are mainly underemployment of rural mass due to mechanization and automation. Under these circumstances, the rural women friendly technologies developed by Tamilnadu Veterinary and Animal Sciences University viz. custom hatching unit and small bird cage unit for rural women are well appreciated and adopted for hatching, growing and marketing of desi chicken in a small scale in rural areas, ensuring sustainable livelihood security with a cost benefit ratio of 1 : 1.

The potential of these rural women friendly technologies are producing, rearing and marketing locally about 100 desi chicken every month with a profit margin of about Rs. 4000. These activities are carried out along with their daily routine i.e. daily labour which ensures additional revenue for the families. The consumers' preference for desi chicken is fast growing and often fetches a premium price. The women Self Help Groups market their produce directly to the consumers and or retail chicken retailers, eliminating middlemen and thus increasing their profit realized. These activities have been implemented in the rural women community in

a participatory mode which also ensures food security through chicken and eggs. Moreover, it also preserves the local germ plasm which is the need of the hour. My paper will highlight the issues and concerns regarding mass poultry production by a handful of entrepreneurs and the production by masses i.e. underprivileged. This type of sustainable rural livelihood security will also help check the exodus of rural mass to semi urban and urban areas which may help in attaining social balance in our country.

The Fodder Innovation Project: Addressing Livestock Fodder Scarcity by Strengthening Innovation Capacity

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The International Livestock Research Institute (ILRI), UNU-MERIT, The International Crops Research Institute for the Semi Arid Tropics (ICRISAT) and the International Institute of Tropical Agriculture (IITA) are collaborating on a research project — The Fodder Innovation Project (FIP) — to explore fodder scarcity from a new perspective. This new perspective involves exploring ways of strengthening the capacity to innovate. In other words the research will re-frame the question of fodder shortage not from the perspective of information and technological scarcity in fodder production, but from that of capacity scarcity in relation to bringing about technical and other changes in fodder practices — this is referred to as fodder innovation. The project understands innovation capacity to be a function of the networks of different players related to livestock fodder and their collective capacity to bring new ideas into use. This paper will discuss the approach that the project will use to address the fodder scarcity issue.

Regeneration of Dry Lands through Vegetation and Organic Farming Methods

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This paper discusses a project proposal to regenerate 80 acres of dry lands in Sooralipatti village, a tiny hamlet in Trichirapalli, Tamilnadu, India, that has been on the way to desertification, with not much vegetation over it. The project is to encourage the marginal landholders to raise more trees and plants in the land and the common places, thus strengthening the existing water sources, along with capacity building initiatives for women farmers organic cultivation training for men farmers. This will result in increased green vegetation in the village which will lead to income from the trees, fodder for their cattle, gradual increase of soil fertility, water recharging in the ground water level, increased moisture content, protection of the top soil from erosion by rains and winds, and increased micro nutrients in the soil to enhance the vegetation in the land.

It is planned to grow all types of trees – timber, fodder, fruits, fuel wood, green manure, medicinal – in the land and harvest rainwater and recharge groundwater, thus lessening the chances of agriculture becoming a gamble in the area. The increased leaf biomass, birds' droppings, insects and small insects such as butterflies and honeybees will strengthen the main crop growth and yields. While the trees provide an income at different stages of their growth, the farmers will have a sustained supply of fodder for their cattle as those are their major assets to sustain their family income.

Traditional Knowledge based Herbal Treatments as Alternatives to Antimicrobials in Primary Healthcare of Livestock in India

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The benefit of administration of the antimicrobials under intensive livestock production systems is to be considered in relation to the risks involved. The prophylactic / therapeutic use of antimicrobials and the feed additive growth promoters may result in drug residues in meat, milk or eggs. Concerns also arise from emerging resistance of some organisms (bacteria / parasites)

and the far reaching environmental consequences. The need to look for an alternative to antimicrobials in livestock production is apparently imminent.

India has a sophisticated medical culture with an unbroken tradition of 4000 years. Two streams, viz., the Codified and the Folk / Oral traditions exist. A large mass of knowledge, however, continues to survive outside the organized systems. **Ethno veterinary medicine** (EVM) includes the indigenous knowledge pertaining to the health care of animals, which is preserved mostly through oral traditions, for generations.

The efforts in the recent past to revive the traditional systems of veterinary health care on scientific lines have been sporadic and ephemeral. Veterinarians in the field face problems related to failures and untoward effects with chemotherapy in commercial establishments. Desperate farm owners resort to traditional remedies. The use of *Curcuma longa* powder in feed for broiler chicken as protection against hepatotoxicity and fresh juice of the plant *Tridax procumbens*, during beak trimming to arrest bleeding in layer chicken are reported in commercial poultry operations. Fresh herbal remedies are used by the farmers under the guidance of this centre for *mastitis* and *gastroenteritis* in safeguarding the interests of the rural livestock holders and the society with safe animal products free from antimicrobial residues.

With explicit treatment strategies involving antimicrobials for all clinical and production situations in intensive livestock enterprises, the future of organic livestock farming hinges on using fresh EVM based herbal remedies. Let us keep the age-old wisdom on animal production and health care intact by open-minded inquiry and not lose it by an indifferent attitude, for livestock provides livelihood and food security to millions of people in the agrarian economy.

Intensive Livestock Production Systems – Issues and Options

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For Animal Husbandry to deliver the required increases in income for the poor households, the following services/ facilities need to be available for the farmers.

- Availability of basic veterinary services at the village level
 - Curative – first aid, handling emergencies
 - Preventive – vaccination.
 - Promotive – de-worming, de-ticking, delousing, etc.

- Awareness and demonstrations of scientific practices to improve the productivity and production from livestock
- Linkages for referral services with veterinary dispensaries for diseases and emergencies which cannot be handled at the village level

Most target groups are not exposed to scientific management practices of livestock. For the day-to-day management of household livestock enterprises, farmers need skills and services (as above), which are not usually delivered through the two-tier Government animal husbandry services. The services currently available are not usually timely, affordable, not locally available and not sensitive to the needs of the target livestock farmers. Unless these services and support are made available, the objective of increasing incomes through livestock development would be difficult to achieve for of the vast majority of the rural poor.

In order to achieve the above, DANIDA developed the concept of Link Worker Couple (LWC), where LWCs (husband-wife couple, who are livestock farmers) were identified, trained in basic veterinary services, linked with community organizations (of livestock farmers) and with the animal husbandry department for technical and curative services. LWCs perform the roles of veterinary service delivery (which is usually charged) and the extension services (skill transfers) which is provided free.

This concept of LWC was tried out in five districts in Tamil Nadu under the DANIDA assisted project. After realizing the importance and benefits of the concept, the Government of Tamil Nadu, had replicated the LWC model in all other districts. The impact monitoring of the project clearly showed increases in adoption of scientific livestock management practices by the target group, use and payment for LWC services.

This paper discusses the current status of the initiative and the challenges faced in its implementation.

Impact Assessment of Livestock Interventions under Watershed Programmes: Issues and Strategies

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Rainfed agro-ecosystem plays a pivotal role in Indian Agriculture, occupies 67% of the cultivated area, contributes 44% to total food grains and supports 40% of the human population and houses 65% of the livestock. The livestock sector provides employment to 11 million people in principal

status and 8 million in subsidiary status, which is 5% of the total working population in India. The share of livestock sector contribution to the National Agricultural GDP has shown a whopping rise from 6.0% in 1970 to 26.5% in 2006. Livestock plays a vital role in sustaining the livelihoods of the poor in rainfed areas as they help absorb shocks due to droughts, a phenomenon commonly observed in rainfed areas. Livestock productivity is constrained by lack of adequate feed and fodder availability and its poor quality besides high incidence of diseases.

The watershed development programme in the past was considered as a synonym to the construction of check dams, percolation ponds, bunding, etc. Of late, a shift to livelihoods in the form of watershed-plus activities have made some impact in creating livestock assets through development CPRs and PPRs under feed and fodder. There have been significant differences in the benefits accrued among large, small, marginal farmers and the landless, with the rich cornering the major share. The landless could not derive their full share of benefits from the programme due to lack of access to land and skewed nature of expenditure mostly on water resources development rather than livestock. The lack of bargaining power of the livestock owners and poor representation in decision-making bodies has further set them back in articulating the issues related to their interests. Hence, equity and poverty issues have remained un-addressed effectively even though there are many developmental programmes that have been launched by State and Central Governments. This paper assesses the interventions in various watershed programmes and comprehensively brings out the impacts and further recommends R&D efforts at par with NRM under different property regimes.

Effective Fodder Resource Management - Balancing Livestock-Based Livelihoods and Forest Ecosystems in Andhra Pradesh

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Rearing of livestock, small ruminants in particular is increasingly becoming an important livelihood option among the rural poor including the forest dependent communities. However, as elsewhere in the country, in Andhra Pradesh, the decreasing common grazing lands owing to their diversion to agriculture, developmental programmes, residential colonies, and others, has

resulted in low fodder availability in the common grazing lands, both in terms of quantity and quality. This has left the forests being looked upon as the primary source of grazing.

Recent trends show that the dependence on forests for fodder in the form of grazing is increasing but the forest area has remained more or less static resulting in the progressive reduction of the fodder potential of the forests. Factors like goat browsing, unregulated cattle grazing and lopping for fodder is resulting in low seed production and hardening of the forest floor creating unfavourable conditions for seed germination and growth of fodder species. If the situation continues unabated there is imminent danger of all the fodder species disappearing from the forests and common grazing lands, putting the very survival of the livestock based rural livelihoods and the pastoral economy in jeopardy. On the other hand, optimal grazing in the forests has an essential ecological function for maintaining the productivity of the forests as several plant species need animal interaction for seed dissemination, germination and growth.

It is also noteworthy that a majority of the poverty alleviation programmes and natural resource management schemes being implemented in the state of Andhra Pradesh through various government departments focus on livelihood generation through livestock, but do not simultaneously address the fodder development needs like creation of fodder plots, enhancing productivity of CPRs & forests – thus possibly aggravating the fodder scarcity further. As a consequence there is a widening gap between fodder-demands on forest land and the quality and quantity of supply available from these lands.

Given the interdependence between grazing & sustained productivity of CPRs, including forests, it is essential that suitable & practical fodder resource management systems coupled with a grazing policy are in place that would use 'grazing' effectively to reverse retrogressive ecological succession of the fodder species, ultimately safeguarding the livelihoods and ensuring the sustainability of the forest ecosystem. However, while the National Commission on Agriculture 1976, the National Forest Policy 1988 and the National Forestry Commission 2006 advocate regulated grazing in forests involving the communities, no comprehensive grazing policy is being followed in AP today.

This paper narrates the situation of livestock based livelihoods vis-à-vis fodder availability, productivity of forests and intends to share the experiences/possible options towards livelihood security for smallholder livestock rearers in Andhra Pradesh.

Sustainable Cities

Sanitation Problem in Slums

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Despite all their efforts, the majority of cities in India have been unsuccessful in meeting the sanitation needs of the poor. Today, one of the main challenges they face in this sector is to develop innovative approaches, as alternatives to the centralised provision of sanitation services. Despite the universal understanding that the availability of adequate and reliable sanitation services is essential to improve the quality of life of the urban poor, Indian cities have been largely unsuccessful in responding to this basic need. This paper describes the problem with respect to finance, space, water, culture, awareness, maintenance, safety, privacy, children, lighting, and disaster preparedness.

Policy and Its Implementations to Abate Impact of Urbanisation on Bangalore Lakes

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Bangalore, the capital city of Karnataka, is the sixth largest city in the country and a nerve centre for the various cultural, social and religious activities, contributing to the growth of the city. Lakes, which have been an inherent part of the ecosystem, also have traditionally served

the function of meeting the water requirements of the populace, be it for drinking, household uses like washing, for agriculture, fishing and also for religious and cultural purposes. These water bodies are also host to a wide variety of flora and fauna, especially birds. With the changing urban realities in Bangalore due to rapid urbanisation ushered in by the Information Technology boom, environment has been at the receiving end due to the increased pressure on land to sustain a rapidly growing city. Lakes and tanks have been very directly affected, primarily in two ways: disappearance due to encroachment and building on lakebeds, and unchecked pollution by means of dumping of untreated industrial and household waste, which includes solid waste as well as sewerage. This paper presents the current status of lakes in the city and the efforts by the civic body, NGOs and the public towards the restoration of these lakes.

Criteria for the Communication, Education and Environmental Local Participation from a Case Study

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This work presents some conclusions and reflections concerning the results obtained in two researches undertaken in Madrid (Spain) in the areas of communication, participation and environmental education, emphasizing their interrelationships. The investigation has been conducted by an interdisciplinary team at UAM (Social Psychology, Sociology and Ecology).

In the first study, the criteria of effectiveness have been obtained in environmental communication from interviews and group discussions by experts from different disciplines and areas of action, applied to the evaluation of campaigns on environmental promotion. In the second study, a diagnosis of the civil perceptions on the environmental urban problems that affect them has been developed. The complaints and suggestions sent to the public institution in charge of the environmental management were then analysed. As part of both studies, an organizational diagnosis was realized focusing on this institution and the local context.

Considering this multiple analysis, evidence was obtained on the effect of interaction among these spheres: evaluation, decision, communication and participation (Tábara, 2006). The criteria used (implicit and explicit) to develop the institutional management determine the lines of environmental education, the styles of communication, the message, the contents, etc., as well as the mechanisms of interaction that is offered to the citizenry for their participation, and the measures that are implemented for the solution of problems detected in the environment. From our epistemological perspective, participation is understood as an individual and collective

learning process (deliberative participation); communication like a strategy of social implication based on the intersectorial dialogue; and environmental education as a tool that provides the training for action towards facing environmental problems and that promotes people's empowerment.

Proposals are elaborated for the design of an environmental participative management and possible lines of intervention based on the interrelationship between the communication and the environmental participation. The conclusions appear suggestive towards increasing the value of environmental education with its different strategies, working in coherence and complementarity with other mechanisms (management, legislation, investment, etc.).

Children's Research: *My Ideal Sustainable City* (Poster)

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The poster presents the research findings of child researchers engaged in a sustainability project, specifically Sustainable Cities. (The Sustainable Cities project is funded by the Federal Department of Education, Science and Training [DEST] with multiple partners and the Gould Group being the manager.) Central to their project were four questions, namely: What are the requirements of a sustainable city / suburb or house?; How can we design one?; What do we have to do to make a scale model of our design?; and Who can help us?. Their research involved documenting their learning about and for sustainability throughout this project. Sixty children from an inner metropolitan area participated in the research (30 primary and 30 secondary children). All researchers received a camera and journal. The poster will present the visual images and the children's descriptions taken from their research journals. Their research reveals significant insights about sustainable urban design and planning for a sustainable future.

Educational Value of Barrier-Free Urban Environment

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A barrier-free design concept is being accepted all over the world in recent years. For this purpose, sidewalks should be constructed where none exist and also existing sidewalks should be improved to reduce the hazards from obstacles and other barriers located over them. An aging society is here to stay and the requirements for a barrier-free design of regional infrastructure are on the increase for us to be a civil society.

During the past few years, people accepted the barrier-free design associated with transportation infrastructure in Japan well. The “Law concerning the Promotion of Accessibility of Public Transport Systems to the Disabled and Elderly” had been passed in 2000. And then, the law was revised last year. It emphasized that a barrier-free environment should be designed as a single system of street network that consists of sidewalks and buildings.

This paper presents an educational experience with our students in developing a planning support system for the design of a barrier-free street network within a downtown area of Morioka city, Japan. We collected data about the barrier-free achievement level in each sidewalk section in the area through a field survey. The route between an origin and a destination is restricted for a pedestrian because of the obstacles. It shows us spatial distributions of obstacles over a street network under the conditions given. Also it gives us the shortest route and its travel time on allowable links for each pedestrian. Students can see that the route for the destination is dependent on his/her physical condition and think about how to design the street network for all people from a perspective of familiar urban street environment.

Understanding Sustainable Development of Cities: Ecological Footprint and the role of Compact City

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Sustainable urban development has been a major area of concern to several nations and is still a controversial issue. There are conceptual questions as to whether urban development itself is

sustainable given the finite resources and the larger footprints of urban areas in terms of resources and energy consumption. It is also contested whether sustainable urban development can be attained with the free movement of goods and people, particularly from rural to urban areas. However, the key question that concerns policy makers is whether the patterns of urban development can be made sustainable through deliberate choice of policies that promote them. Compact city development has emerged as a consensual choice among the policy debaters as it leads to sustainability of urban development through reducing energy consumption and related emission reduction. The cities in the East are often cited as examples of how they have been able to sustain high densities in the cities without intruding into much of the hinterland in terms of land, water and energy. However, this theory has been debated afresh with the citation of omissions and survey of the cities in the West. The developing countries in the South have been growing steadily and increasingly urbanised due to the onset of demographic transition. In these cities, as urban areas are becoming metropolis to megapolis, the urban services are becoming complex and severely pressurized, thereby affecting the quality of living environment in the cities. Outward expansion of the city and increasing sub-urbanisation is not only an 'American Dream' but the dream of several cities in the world, as it gives more space and new infrastructure. However, lack of transportation infrastructure, social and commercial services is a concern. At the same time, the compact city is contested for bringing in energy intensive structures, services and transport. The policy choices appear to present different options under different circumstances of cities in the North and South and there is a division of East-West now. The current paper brings forth the dilemmas of city managers, policy and decision makers about the right choice of the path and policies for urban development so that it becomes sustainable from all perspectives. It attempts to set out the variation of conditions and the appropriate parameters that would predominantly influence the policy choice, thereby trying to analyse this divide.

Answering India's Water Woes: Is River Interlinking the Only Answer?

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India's ever increasing and widespread water crisis is the result of the culmination of myopic planning, muddled policies and misguided perceptions. As cities grew and towns sprouted, no thought was paid to the emerging mismatch between demand and supply. In the quest for food security, groundwater was pushed forward as a solution. It was cheaper and quicker; storage and distribution projects were neglected. The race for industrialisation saw no checks on wasteful technology and pollution of water resources. With rapid development and urbanisation, traditional systems of managing water resources were dismantled and thrown by the wayside. Today, the

very development, growth and security it sought to build while neglecting the ecological side effects are under threat

Water security is indeed dear to all and there is no doubt that the citizens of India have suffered for too long from water security. At this crucial juncture in the history of water resource management in our country, the planners of our country need to proceed cautiously. As much as we may attempt to manage water supply through mega projects like interlinking of rivers, we can no longer underestimate the need to manage our demand and evolve strategies for conservation and augmentation of water bodies. The Government surely needs to redefine the need-availability paradigm by redesigning and restructuring the demand. Growing water intensive paddy or sugarcane can never be the right of any peasant.

Today when the Government is proposing to undertake river-interlinking project as an answer to India's water concerns, there is very little information available in the public domain which can substantiate the tall claims being made by the Government. The total absence from the public domain of any technical and economic assessment report on this project surely creates a lack of comfort and confidence in the public mind on the wisdom behind such an investment decision. The citizens of India certainly expect the Government to be completely transparent and professional at all levels, before it gets a clearance for this mega project. This is particularly important at a juncture when the paradigm of water resource management is undergoing a fundamental change, with old ideas falling by the wayside, getting dislodged by more integrated and transparent scientific knowledge. It is imperative that the people of India are assured that the country will not be investing in a 21st century project that is developed on the basis of a 19th century knowledge base.

Though there sure are certain benefits involved in the river-interlinking project, it needs to be scrutinised thoroughly and there should be deliberations on alternative means to sustain the constant supply of water. This paper attempts to do the same.

Corporate Ecobuilding: A Lesson to Learn How to Build Properly

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Once our company decided to build its headquarters, a whole strategic plan was initiated involving every worker and the local community in it. To start with, an internal participation process was opened up so that every one of us could decide how our working place should be. A local

architect worked closely together with our engineer in this process, which was revealed to be crucial for efficient ecodesign that follows sustainable criteria: minimum resources consumption and waste generation during its lifecycle, choosing products and their providers according to their environmentally and socially responsible practises and well-adapted to the local climatology and the existing built environment.

To ensure the work process, each of us took the responsibility of monitoring an activity like waste management, signposting and capacity building of the labourers. The inauguration was extended to the local community and they were invited to attend a lecture on ecobuilding and visit our brand new building guided by our own educators.

Nowadays, our headquarters is accessible to the community in many ways: outside there are some panels showing the ecosolutions adopted; inside the signposting remind both workers and visitors about the best practices for more efficiency. A website reveals the secrets of our process (www.ecoedifici.com), and we invite our customers and professional colleagues to visit it. We are also open to scholar groups coming to learn about it. The process has also shown us how to carry out similar projects for our costumers.

Finally, we are proud of having a headquarters that reveals the company values and have been distinguished with several awards.

Using Ecological Principles to Benchmark Design Synergies

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It seems clear that existing 'sustainable' design methods have failed to reduce biodiversity depletion and climate change substantially. This paper outlines a novel alternative to sustainability discourse by emulating synergies found in ecological systems. This approach will be used to offer an alternative design benchmarking system to the UK Government and industry. Evidence shows that, unless users are willingly and knowingly involved in the whole process, eco-design may be sub-optimal. At present, Governments tend to favour clear quantitative indices for promoting 'sustainable' design (E.g. the latest UK code for sustainable homes: <http://www.planningportal.gov.uk/england/professionals/en/1115314116927.htm>). While these represent a constructive improvement, they are unlikely to foster a coherent pattern of change. This is because they are narrow and reactive rather than holistic and vision-based. Imposing discrete, technocratic standards is unlikely to foster a perceived improvement in the quality of life. This paper suggests that what is needed is a more dynamic, holistic and interrelated approach to sustainability, one in which a complex set of aspirations is made attractive to consumers at

the level of a shared vision. This could apply qualitative methods that model the relevant interrelations among all the significant stakeholders. Studies of ecological systems may help societies to self-regulate highly complex processes. The paper will highlight eight ecological principles and how they ensure high levels of synergy within living systems. The ecological principles are defined as: Interdependence, Homeostasis, Degree of Closeness (autopoiesis) vs. Degree of Openness, Holarchic Organisation, Positional Value, Feedback Mechanisms, Purposefulness and Increasing Complexity. The paper will outline possible ways in which these principles can be used to benchmark a more profoundly ecological approach to design, at the following levels:

1. The practical, resourceful level
2. The analytical, tactical level
3. The discursive, interpretive level
4. The spontaneous, intuitive level

An Integrated Approach to Use the Web of FEH for Sustainable Development

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The paper establishes the bidirectional interlinks between food, environment and health. These interlinks exist in the form of a 'web' where all environmental components - food, soil, water, population et al are connected. The various linkages are illustrated and an integrated approach is recommended to minimise the adverse effects, e.g. the geometric increase in global population leads to increase in demand for food, affecting the food generation methods with excessive use of agrochemicals, thereby over-exploiting and degrading the limited natural resources. This further results in poor quality products, reduction in the level of water in water bodies, soil degradation and conversion of forests to agricultural land. The bottom line consequences are the degradation of the global environment and reduction in the quality of food to meet the demand, thus affecting the consumer's health. The overlooked fact is that the interlinkages are not unidirectional but bidirectional, e.g. use of corn to produce bioethanol to help contribute to a cleaner environment is resulting in an increase in food prices. Thus, the concern for a cleaner environment is affecting food. The integrated approach recommends organic farming, production of high quality crops through R&D, and processes to protect the resource base (especially topsoil & freshwater) by responsible governance. However, no technology is free from cons. The

measures need to be complemented by commitment to food security, increased access to education, healthcare and family planning with special focus on women. Appropriate local and global benchmarks need to be established to balance the extent of use of technologies vs. the natural processes. This will ensure that sustainable development is achieved.

Sustainable Consumption

Reverting To Nature Bio-Fuels as Alternative to Conventional Fuels: Issues of Need & Feasibility

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Dependency on conventional energy resources is a cause for worry across nations and research disciplines. The problem attains a serious state when it raises severe environmental issues of pollution and the resultant environmental degradation. As a solution to this problem, scientists have come up with Bio-Fuels as an alternative to petrol (gasoline), diesel and other nonrenewable resources. Beyond doubt, the tests conducted on using bio-fuels, especially for the automobile sector, have been successful to some extent. But unfortunately in the view of many scientists and researchers, these proposed bio-fuels would never be able to replace the conventional fuels in use. The object of the paper is to look into these contrary views of researchers and scholars around the globe and to put forth a few cogent and feasible propositions on the issue. Though bio-fuels are prima-facie a better option, many claim that the total cost to be incurred in establishing basic infrastructure for bio-fuels, which includes setting up fuel production plants, producing bio-fuel engine kits, determining fuel quality standards, etc. would exceed the utility generated by them. Another major hurdle for widespread adoption of bio-fuels is the challenge of growing enough crops to meet the demand, something skeptics say might well require converting just about all of the world's remaining forests and open spaces into agricultural land. There is also a doubt in some minds whether producing them actually requires more energy than they can generate. After factoring in the energy needed to grow crops and then convert them into bio-fuels, it has been concluded that the numbers just don't add up. For example a study shows that producing ethanol from corn required twenty nine percent more energy than

the end product itself is capable of generating; similar problems can be faced in producing bio-diesel from soybeans.

With all this being said, we cannot ignore the fact that the environmental and economic issues associated with conventional fuels have to be addressed. As it is not just that future availability of these fuels is a problem but the impregnable loss that's being inflicted on the environment is an even more severe issue. In the paper, the researchers have tried to answer such related questions. The first part of the paper gives an introduction to the central idea discussed in the paper. In the second part, the question of the need for such fuels is dealt with in detail, considering the various environmental and developmental issues. The third part of the paper throws light on the larger problems of feasibility and enforceability. In the fourth part, the production-possibility and utility of such fuels in India and other developing countries has been discussed. In the last part the researchers have come up with their conclusions on the topic. On the whole, the paper approaches the topic not as a core economic issue but as something with which the future of human society is closely related.

Responsible Consumption – Need of the Hour in the Building Industry

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Indian construction industry ranks twelfth in the world. With MNCs entering the construction arena and with the increase in spending power, the growth has touched 100%. Well, it is an extremely good sign from the economy point of view. But what about the environmental implications of such a growth?

Commonly used and widely consumed building materials are cement, sand, jelly or blue metal, bricks, steel, timber, granite, marble and various other natural stones. Of these, all the materials except cement and steel are naturally occurring materials. Though cement and steel too are produced from naturally occurring raw materials, this paper concerns the consumption of naturally occurring materials. Of the said materials, only timber can be 'produced', by planting trees – though none of us in the construction industry spare a thought for it. River sand and other natural stones are non-renewable resources and they are fast depleting. The present trend is to clad all buildings with granite – irrespective of whether they are commercial or residential. It has been found that bricks, river sand and blue metal can partially be replaced by similar products made from fly ash, a waste from thermal power plants. But the construction industry is slow to adapt new technology. In the process, precious natural resources are slowly vanishing. Using natural stones for needs and necessities is agreeable. Convenience and ease of work is essential. But we need to develop a conscience among not only builders, but consumers in the building

industry as well. For, very often it is found that stones are used to pander to our fancy ideas and for flaunting our financial position. This paper analyses the current trend in the consumption of natural resources by the building industry and possible ways of educating the stakeholders in the construction industry.

Sustainable Livelihoods

Development Interventions, Livelihoods Security and Sustainability of Resources among Tribal Communities of South Asia

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There is a direct link between livelihoods security and development interventions by different agencies and sustainability of the resources among the tribal communities of South Asia in general and India in particular. The link between them is crucial to achieve the desired results of both sustainability of resources and livelihoods. It reduces the risks and paves the way for poverty reduction among the marginal communities of South Asia. To achieve livelihoods security, the donor agencies and also the State must take cognizance of and balance the existing local resources. This paper tries to address the interface between the poverty reduction strategies and the attainment of the goal of sustainable development by managing the natural resource base among the tribal communities of South Asia. Further, it also tries to address the role of international donor agencies in bridging the gap between the haves and have-nots, which is drastically increasing year by year without any change.

The objectives of this paper are:

1. To examine the livelihoods security and natural resource base
2. To understand the link between livelihoods security and poverty reduction
3. To assess the impact of developmental interventions on the tribal communities
4. To address the donor agencies or NGO's role in the sustainable development of tribal communities
5. To analyse the role of cultural knowledge in the management of livelihoods security and poverty reduction for evolving sustainable and equitable development of tribal communities

This paper bases its inferences on the data gathered from official reports and records, census records, published as well as unpublished research reports, papers, etc., with reference to India. Besides, it also draws its inferences from the studies made by the authors and other scholars in Andhra Pradesh, India. It takes into account the studies made in other parts of South Asia too.

The expected conclusions are that:

- Livelihoods security plays an important role in sustaining and managing the available resources.
- Sustainability of resources addresses the need for overall development of the tribal communities.
- Development interventions must be in accordance with the people's choice and their involvement in the process of development, which is necessary to achieve the sustainability.
- Overall development of tribal communities must be addressed through the interventions by the State and donor agencies.

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Governance of Forest Resources and Sustainable Livelihoods:

Analysing the Implications of the Logging Ban on Rural Household

Strategies in Meghalaya, India

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There is a growing international concern about the depletion of forest resources and some states are using logging bans to control deforestation and promote conservation. But these bans are clumsy and often ineffective and are seen as top-down control by big states on small forest users. Moreover, some experts argue that these logging bans damage poor people's livelihoods in the remote areas. In response, this paper based on research, will contribute to debates about the governance of forest resources and sustainable livelihoods in general by examining a specific case study on how the Supreme Court of India's logging ban has impacted the household strategies of the indigenous Khasi people in the State of Meghalaya in North East India. The central question is: How has the logging ban affected household behaviour and what does this change tell us about the theories of adaptation and sustainable livelihoods? The analysis focused on two relevant concepts: Logging Bans and Sustainable Livelihoods (SL). Using the SL Framework, the research followed qualitative methods using focus group interviews and household surveys from six villages in two clusters located in the West Khasi Hills District to document land use change, identify dominant patterns of forest-use, examine variations in resource dependency among the local populace, and identify the link between livelihood strategies and adaptations.

The research found that the logging ban had a negative impact on the social life and structure of the households, on their access to environmental and economic resources, and on the combined purposes of protecting forests and livelihoods. Building on local people's adaptation to the logging ban which showed a clear link to their livelihood strategies, the research also concluded that strong institutions at community and state levels are required to generate practical actions that are needed to safeguard local livelihoods and ensure environmental sustainability.

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Propagation and Agrotechnology Status of Commercially Important Medicinal & Aromatic Plants on Soidic Lands: A Case Study

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Bundelkhand and Lucknow Region are situated in Uttar Pradesh (India). In geographic terms, Bundelkhand region is stretched between 23° 35' – 26° N and 78° 0' – 82° E, bounded by the Yamuna in the North, the Chambal in the North West. These two regions are a rich treasure house and the biggest centre for the production of medicinal and aromatic plants since ancient times. Results showed that the propagation and agrotechnology of some commercially important medicinal and aromatic plants could endure soidicity and were experimental for the rehabilitation of the once barren soidic landscape in the Bundelkhand and Lucknow region, India. It is also observed that improved agrotechnologies together with new crop rotations permit integration of medicule with conventional agriculture among the SC/ST/rural populations residing in the villages of Lucknow and Bundelkhand region, enabling them to obtain larger profits and also to promote the growth of small-scale industries in larger numbers. Unlike agricultural food crops, cultivation of these crops involves a number of auxiliary activities like distillation, value addition, preparation of perfumery items and isolation of active component. Therefore, there is ample scope for generating employment opportunities for the rural sector. Suggested strategies for sustainable management of soidic wastelands are maintenance of ground water level in the safe zone and following intensive intercropping agrotechnology to get desired and long lasting results. We selected 50 villages on the marginalised segment of the rural population from within the SC/ST/rural villages. Over 150 species of rare and endangered plants were collected for establishment in the demonstration of the garden and for germplasm conservation. Based on documentation of local knowledge and medicinal plant resources, nearly 25 medicinal species that are in wider use for primary health care among the communities were identified. Intercropping is being decided according to experience and agrotechnology principles. For example, better results had been obtained from the *Chamomile recutita* intercropped with chickpea and *Chlorophytum borivianum* with maize, and pigeon pea.

**Waves of Change: From Environmental Education to Community Based
Ecologically Sustainable Development Planning
*Case Studies from Kerala and the Union Territory of Lakshadweep***

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The environment at large and the human society in particular are in a state of continuous change. Most of these changes occur at such a rapid pace and the consequences of it are so complex that it sometimes escapes comprehension. Education too has assumed different meanings and dimensions since its inception as an essential formal ingredient in the making of a civilised society. The need for a more holistic view in contrast to the reductionist approach of traditional education has been considered essential for the making of a responsible member of the society. The political dimensions and implications of such a change which will make education the key element in social transformation have also been addressed in this context. In Kerala and in the Union Territory (U.T) of Lakshadweep, where literacy and the participation of an informed and conscious civil society is paramount, the change and transition to informal and innovative means of educating and communication has undergone marked change in the past decade.

The paper will address the waves of change in two key regions in both these areas namely, the village of Karimpuzha in the Palakkad district of Kerala and the island of Agatti in the U.T of Lakshadweep. Both these apparently diametrically opposite regions, one in the hills and another in the coral archipelago, have been witness to the change from environmental education to community based ecologically sustainable development planning. The regions have been subjected to intense environmental education activities since 1996 in separate and distinct action research programs. The regions have also recently been active participants in the process of inclusion of sustainable values and attributes in the development planning process.

The Karimpuzha area with all the vestiges of a self-sufficient agrarian village is in a state of transition with the natural resource based economy shifting to secondary urbanised level. The Kerala Research program on Local Level Development of the Centre for Development Studies conducted a study based on the schools of the Panchayat with inputs into the curriculum, which later evolved into an Environmental Appraisal of the area with community participation that was taken up by the Kerala Institute of Local Level Development.

In the U.T of Lakshadweep, the Environmental Orientation to School Education Scheme of the Ministry of Human Resources Development has prepared a teacher training manual called 'Our Island, LAKSHADWEEP' in the local language, for the islands, with Kalpavriksh as the

coordinating NGO. Later on, the Centre for Environment Education and the NGO CARESS together undertook a 'KNOW YOUR ISLAND' programme in the islands. Now the Agatti Island, which was part of both the above said programmes, is witness to 'The Conservation of Giant Clams' through a Community Reserve, being executed by the Bombay Natural History Society and LEAD-U.K –Darwin Initiative.

Both these studies and processes demonstrate the relevance and impact of Environmental Education and the need for its upgradation as the key element in Sustainable Development Planning.

Ecotourism: A Sustainable Livelihood Alternative in the Developing Nations

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The notion of sustainable tourism has its roots in the concept of sustainable development. The Brundtland Commission defined sustainable development as "development that meets the needs of the present without compromising the ability of future generation to meet their own needs". For the tourism sector, the concept of sustainability implies meeting current uses and demands of tourism without impairing the natural and cultural heritage or opportunities for collective enjoyment of tourists of the future and especially for the people dependent on tourism for earning their livelihood.

Since we have observed that non sustainable tourism has made a negative impact on our society, world and specially the environment, the development planners and managers have suggested a new upcoming concept of "Ecotourism", which is sustainable in nature and gives us a hope for substantial growth to all the stakeholders involved in protective efforts.

Hence the following are the summarised positive implications of new the livelihood options in a categorised manner.

Ecology Environment	For Conservation and Protection of areas • Greater awareness among the public and local people about protected areas and the environment • Political support which can help to attract funding and support the designation
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Tourism and Economy	For the tourism sector • Government support for business and employment • Development of new, high quality, environmentally sound products, based on nature and culture with a long term future • Attraction of customers looking for environmentally sound holidays • Increased tourist awareness of the need to protect the environment • Increase in GDP (Gross Domestic Product) and foreign exchange earnings
People and Livelihood	For local people and society • Improvement in income and standard of living • Preservation of local culture and traditional crafts • Stabilisation in the migration of local population • Local population becoming responsible for environment protection

Thus we may infer that ecotourism has significant potential as a sustainable livelihood alternative to boost the economy of the developing countries and therefore efforts towards this must be pursued with great vigour.

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Hence the following are the anticipated positive implications of new the livelihood options in a categorised manner.

Ecology	For Conservation and Protection of areas • Greater awareness among the public and local people about protected areas and the environment • Political support which can help to attract funding and support the designation
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Values & Ethics

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Integrating Ethics into the Curriculum of Environmental Education

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With the increasing number of environmental problems affecting humanity in manifold ways, there have been concerted efforts to find significant solutions to them amidst various strata of human society. While some of the problems have touched international borders, there are concerns which have become global, and are affecting almost every individual's life, such as 'global warming'. Besides efforts to find a solution in technological ways, there are other sociocultural ways to bring in respite from the problems. One of such concerted efforts is, 'Environmental Education', which is being used in a widespread manner to make people aware of the growing environmental problems and how we may prevent them at individual, social or even global level. However, barely making a person or learner aware of problems or finding a solution in a technological or sociocultural manner - such as learning about 'Sustainable Development; i.e. safeguarding natural resources while utilising them at the same time and a concept that fulfills the basic ethical quest - may not stop the process of polluting the atmosphere or degrading and destructing natural assets. Therefore, the threat to them will remain perceivable as human society is actually responsible for causing and letting them continue. Mankind, which is utilising nature indiscriminately for the development of society, is now at the threshold of rationalising and sitting in judgment on the well being of not only mankind but nature as well, as it is dependent on it for its own survival and therefore owns moral responsibility for the same. Hence, it is time to integrate in the curriculum of Environmental Education, the ethical concept of moral responsibility for having a 'right' over nature, 'human obligation' towards it, the 'rights' of the animals, or even the human-centric view of 'justice' for safeguarding natural resources for future generations. Only then will it achieve true significance in making society rational and for the upliftment of human values.

Practical Environmental Ethics and ESD

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The aim of this paper is to introduce a discussion on the relationship between the theoretical presuppositions in (a) education for sustainable development (ESD) and (b) environmental ethics. In the paper, we argue that ESD calls for a pluralistic and integrated conception of environmental ethics and suggest that ESD is not coherent with common understandings of environmental ethics as e.g. synonymous with “nature ethics” and/or “nonanthropocentric ethics”. Accordingly, we suggest that ESD is not coherent with a dualistic view of nature/culture implicit in the idea of environmental ethics as “nature ethics”, and further that the inherent democratic values and pluralistic epistemic and normative ideals in ESD do not cohere with the idea that environmental ethics is synonymous to merely one normative ethical position, i.e. “nonanthropocentric ethics”.

The first part of the paper discusses the relevance of environmental moral values, hence of environmental ethics, to ESD. The second part outlines two common conceptions of environmental ethics; nature ethics and nonanthropocentric ethics and presents arguments against these conceptions. In the third part, we argue in favour of a pluralistic conception of environmental ethics, which integrates (a) social, nature, and animal ethics, (b) classic environment and development issues, and (b) ecologic, economic, and social values.

The paper contributes to a discussion of the environmental ethical content of environmental moral meaning making in research of and education for sustainable development. Thus, the paper widens the critical debate on the value dimension of ESD.

Gandhian Idealism: Initiating a Viable Model of Sustainable Living

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The pressure of immense population growth being exerted on the world community has brought extreme ecological strain, triggering a cause of concern in the form of life sustenance. Declaratory principles apart, no viable implementation model for sustainable living exists.

Any measure towards sustainable living requires a flexible implementing mechanism capitalising on the potency of a strong theoretical foundation. It must provide a balance between the practical wants of the society and the collective means of implementing it.

Gandhian philosophy, pregnant with principles such as responsible consumer behavior, energy conservation and ecological preservation provides a blueprint for sustainable living. This probable panacea for modern day problems has been ignored by the world community but Utopian Gandhism can be practically realised by a sensible and pragmatic approach towards understanding and applying it in our lives.

This paper proposes an execution mechanism on the **Gandhian Sustainable Living Index (GSLI)**. It is the numerical representation of ideal standards of production and consumption based on Gandhian Principles. The Defining Parameters of GSLI would include population density, resources, occupational tendencies, etc. of the particular region.

The role players for this would be:

Government:

- Setting Expert Regulatory Bodies at regional level for GSLI formulation
- Ensuring compliance and promoting incentives to the public

NGOs:

- Contributory role in formulation of GSLI
- Promoting awareness, initiating reforms and checking discrepancies in implementation

Citizenry:

- Active fulfillment of their role as basic units in the compliance mechanism
- Supporting the other role players

Sustainability Initiatives through Environmental Education: The Case of a Small Island State - Mauritius

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Mauritius, as a fast developing country, has undergone drastic changes on the ecological, social and economic fronts. As a small and densely populated island state, it has a fragile and vulnerable ecosystem. Considerable efforts are being made to equip the citizens of the country with awareness about the ethics of sustainable living and to meet the challenges and pressures of modern lifestyles and a fast developing economy.

We have to make an efficient use of our limited natural resources so that as responsible citizens, a right balance is struck among the three essential and integral components of Agenda 21 which are: economic growth, social development and environmental protection. Sustainable development is about finding out practical solutions to both environmental and societal imbalance through more responsible attitudes from everyone. While ensuring that the basic needs of one and all are met, without jeopardising the needs of future generations, we have to adopt a sustainable lifestyle and reflect on how our modern way of life based on a throw away culture is a threat to our country and the planet's future.

By adopting sustainable consumption patterns, we can promote the ethics of sustainable living by translating this principle into practice while at the same time integrating environmental protection and preservation with development so as to keep our actions within the Earth's capacity and enjoy a better quality of life through sustainable development.

This paper argues how Environmental Education for Sustainable Development is made to address the three pillars which contribute to sustainability: society, environment and economy.

Clarifying the Ethical Tendency in Educational Practice

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The aim of this paper is to present a didactical typology through which research about and education concerning the moral and ethical aspects of Education for Sustainable Development (ESD) can be executed. The paper presents the results of interdisciplinary didactical-ethical analyses in *educational practice* based on audio- and video case studies. The results of the analysis, which is based on a Wittgenstein-inspired approach, suggest that what is referred to as the ethical tendency appears in three different kinds of situations in school: *personal moral reactions*, *norms for correct behaviour* and *ethical reflections*. We discuss how this topology can provide a practical tool for teachers by clarifying the diverse learning conditions of these situations, and how various types of ethical theories can further deepen the knowledge of the ethical content in ESD-research and education.

This paper contributes to the debate about the democratic and environmental ethical aspects of ESD, through a clarification of ethics and morals made possible by an investigation of how these aspects appear in *educational practice*.

Contributions of Two Faith Organisations to the Evolution of Education for Sustainable Development

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Education for Sustainable Development (ESD) has been identified as a learning process that contributes to the transformation of society towards a sustainable future. ESD has evolved over time. The dedication of the United Nations Decade of Education for Sustainable Development

(UNDESD), following the 2002 World Summit for Sustainable Development, underscores the important role of ESD, and provides opportunities for further development of ESD.

UNESCO, the lead agency for the UNDESD, various NGOs, academics, educationalists, and economic institutions have identified faith organisations as having an important role to play in the transition towards a sustainable future through ESD. However faith organisations and their perspectives have not been explicitly considered in the conceptualisation or evolution of ESD.

This PhD research aims to address this gap by involving faith organisations in generating considerations for the ongoing development of ESD. The research engaged two faith organisations, the Bahá'í Community of the US and Soka Gakkai International USA, in an exploratory study of their teachings, typical community education initiatives and initiatives addressing sustainable development. The goals of the research were to investigate both the contributions of EfS best practice understandings to the faith organisations' initiatives, and the faith organisations' philosophical, conceptual and practical contributions to the evolution of approaches to educating for sustainability, particularly in its use by the organizations themselves. The research examined the dialectic between the perspectives of the two faith organisations and the current understandings of ESD, as regards learning and change for sustainable development. Implications for the conceptual framework and practice of ESD were identified. This paper shares two of these implications, which concern: (1) the focus of the educational endeavor between the transformation of the individual and the transformation of society; and (2) the role of spiritual development and critical and spiritual knowledge in motivating action for sustainable development.

Both organisations support the Decade, and were integrally involved in the conception and establishment of the US Partnership of the Decade of ESD. Also, both are developing and implementing their own programs. In addition to presenting research findings, this paper will briefly share examples of community education initiatives from the two faith organisations. These include initiatives specifically created to promote EfS, as well as existing educational initiatives from which useful lessons can be drawn. Such examples include national and grassroots EfS workshops and seminars, special editions of community children's magazines, character education curriculum, and institutional capacity building programs.

A Changing Climate Calls for a Change in Consciousness

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As we approach the end of the first decade of the 21st Century, we find that humanity is on the brink of disaster, facing the same challenges that were perceived some 30 years ago, and yet continuing on the same treacherous trajectory and to what avail? With scientists the world over now providing proof and severe warnings of future Climate Change scenarios and the increase in the size and force of natural calamities, and with perhaps a window of ten years to transform our global industrial practices and lifestyles to prevent an environmental catastrophe, many people are asking how we can manage what is required to be done in such a short amount of time and on such a large scale? How can we create a global reformist agenda and the necessary paradigm shift? Obviously there are many organizations and individuals working collectively to change things on the ground, but the opposing forces still pervade.

The Brahma Kumaris World Spiritual University (BKWSU) recognizes the seriousness of the impending threat of a global catastrophe caused by human induced climate change and as such has identified that “spiritual preparedness through practicing a Pure Lifestyle” creates resilience for the current environmental crisis facing humanity, and can help to alleviate suffering and assist in the mitigative and adaptive responses required.

This paper and presentation will argue the position that, in fact, what underlies the environmental crisis that we are now facing is a “spiritual crisis” and that the root cause is “the way we think”, “the pollution of our minds”, “inappropriate attitudes and values” and that the change that is sought is “a fundamental and deep-rooted transformation in individual behaviour, and therefore also in attitudes, thinking and values” and that, “we will not be able to get the outer world in order until we have first learned to get our inner world in order, and transcend short-term selfishness, consumerism, disregard for others and a corruption of values”.

The ethical and ecological benefits of living a pure lifestyle will be explored to reduce one’s Ecological Footprint and an exploration and experience of the practice of meditation will be used to demonstrate how skills can be developed to control the mind, create powerful and peaceful thoughts and increase one’s resilience for self transformation and therefore engender values for world transformation.

Waste Management

Municipal Solid Waste Management in Srinagar City – Problems and Solutions

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Solid waste is becoming a critical issue in the urban and sub-urban areas of Srinagar city due to its faulty handling and disposal practices. The paper presents the current status of municipal solid waste generation and disposal practices, and different kinds of environmental problems arising out of it. The major problems identified include land and water pollution, poor administration, shortage of sweepers and collection bins, non-availability of sanitary landfill, uncontrolled disposal of solid waste by people, lack of public awareness, etc. A comprehensive survey of the whole city revealed that biodegradable/compostable food waste was the major constituent of the municipal solid waste (MSW) stream followed by inert material and recyclable materials including polythene, plastic, cardboard and paper. Most of the solid waste generated remains unattended and only 40 -45% is collected, albeit irregularly, by the municipal workers and unscientifically disposed of at a dumping ground located in the buffer zone of Anchar Lake, around 8 km north-east of Srinagar city. Awareness regarding proper solid waste management was found to be very low among the inhabitants. However the general public was found ready to cooperate with the municipal authorities if regular solid waste collection and disposal services are provided. Irregular and selective waste collection was the major reason for the disposal of solid waste in water bodies, roadsides and open spaces. Keeping in view the cultural, socio-economic, ecological values and great tourism potential, some remedial measures for municipal solid waste management in the city have been suggested including segregation of solid waste into dry and wet wastes for recycling and bioremediation respectively, use of hand carts fitted with bins for door to door segregated waste collection, increase in the existing number of sweepers

and transport fleet, regularised waste collection, comprehensive public awareness, and encouragement of private initiatives in MSW management.

Mobilizing the Community through Environment Education for Waste Management in the Maldives

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Live and Learn Environmental Education, Maldives

The Maldives are a chain of 1,190 small low-lying coral islands grouped into 26 atolls in the Indian Ocean: 198 islands are inhabited and 80 house tourist resorts. The islands are predominantly coastal entities, and their ecosystems are among the most vulnerable in the world. The Maldives have a narrow economic base that relies on two critical sectors - tourism and fisheries. As most atoll workers are employed in these sectors, protecting the Maldives's fragile coral reefs and coasts, fisheries and the marine environment, which comprise the main source of livelihood in the atolls, from polluting sources is central to any poverty strategy. Its unique geography and vulnerability pose key development challenges for the country. The dispersion of the population across the archipelago raises the cost of delivering social services, as economies of scale are difficult to achieve in service provision.

The environment in the Maldives is being placed under increasing pressure from a growing population, changing lifestyles and improvements in living standards. Wastes are being generated in ever growing volumes. Without adequate management, the risk of polluting the environment is becoming even greater. The impacts of poor waste management on people's health, livelihoods and overall quality of life are becoming more negative. In this situation, different groups are showing increasing interest in dealing with the issues of waste.

In working with the different communities, the *Live and Learn* staff has learnt new approaches and strategies for mobilizing the different communities. *Live and Learn* has worked in 16 communities and reached out to 673 participants for waste management.

In relation to 'Promoting Community Mobilization for Waste Management in the Maldives', there are a variety of international theoretical models and approaches. The following concepts are based on case studies that have been conducted in five pilot communities in the Maldives. The approach chosen for community mobilization has been developed through six broad steps.

1. Plan
2. Listen & Learn
3. Discuss & Develop

4. Adapt & Act
5. Support
6. Evaluate

The *Live and Learn* team also faced challenges in using the same channels of communications for all the communities. The effective channels of communication had to be explored and modified in order to identify the most responsive for a particular group. In some communities the *Live and Learn* team had to work through the community based organizations which were more influential in mobilizing that respective community.

Economic Instruments for Managing Municipal Solid Waste in India

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Recent trends show that the generation of municipal solid waste (MSW) has been increasing due to population growth, life style changes and economic development. Waste management responses have not kept pace with the increasing quantities of waste resulting in (a) a high proportion of uncollected waste, and (b) poor standards of transportation, storage, treatment and disposal. The insanitary methods adopted for disposal of solid wastes is a serious health concern with significant environmental, social and health costs associated with it. According to a study conducted by The Energy and Resources Institute (TERI), the annual per capita municipal solid waste generation in India is projected to grow from 1 to 1.33 percent, which would lead to a generation of over 260 million tonnes of waste by 2047 - a five fold increase over 1997 levels. It is further projected that an additional 1400 km of land is needed to dispose this waste, most of it in urban areas.

The current paper analyses the role of economic instruments in MSW management. In particular, it reviews the successful use of market based approaches for MSW management in the European Union, OECD and Latin American countries. It further includes a critical review of waste management policies in India on the basis of case studies carried out in three metropolises, viz. Kolkata, Delhi and Chennai. The study reveals that the existing policies in India are mostly regulatory in nature focusing on the transfer of waste from source to disposal sites. The paper strongly suggests that sustainable solid waste management requires the adoption of incentive based economic instruments backed by proper institutional and regulatory mechanisms.

Resurrecting a School Buried under a Rubbish Dump (Poster)

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St. Leonard's College has implemented this project aiming to provide a context to discuss waste management issues and also to provide an opportunity for students to actively involve themselves in poverty alleviation. This model could be adapted to other ESD initiatives.

Agamathi Vidyalaya is a small school near a rubbish dump in the capital city of Colombo in Sri Lanka. The facilities provided to this school are well below the required basic level. Students of St Leonard's College, Melbourne, have implemented this project which aims to give the children at Agamathi Vidyalaya some hope in continuing their education as this could bring upliftment to their lives in the long run.

Currently students are making educational material and other useable things out of the waste materials collected from the rubbish dump. The next phase of the project is the recycling of plastic to make educational material. This phase needs a small plastic pelting machine, a plastic injection molding machine, a woodworking machine, woodworking tools and some money to cover the running expenses.

St Leonard's College students have undertaken this challenge as well by raising funds and also by campaigning for sponsorships for the projects. Further, they are planning to undertake the marketing of these products to schools around the world. By engaging in these projects, students get exposure to the issues related to poverty as well as sustainable waste management practices. By providing the opportunity to actively respond to the issues, they could develop a positive attitude towards sustainable practices. Students and schools working collaboratively with other students around the world should be a major component of ESD.

This poster highlights the successes of the project which other schools could adopt. It also gives information about opportunities that other schools and organisations could consider becoming involved in.

In-house Distribution of Hospital Waste in Large Hospitals of Dhaka City

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Dhaka, one of the mega cities in Asia, is the center for the economic activities of Bangladesh. Solid waste management including medical waste is the burning issue of the country. The mis-governance of hospital waste has manifold impacts on the economy and public health of the city dwellers.

The general objective of this study is to determine the per capita waste generation and to measure the in-house spatial distribution of hospital waste in the study area. Data was collected through field observation, interviews, and in-house survey in 2006. The hospital waste was collected from different wards and departments with protective measures being taken while doing this work. Data analysis was done through standard analytical procedure.

From the study, it has been found that per capita hospital waste generation is 0.344 kg, 0.365 kg and 0.184 kg in Dhaka Medical College Hospital, Sir Salimullah Medical College Hospital and Dhaka Shishu Hospital respectively. However, their waste generation rate is well below that of a general hospital of high income countries; even lower than a district hospital.

Several departments were brought under this investigation. The in-house spatial distribution of hospital waste varies from 0.097 to 0.922 kg/person/day. Variation occurs due to various activities of the department, patients' variation and visitor population. This type of study can play a vital role for the in-house planning for efficient hospital waste management.

Treatment of Leachate of Lalmati Dump Site in Sylhet City

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The proper management of solid waste should be one of the major environmental initiatives to protect human health and the environment. Open dumping is the only method used to decompose all of the collected solid waste in Sylhet City Corporation, Bangladesh. Lack of proper management of domestic, commercial, industrial and clinical wastes, turns them into hazardous

waste. Such wastes have been directly dumped at the dumping site Lalmati in Sylhet City. The main objective of the study was to provide a better understanding of the composition of the leachate that has been formed by the decomposition of these wastes. For this, soil samples (from various points) were analyzed for zinc (Zn), Copper (Cu), Chromium (Cr) and Cadmium (Cd) using the method of flame atomic absorption. Spectrometer and also chlorides (Cl^{-1}), Sulphate (So_4^{-2}), Phosphate (Po_4^{-3}), and nitrate nitrogen were determined by the UV VISIBLE spectrophotometer. Surface water samples at various points in dry and wet season were analyzed for P^{H} , Temperature, Turbidity, BOD, COD, chlorides (Cl^{-1}), Sulphate (So_4^{-2}), Phosphate (Po_4^{-3}), and nitrate nitrogen. In the soil and surface water, the concentration of most of the parameters was seen exceeding the standard limit. From the experimental results, it can be said that the leachate contains organics and heavy metals and as such, is highly toxic, and contributes to the contamination of the soil, surface and ground water. It is found that approximately 288 tons of solid waste is generated daily within the Sylhet City Corporation area, of which 44% remain uncollected and disposed of locally. Various types of environmental and health problems are prevalent due to this, besides blocking of the drainage system and pollution of water bodies caused by the locally disposed wastes. A questionnaire survey was also conducted to assess the vulnerability of the environmental quality and the health to the local people, especially of the persons engaged in the handling of solid wastes. The survey result shows that laborers are most affected by different types of diseases. To minimize the above problems, this study has strongly recommended identifying and segregating the hazardous wastes from other wastes and disposed a sanitary landfill.

Conception of Waste and its Management at Household Level - A Case Study from Visakhapatnam City, India

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The domestic sector forms a vital part of resource consumption and environmental exploitation; therefore environmental education and awareness among the common people is essential for the conservation and management of resources and environment. The present study aims at assessing the awareness among the urbanites regarding their local environs, especially with respect to the waste generated and its management at household level. The study involves interviewing people from various income groups using a formatted questionnaire specially

designed for the purpose. The main emphasis was on their knowledge of waste generation, segregation, recycling and potentially hazardous waste identification. From the study, it was understood that most of the householders lack awareness on segregation and other basic issues related to household waste and its management. Key recommendations were made to educate people on the importance of waste management from the grassroots level.

Design and Delivery of a National Waste Awareness Media Campaign Case Study: Live & Learn Maldives 2007

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This paper and presentation will provide an overview of the design and delivery of a National Waste Awareness Media Campaign for the Maldives on behalf of the Ministry of Environment, Energy and Water (MEEW).

The project's objective is the *"the design and delivery of an in-depth public awareness program targeting the waste reduction, recycling and reuse at national and household level"*.

The Public Awareness Program comprises six outputs, namely:

- (1) Developing the content of a public awareness program;
- (2) Enhanced awareness and understanding of the objectives of the South Ari Atoll Regional Waste management project through the delivery of a media campaign;
- (3) Enhanced awareness and understanding of socio-economic and environmental issues associated with poor waste management practices through delivery of a media campaign;
- (4) Enhanced awareness and understanding of the responsibility of stakeholder groups, households and individuals in managing waste effectively;
- (5) Enhanced awareness and understanding of issues associated with increasing waste production through the delivery of a media campaign; and
- (6) Enhanced awareness and understanding of the polluter pays principle and that waste management services in the Maldives come at a cost.

The National Media Campaign will utilize the electronic media (Television, Radio & Website) and print media (via Newspapers & Posters) to reach the national audience of the Maldives. In addition, a series of training forums for journalists and retailers will be delivered.

The paper will describe the approach taken in the design and delivery of a National Waste Awareness Campaign drawing upon traditional approaches from environmental education, community mobilization and the utilization of advertising, media, communications and community-based social marketing.

Endosulfan Removal by *Rizopus Arrihzus* Biomass

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Pesticides have been accepted as an integral part of modern agricultural practice. However, their extensive application has caused the pollution of soil, ground and surface water, which constitutes a serious risk to the environment and human health. Some of these pesticides have been reported to be persistent, toxic, mutagenic, carcinogenic, and tumorigenic. Particularly, the organochlorine pesticides, being lipophilic, hydrophobic and with low chemical and biological degradation rates, have been found to accumulate in biological tissues with subsequent magnification of concentrations in organisms, and progressing up the food chain. Hence, the usage of many organochlorine pesticides has been either abandoned or banned in most of the developed countries. As per BIS (Bureau of Indian Standards), the pesticide residue should be absent in drinking water and should not exceed 0.005 ppm in surface waters. Endosulfan, a highly toxic organochlorine insecticide and acaricide, is one of the most widely used pesticides in developing countries as well as parts of Europe and Africa and has been found contaminating surface waters, soils and ground waters. The removal of pesticides by conventional methods is found to be either uneconomical or insufficient. Recently, the biosorption, i.e. the passive uptake of pollutants from aqueous solutions by the use of non-growing or non-living microbial mass, has emerged as a better option which allows the recovery and/or environmentally acceptable disposal of the pollutants.

In the present study, fungus *Rhizopus arrizus* NCIM 997 is employed as a model micro-organism for investigating endosulfan adsorption from aqueous phase. In the adsorption experiments carried out for durations of three days, different doses of biosorbent prepared from the fungal biomass ranging from 2.5 to 50 mg were added to an endosulfan solution of 1 ppm. The adsorbed endosulfan on the fungal biomass was extracted easily by n-Hexane solvent and the extract was analysed using high-resolution gas chromatograph. The biosorbent was found to remove 87.9% of endosulfan from water. The suitability of the Freundlich, Langmuir and BET adsorption models to the equilibrium data was investigated for the endosulfan-biosorbent system. The results showed that the equilibrium data for endosulfan-biosorbent system fitted the Langmuir model with a correlation coefficient of 0.9536.

Water and Sanitation

Adaptiveness and the Role of Institutions of Governance in Water Sector: A Futuristic View

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The state of the environment has been a growing concern over the past century. The modern governance system and industrial economies have failed to manage the environment, and concerns about its sustainability and the sustainability of the human race have abounded. Enough has been said about the harm done to nature by the rapid industrialisation and the so called march of development through modern scientific times. This is an age where every individual is 'institutionalised' in Geoff's words. We are all constrained by institutions in our thoughts and endeavors. As such, it is critical that we look at the role of institutions in the context of Environmental and Sustainable Development (ESD) and governance. Hayek had professed that *"the economic problem of society is mainly one of adaptation in particular circumstances of time and place."* Contemporary wisdom tells us that governance is mediated and facilitated by institutions in the modern world. It is in this light that the present paper looks at the role of adaptiveness in institutions and what it means specifically in the context of governance in the Water Sector. It identifies specific trends like climate change and changing landholding patterns and links institutions and adaptiveness in two ways, placing each at the macro and micro level respectively. It discusses how adaptiveness has a different meaning in each scenario and also its likely impact on governance. Thus a new way at looking at institutions for ESD and governance is presented here.

Right to Water - Commodification of a Fundamental Facet of Human Rights in the Era of Globalisation

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The era of globalisation has commodified even the feelings of the people; the effect of this is that everyone tries to make money out of the indigence of another. MNC's like Suez, Vivendi, Radius Water Inc., Pepsico, Coca Cola and Indian corporations like Tata are already in the field of water trade, with several other Indian corporations like Reliance also setting their sights on this field. There is an extensive body of covenants and international agreements formally identifying and declaring a range of human rights.

The right to water is fundamental to life and health. Sufficient and safe water is a precondition for the realisation of human rights. The growing scarcity of freshwater on a global scale has become a matter of grave concern in these times and the United Nations has also expressed concern, especially after the emerging worldwide trend of trade in water and water bodies. The general principles of law which act as a source for legislative instruments and judicial decisions, prohibit privatisation of water: one such principle is the Public Trust Doctrine. This Doctrine is a part of the law of our land. The Supreme Court itself has said that the government holds water in India as a trustee on behalf of its people and thus is in the domain of public trust. There have been both express and implied references to the right to water in both national and international laws.

The present paper tries to justify the right of the people to have free access to water and brings out the disadvantages of privatisation and commodification.

Water Supply and Sanitation Improvement in Urban Poor Communities in Nepal – A Study

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Urbanisation is one of the most pressing concerns in Nepal today. According to the 2001 census, 3.3 million people or 14.2 percent of the Nepalese population lived in 58 municipalities. The

government predicts that by 2011, 24 percent of the total population will be living in urban areas. Although urbanization is a relatively new phenomenon in Nepal and the percent of total population living in cities is still small compared to other countries, the rate of urbanization is very high. According to census data, between 1991 and 2001, the municipal population increased by 94 percent or 6.8 percent per year.

With rapid urbanization, wastewater management is emerging as a major challenge in most developing countries. Discharge of untreated effluents in water bodies is leading to the deterioration in the quality of rivers in most urban centers in Nepal and this has significant adverse impacts on human health and environment. Conventional wastewater treatment systems are often very expensive and complex. Local governments, which usually have very limited human and financial resources, are struggling to find an appropriate solution to the problem of wastewater management. Lack of strong legislation to control wastewater discharge and the institutional capacity for integrated planning and management, is making environment management a significant challenge in the urban centers of Nepal.

The rapid and haphazard urbanization is exerting immense pressure on the urban environment and the municipal managers, who often do not have sufficient expertise and resources to deal with such rapid growth. With the enactment of the Local Self-Governance Act, 1999, municipalities have been given many additional responsibilities, but adequate measures to enhance their capacities to deliver these services have not been made. As a result, many cities in Nepal are facing environmental problems such as solid waste management, wastewater management and drainage.

Youth

ESD through the Use of the UNEP's AEO for Youth Practices and Pachamama Books in Rwanda

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Environment education is lacking in Rwandan schools, despite the fact that, it has been made one of the priorities in the Action Plan for the Conservation of Biodiversity in Rwanda.

ESD (Education for Sustainable Development) is one of the priorities of the Millennium Development Goals. In order to achieve ESD, young people must be sensitised and encouraged to change their behaviours and practices towards the environment, and this of course needs to be integrated in the whole of Rwandan Society.

"Messages from Governments, exhorting people to drive their cars less or admonishing them for buying products that cause environmental damage, appear not to be working. People are simply not listening. Making people feel guilty about their life-styles and purchasing habits is achieving only limited success." - Klaus Toepfer, Executive Director of UNEP.

There is a great need to use practical environmental methods, which will stay in people's minds. This is why Rwanda Environmental Conservation Organisation – RECOR – has joined other African Youths in the UNEP's AEO for youth practices, and has undertaken several activities in environmental education involving young people in environmental conservation, thus contributing to ESD in Rwanda.

In one of the efforts of UNEP, youth in other parts of the world have been involved, who have come out with an environmental education publication - PACHAMAMA, which helps to teach young people about the future of our earth and uses nature as a guide.

These books, launched by the Minister of State for Lands and Environment in the Southern Province, have been used by RECOR and we are now in a process of extending their use in all schools in Rwanda, which, we hope, will pave the way for a sustainable environmental education in the country and thus bringing about ESD.

Inspiring Young Emerging Leaders: Creating a Sustainable Future!

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Crissy Field Center, located within a U.S. national park, offers programs that connect diverse populations of the San Francisco Bay Area to local environmental issues. Working in partnership, the Center engages the inner-city youth by focusing on the convergence of the urban and natural worlds through multicultural perspectives. The Center serves thousands of people each year through school field trips, workshops, after school programs, summer camps, and youth leadership programs. This presentation will focus on the Center's *Inspiring Young Emerging Leaders* (I-YEL) program. I-YEL encourages, prepares, and challenges diverse teenagers to be environmental advocates and entrepreneurs for social change. I-YEL is initiated, designed, and coordinated by youth, who receive training and support in planning and implementing projects which create positive change in their communities. Through environmental education, leadership development, academic and career planning, combined with personal goal setting, participants acquire skills and experiences that last a life-time. I-YEL is integral in educating their peers, and others, through sustainable practices and seeking innovative, long-term solutions to urban environmental issues. Youth make a minimum commitment of one year (many return), meeting once per week, after school, and three Saturdays each month. Youth participate in activities such as teaching drop-in programs at the Center, outreaching in communities, attending conferences, and creating their own service projects. The program model will be explained, best practices shared, and results of a recent evaluation study showing evidence of how this program contributes to sustainable development for youth and their communities shared.

Linking Education for Sustainable Development (ESD) and Responsible Conduct of Research (RCR): Training Young Researchers at INRA, France

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Both Education for Sustainable Development and Education in Responsible Conduct of Research (ERCR) call for a re-orientation of educational approaches - curriculum and content, pedagogy and examinations. Both aim at developing individuals into reflective thinkers, connected and autonomous learners, ethical and responsible citizens. High-quality education must be interdisciplinary, holistic and values-driven. It must emphasize critical thinking, communication skills, problem solving and participatory decision-making. Enquiry based learning (EBL) and enquiry learning models are hailed as the approaches that will revolutionize schools and teaching, transforming students from passive receivers into active partners in the learning process.

Training future generations of researchers and enquirers in various fields of knowledge and activity is a vital issue in our knowledge-based society. Yet the quality of the education and training young researchers receive has been widely criticized worldwide and things change only very slowly. We take the example of an innovation constructed within a research organization (French National Institute for Agricultural Research – INRA): *Réflexives®* is a training scheme integrating the issues of ESD and RCR, for an audience of doctoral students and their supervisors, postdocs and mentors. The results of its evaluation are presented and the capacity of the research organization to take ownership of the innovation is discussed in this paper.

Convincing the research community at large that ESD and RCR must be linked is crucial to accelerate change and foster new approaches for the training of future generations of scientists who need to be educated as responsible citizens caring for society's needs and for a sustainable future.

Rehabilitation process based on Environmental and Outdoors Activities

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One of the problems that the rural young people in Colombia confront as a part of their normal life is that their contact with nature is slanted by the fear and uncertainty of finding an antipersonnel mine. Colombia is one of the most biologically diverse countries but unfortunately it is at the same time a country whose territory is peppered by antipersonnel mines, mainly in areas far away from the great urban centers where great natural wealth is present.

According to statistics, 25% of the civil populace victims of antipersonnel mines are youngsters and children. In order to confront this problem and to connect the young victims of antipersonnel mines with nature, a test project of environmental education and rehabilitation was carried out jointly by the Organización para la Educación y Protección Ambiental - OpEPA- and by the Centro Integral de Rehabilitación de Colombia - CIREC.

In this project, we are working with 40 young people with some type of physical disability (some are victims of these antipersonnel mines) in a process of youthful empowerment. Through impactful outdoor activities like scuba diving, canopy and rafting, it has been possible to make the young people become agents for change and leaders within their community, fortifying their process of integration in the society through rehabilitation. As a result of this program, the young people have created a network of young victims that allows them to develop their own projects related to environmental subjects, peace and sports. These activities help them reconcile with their surroundings and their country, becoming spokesmen for the natural wealth of the country and models of personal victory and youthful leadership.

ZOO EDUCATION

Learning from Docent-Visitor Interactions at Zoos: Intentions, Perceptions, and Observations

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Conservation education at zoos, parks and other free-choice conservation settings is geared towards building conservation and environmental issue awareness, engendering positive attitudes towards sustainable living, and fostering appropriate behaviors. For this purpose, certain key conservation messages that relate to the mission of the institution are taught. These messages are communicated through a variety of channels ranging from interpretive signage, to resource elements (e.g. animals, scenic vistas, etc) and personnel (e.g., docents, volunteers, and interpreters). This paper reports on a study to examine perceptual factors that influence message related learning from informal docent-visitor interactions at zoos. An emergent design with mixed methods was used in this three-phase study. Docents and visitors were interviewed in phase I. In phase II, docent-visitor interactions were observed, and some of these observations were followed up by interviews. A visitor exit survey was used in phase III to assess perceived efficacy of docents as a message source. The study found that though docents believed their role was to teach visitors about conservation, actual message communication was limited. The nature of messages influenced the docents' ability to teach these messages; docents were not very successful at teaching affective and higher order cognitive messages. Despite this, visitor perceptions of docents as a good source for messages led them to attribute messages to docents that were in actuality learned from other elements of the exhibit.

The Smithsonian Institution's International Environmental Education and Wildlife Management Training Programs

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The World Conservation Strategy identifies three high priority issues: (1) the establishment of protected areas; (2) public education; and (3) training of conservation personnel in tropical countries. The Smithsonian has chosen to focus its resources on issues two and three - the training of conservation personnel and public education. Without trained personnel and heightened public awareness, efforts to protect natural habitats rarely get beyond the planning stages. Trained personnel are the essential catalysts for the establishment of protected areas and the implementation of public education programs.

To meet the challenge of personnel training, the Smithsonian Institution launched a program in 1981, to provide training to mid- and upper-level personnel of developing countries. Thus far, the program has conducted about 135 courses and workshops and trained over 2300 resource managers, wildlife biologists, and environmental educators from 81 countries. The workshops were conducted in order to provide intensive training in topics that were specifically requested by developing countries.

The presentation at Tbilisi plus 30 will review the Smithsonian's international training program and provide specific examples and success stories with a focus on the Applied Environmental Education (AEE) training component of the overall program. The AEE program provides training in the use of public education and communication strategies as tools to promote effective, sustainable resource management.

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