

TRADITIONAL KNOWLEDGE AND BIODIVERSITY

LEARNING CONTRIBUTIONS OF
THE REGIONAL CENTRES OF
EXPERTISE ON EDUCATION FOR
SUSTAINABLE DEVELOPMENT



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Foreword

The UN Conference on Sustainable Development (UNCSD, 2012) was a landmark event in the history of sustainable development in that countries agreed to a 'Future We Want'. Twenty years ago the UN Conference on Environment and Development (UNCED, 1992) provided for Agenda 21 that laid the framework for sustainable development. Chapter 36 specifically addresses reorienting education towards sustainable development, and encompasses all streams of education, both formal and non-formal, basic education and all the key issues related to education for sustainable development. Actions to achieve this resulted in a series of initiatives around the world at national, regional and global levels.

During the World Summit on Sustainable Development in Johannesburg in 2002, 11 of the foremost educational and scientific organisations in the world signed the Ubuntu Declaration with a goal to strengthen collaboration between science and technology researchers and educators, to better integrate science and technology into educational programmes for sustainable development, for all subjects and at all levels, and to strengthen cooperation between formal, non-formal and informal education.

Education for sustainable development (ESD) is seen as not just environmental education nor even sustainable development education, but "education for sustainable development". ESD covers not only environment and natural resources management but much broader topics such as poverty alleviation, gender, peace and dispute settlement, inter-cultural understanding, democracy and others. The Regional Centres of Expertise on ESD (RCEs) were established to mobilise many and serve to give focus to their contributions in creating, jointly, a global learning space for sustainability.

We are living in a time of profound change in an increasingly interlinked world. These changes are for both better and worse. The role and relevance of education has continued to attain importance with countries vying for top spots in ensuring education provides for development as well as the economic empowerment of its people.

Biodiversity, traditional knowledge, poverty reduction all are topical today for the linkages that exist on the ground where communities have time and again proved that their knowledge and practices outweigh the risks associated with technology-based interventions to achieve sustainable development either as a macro-economic component or as a micro-enterprise led development. Recognising the need to learn from the ground and collate the experiences of communities on issues of managing natural resources, especially biodiversity, sharing the same, contributing to local well-being models, this publication comes at an appropriate time when the topic of 'Biodiversity and Livelihoods' has recently received significant attention at the eleventh meeting of Conference of Parties to the Convention on Biological Diversity (CBD COP 11) in Hyderabad, India in October 2012.

The case studies examined in this publication are characterised by local expertise being brought together for transformative learning. Be it the bio-cultural approaches or the contexts of today's policymaking, the case studies demonstrate the need for three key approaches to ensure education for sustainable development is successful. First, the need for 'learning by doing'; second, the value of learning from practitioners and third, the importance of collective interventions.

I am confident that this publication will further enhance the visibility of RCEs as key hubs for knowledge and experience based learning and congratulate the authors and editors for their efforts.

Balakrishna Pisupati
Chairman, National Biodiversity Authority
Chennai, India

September 2012

The recognition of the contribution of relevant traditional and indigenous knowledge in relation to actions in support of biodiversity conservation and its sustainable and equitable use goes beyond its simple validation in the context of conventional science-based approaches to the study of biodiversity. Traditional and indigenous knowledge related to biodiversity is central to elucidating its status and trends and for developing plausible scenarios based on community participation with regard to the way biodiversity is conserved and used.

Biodiversity-dependent services such as provision of food and fiber, purification of water and air, climate regulation and many cultural and spiritual values that depend on it are key to human well-being and sustainable development. Learning about biodiversity, about how traditional and indigenous holders of biodiversity-related knowledge cope with biodiversity, how this knowledge is used to effectively manage biodiversity and to maintain ecosystem services at various scales, as well as which are the most appropriate approaches to promote education and raise further awareness on these issues – all of this has been part and parcel of the mission of Regional Centres of Expertise on Education for Sustainable Development (RCEs) since their inception.

This book constitutes an important contribution to multistakeholder learning in the area of biodiversity and traditional knowledge at the nexus of the goals of the UN Decade on Education for Sustainable Development (2005-2014) with those of the UN Decade on Biodiversity (2011-2020), which are mutually reinforcing.

The book provides an important reality check on the way traditional and indigenous knowledge on biodiversity is being increasingly widely recognised – in the variety of social, cultural, economic and environmental contexts covered by the case studies treated in the book.

Until a few years ago only, the notion of bio-cultural diversity was still being questioned. Today, bio-cultural protocols are being designed and implemented to regulate access to biodiversity and the sharing of the benefits arising from its utilisation at the local level in several countries and regions in the world as a concrete way to operationalise the Nagoya Protocol on Access and Benefit-Sharing under the Convention on Biological Diversity.

This book demonstrates further the interlinkages between biological and cultural diversity and raises important questions for further research and for the development of policies which can be better reflective of a more integrated approach to dealing with biodiversity i.e. an approach which takes the cultural element of sustainable development into due account. Not surprisingly, the education and learning experiences conducted in the context of the RCEs reveal how artificial separating biodiversity knowledge from culture can be. It is only through a process of co-learning among all stakeholders concerned with biodiversity – each representing a cultural perspective – that appropriate biodiversity and ecosystem services policies can be co-designed.

The lessons learned through the experience of the RCEs are elucidated in this book, including on how to document those experiences, anticipate the direction which the international science and policy debate on biodiversity has taken with regard to the recognition of relevant traditional and indigenous knowledge. It is now widely recognised that processes at the science-policy interface, such as the Intergovernmental Panel on Climate Change and the newly-created Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, must also work with non-peer reviewed, grey literature and with relevant knowledge held by local and indigenous communities.

The RCEs constitute not only a network of projects but also a knowledge network from the experience of which multiple stakeholders can benefit – governments, scientists, multilateral environmental agreements, civil society organisations, and the private sector. The ultimate objective being learning together about and acting together for the sake of biodiversity, human well-being and sustainable development.

Salvatore Aricò
Coordinator, UNESCO-wide Biodiversity Initiative

November 2012

Two decades have passed since nations of the world assembled in Rio de Janeiro and agreed to adopt a sustainable development (SD) agenda, promising to chart a development path that is equitable, environmentally just and economically rewarding. We now stand at a crossroads looking for the right path towards the world we want. The prognosis is not encouraging. According to many studies conducted by research or policy bodies, we seem to have made some progress, but still fall far short of what is required to sustain current levels of well-being. Negative environmental trends continue to be exacerbated by human interventions – primarily led by a model of unsustainable and conspicuous consumption

The unsustainable conversion of natural capital for supporting this emerging consumer culture while ignoring the ecological consequences to economies and other aspects of well-being has become quite entrenched. The extraordinary emphasis on developing produced capital appears to have overwhelmed all other aspects of natural capital required for our well-being.

On the positive side, there is expanding awareness and a growing acknowledgement of this gap in our planning and implementation processes. Increasing resolve to align production activities with environmental and equity considerations, and efforts aimed at reforming global institutional structures to create more synergies and effective implementation of relevant policies are welcome signs of change. Indeed, the eleventh meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP 11) is seen as an opportunity to streamline various decisions and focus on implementing them to achieve the different objectives of the Convention, and more broadly, that are relevant to global goals.

Research and capacity building activities at the United Nations University Institute of Advanced Studies (UNU-IAS) have examined various aspects related to the rubric of governance challenges in achieving SD – from a focus on broad-based development and well-being at the community level, equity issues related to urbanisation and its implications for environmental resources, to innovations that could aid in achieving global goals for policy-making for SD. This publication analyses

a diverse set of biodiversity and traditional knowledge related case studies from various Regional Centres of Expertise on Education for Sustainable Development and highlights the need for strengthening multistakeholder, cross sectoral partnerships at the local level for effective implementation of global and national strategies and targets. It also draws attention to the importance of education, communication and awareness building in this context.

Our broader research indicates that despite the exalted nature of global goals, they become relevant only when defined and shaped into pragmatic objectives and actions. This would require cooperative action by all stakeholder groups, implying that future policy processes need to ensure their relevance at various levels to guarantee successful implementation. This is no easy task, but by no means an impossible one. Current accepted standards of practice and business norms must be re-oriented to include a more consultative policy setting with all major actor representatives. It would require designing regulations that acknowledge the need for balance among all forms of capital, and incentives that provide equitable access to resources and services.

There are a number of expectations from the outcomes of CBD COP 11, particularly on how the decisions will be transformed into action and results. UNU-IAS stands ready to work with its existing and future collaborators to transform our aspirations into reality as we move forward in translating the sustainability agenda into action. Partnerships with the Regional Centres of Expertise on Education for Sustainable Development are one of the significant avenues to realise this ambitious task through learning and capacity development.

Govindan Parayil
Director, UNU-IAS and Vice-Rector, UNU

October 2012

Global Map of RCEs

The ESD Programme at UNU-IAS created a global network of more than 100 Regional Centres of Expertise on Education for Sustainable Development (RCE) worldwide. The RCEs provide a framework for strategic thinking and action on sustainability by creating diverse partnerships among educators, researchers, policymakers, scientists, youth, leaders within indigenous communities and throughout the public, private and nongovernmental sectors.

Because of each RCE's diverse network of partners and their wealth of local knowledge and resources, they have the potential to transform the way we approach traditional knowledge and biodiversity issues. Globally, RCEs have launched a number of groundbreaking ESD initiatives that address some of the greatest challenges we face in safeguarding biodiversity and traditional knowledge.

AFRICA & MIDDLE EAST

- Cairo, Egypt
- Ghana
- Greater Mbarara, Uganda
- Greater Nairobi, Kenya
- Jordan
- Kakamega-Western Kenya
- Kano, Nigeria
- Khmomas-Erongo, Namibia
- Kuwa-Zulu Natal, South Africa
- Lagos, Nigeria
- Lesotho
- Makana & Rural Eastern Cape, South Africa
- Maputo, Mozambique
- Mau Ecosystem Complex, Kenya
- Minna, Nigeria
- Senegal
- Swaziland
- Zomba, Malawi

THE AMERICAS

- Bogota, Colombia
- British Columbia (North Cascades), Canada
- Chaco, Argentina
- Curitiba-Parana, Brazil
- Grand Rapids, USA
- Greater Sudbury, Canada
- Guatemala
- Lima-Callao, Peru
- Montreal, Canada
- North Texas, USA
- Rio de Janeiro, Brazil
- São Paulo, Brazil
- Saskatchewan, Canada
- Tantramar, Canada
- Toronto, Canada
- Western Jalisco, Mexico

ASIA-PACIFIC

- Anji, China
- Arunachal Pradesh, India
- Bangalore, India
- Beijing, China
- Bogor, Indonesia
- Bohol, Philippines
- Cebu, Philippines
- Cha-am, Thailand
- Chandigarh, India
- Chubu, Japan
- Delhi, India
- East Kalimantan, Indonesia
- Gippsland, Australia
- Goa
- Greater Dhaka (IUBAT), Bangladesh
- Greater Phnom Penh, Cambodia
- Greater Sendai, Japan
- Greater Western Sydney, Australia
- Guwahati, India
- Hyogo-Kobe, Japan
- Ilocos, Philippines
- Incheon, Republic of Korea
- Kitakyushu, Japan
- Kodagu, India
- Kyrgyzstan
- Lucknow, India
- Mumbai, India
- Northern Mindanao, Philippines
- Okayama, Japan
- Pacific Island Countries
- Penang, Malaysia
- Pune, India
- Shangri-la, China
- Southern Vietnam
- Srinagar, India
- Tongyeong, Republic of Korea
- Trang, Thailand
- Ulju, Republic of Korea
- Western Australia
- Yogyakarta, Indonesia
- Yokohama, Japan

EUROPE

- Açores, Portugal
- Barcelona, Spain
- Central Macedonia, Greece
- Creias-Oeste, Portugal
- Crete, Greece
- Denmark
- East Midlands, UK
- Espoo, Finland
- Graz-Styria, Austria
- Hamburg, Germany
- Ireland
- London, UK
- Munich, Germany
- Nizhny Novgorod, Russia
- North East, UK
- Nuremberg, Germany
- Oldenburger Münsterland, Germany
- Porto Metropolitan Area, Portugal
- Rhine-Meuse
- Samara, Russia
- Severn, UK
- Skåne, Sweden
- Southern North Sea
- Vienna, Austria
- Wales, UK
- Yorkshire & Humberside, UK



List of RCEs as of July 2012

Traditional Knowledge and Biodiversity within Regional Centres of Expertise on Education for Sustainable Development

Unnikrishnan Payyappallimana

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Rob O'Donoghue

RCEs, Traditional Knowledge, Biodiversity & ESD

Regional Centres of Expertise (RCEs) were developed as sites for participatory learning and action within the United Nations Decade of Education for Sustainable Development (DESD), opening up more collaborative and inclusive learning spaces towards more just and sustainable ways of life now and in the future. Some of the contours of these emergent education processes of collaborative learning-to-change are reviewed as they relate to traditional knowledge (TK) and biodiversity, and are developing in many RCE contexts today. This editorial takes particular note of how RCE processes that include traditional knowledge practices are emerging to address biodiversity loss within a social-ecological perspective across heritage, local issues and the current state of our environmental knowledge. It also discusses how multistakeholder, cross-sectoral initiatives such as RCEs open new opportunities for various knowledges, especially traditional knowledge, to interact on a new and equal footing, for the benefit of (sustainable) development. The RCE cases examined in this publication are characterised by local expertise being brought together in open-ended, practical and co-engaged approaches to social and transformative learning. The RCE approaches reposition the available expertise in collective learning-to-change endeavours where a grasp of what is changing and producing risk is practically deliberated across what is known and what might be done about the problems that are confronting a society.

The local heritage of traditional knowledge practices and patterns of valuing in relation to biodiversity have not always been read within an open-ended bio-cultural diversity perspective such as this. The development and learning within the RCEs that recognises the often plural and yet integrated nature of the inhabitants of modern social-ecological systems is often possible as the RCEs are governed by the ESD principles that recognise a need for multiple perspectives in learning while acknowledging the complexity of working across sectoral and disciplinary boundaries – challenges that are addressed in this book.

Bio-cultural Diversity and Sustainable Development

In its broad sense the term bio-cultural diversity denotes an inseparable link between the diversity of life forms, their ecosystems and environments on the one hand and the array of human-made expressions in relation to these. In totality, this view has come to encompass genes, species, ecosystems, landscapes, and seascapes to worldviews, belief systems, knowledge, morals, values, norms, languages, rules, artistic expressions, artifacts and institutions of a region that have generally been passed on through an intergenerational transmission process and shared by a group (Haverkort et al 2006; Ibisch et al. 2010). A social-ecological approach here reiterates the inherent, dynamic relationship between nature and humankind and hence a biological and cultural diversity perspective for development towards a sustainable future. From a utilitarian point of view, bio-cultural diversity impacts on human well-being through ecosystem services as well as cultural resources in sectors such as agriculture, health, food security, environmental protection, purification of air and water, climate regulation, natural resource management, land use, livelihoods, disaster management, arts and culture among many others. Consider, for example, the case of traditional knowledge in the realm of medicine: The World Health Organization (WHO) estimates that traditional medical practices cater to a major percentage of (in some regions) up to 70-80% of the world population's health requirements especially in developing countries (WHO 2008). As described in several case studies in this volume, the inherent link of community-specific knowledge with local ecosystems is obvious in the usage of plants, and animal and mineral/metal derivatives that are primarily locally available and easily accessible in traditional health cultures. Upholding and revitalising such knowledge is seen as an important mechanism for affirming identity and social cohesion and has a vital role in local livelihoods and socioeconomic and cultural systems. In mega-diverse countries that are experiencing rapid economic and social transition, bio-cultural diversity holds major untapped potential for poverty alleviation and local development in multiple sectors (Ibisch et al. 2010).

However strong the reliance of human existence on biodiversity, its rapid decline due to human interventions is alarming. The millennium assessment report indicates that developed and fast developing regions with higher gross domestic product (GDP) have critical loss of biodiversity (MA 2005). Corresponding to the loss of diversity in traditional languages the world over, traditional knowledge practices are also eroding at a rapid pace. The loss of biota and associated traditional knowledge practices can have a significant negative impact on the livelihoods, production systems (bio-resource-based markets) and the health of local communities (TEEB 2010, Suneetha and Balakrishna 2010). The erosive trajectories here are compounded by the concern that there are no comprehensive approaches to valuing these ecosystem services as policy makers often have less conviction, compared to other sectors, regarding the need for national and subnational level efforts for conservation and development in the sector. While such dominant practices are rooted in the history of governance towards biodiversity (Box 1), assuring conservation and sustainable use of biological resources is increasingly becoming a high priority area in the sustainable development (SD) agenda. Whereas regulated, sensitive use is important for sustenance of biological diversity, augmented, active use as social traditions is vital for revitalising as well as protecting traditional knowledge practices. Increasing social and economic disparity and inequitable access to resources and benefits is an area which has been in active discussions both at international as well as national policy processes. Recognising the potential of local livelihoods through appropriate Access and Benefit Sharing (ABS) mechanisms is an area which is still in nascent stages. These challenges are often dealt with individually and not in an integrated manner at the level of implementation. For instance, in the case of improving nutritional or health security, conservation programmes of local cultivars or varieties may not necessarily be based on the contextual nutritional needs or the knowledge or technical resources available within a region. The ecosystem services framework to a great extent addresses the issue by broadening the perspective of biological and cultural diversity. To be effective, local development approaches need integrated frameworks and strategies related to various resources such as biological, knowledge, human, social, economic, cultural as well as produced.

Box 1 Development Context – Changes in Perspectives

Policy, as a policed course of action in the governing of civil society for the common good, has seldom taken account of TK in environmental management practices for biodiversity conservation. Traditional ecological practices were most often seen as destructive, notably the use of fire to manage range lands or shifting agriculture where slash and burn methods were used. Traditional uses of plants by indigenous communities were noted and documented for commercial exploitation, most often without reference to the communities that were custodians of that knowledge. Prior to recent global conventions, policing regulations often encouraged the exploitative mining of cultural capital with the appropriation of local natural resources and natural resource areas.

The early approach here was thus to protect natural resource areas, taking little account of local knowledge and practices in relation to their natural history. Here indigenous peoples were often seen as noble but primitive communities that needed to be rescued from their ignorance and destructive practices. These, imperial and, later, some of the post-imperial policies consequently reflected a double separation: people from nature and institutions of governance from people. These separations opened up specialist outsider and institutional imperatives to educate by communicating the conservation message so as to change their behaviour.

The last 50 years has produced a slow shift in policy across the globe and the beginnings of social-ecological perspectives being brought into community engaged policy development are emerging within new multilateral perspectives on cultural diversity and traditional knowledge. The attendant concern for traditional knowledge practice and the democratic inclusion of indigenous peoples in co-engaged land use management decisions is being found to have a natural affinity, with an integrative perspective that has long been central to TK practices.

Here cultural knowledge and practices was the balancing facet between natural or ecological resources and human intervention and any development (Berkes and Folke 1994, Cochrane 2006). According to Breidlid

(2009) the modern hegemonic discourse of economic development has fallen short of exploring the potential of diverse knowledge systems, considering these as an impediment to development. A key challenge for stakeholders who are striving to promote the concept of SD is to find appropriate tools to convey the spearheading roles that cultural knowledge, norms and values play in achieving SD.

Contemporary Policy Context

The Convention on Biological Diversity (CBD) calls for the need to: respect, preserve and maintain traditional cultures; encourage customary custodial use of biological resources in line with principles of sustainable use and conservation; and ensure equitable sharing of benefits among holders while accessing biological resources and related knowledge in line with national legislation. By drawing attention to preserving local innovations and practices of 'indigenous and local communities following traditional lifestyles' it alerts the need for promoting awareness of the importance of biodiversity through various educational interventions, designing suitable educational curricula, and strengthening multilateral cooperation for education for conservation and sustainable use. Recent developments like the Aichi targets have completely recognised the importance of education awareness (particularly through Strategic Goal E, Box 2), which highlights the import of strengthening capacities and learning interventions of various stakeholders.

Box 2 Aichi Biodiversity Targets

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

The World Heritage Convention of UNESCO is an important instrument for the protection of cultural and natural heritage. The Convention on Cultural Diversity, yet another multilateral policy instrument of UNESCO, recognises the significance of cultural knowledge 'as a source of intangible and material wealth' especially in indigenous communities. By pointing to their constructive role in SD, it emphasises that "cultural diversity widens the range of options open to everyone; it is one of the roots of development, understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence" (UNESCO 2001: 13). Avowing the need for appropriate policies to strengthen the developmental role of traditional communities, UNESCO calls for cultural pluralism and free circulation of ideas. The importance of culture and development is fittingly underlined in the Convention by calling for national and international action that recognises the link in all countries, specifically in developing regions that still have rich repositories of this diversity. It says that there is a need to create a favourable atmosphere for production and propagation of varied cultural goods and services that have the strength to influence local as well as global levels (UNESCO 2005). By emphasising the central role of culture and complementary nature of economic and cultural dimensions of development the Convention highlights individuals' and communities' 'fundamental right to participate and enjoy.' As a core principle, protection, maintenance and promotion of bio-cultural diversity are vital requirements of SD for present and future generations, while equitable access to varied expressions and principle of openness and balance towards other cultures are equally important.

The Convention on Cultural Diversity (UNESCO 2001) calls upon parties to "endeavour to integrate culture in their development policies at all levels for the creation of conditions conducive to SD and, within this framework, foster aspects relating to the protection and promotion of the diversity of cultural expressions" (UNESCO 2005:13).

Conversely, there are different views and perspectives on the integration of cultural knowledge into development programmes. These range from a romantic (e.g. all practitioners are knowledgeable, logical and everything in tradition is sound) to a utilitarian (e.g. aspects have to be selectively studied to strengthen modern needs) to pluralistic (e.g. should be allowed to co-exist and play a complementary role) views (Haverkort 2006). While this complicates the need for many countries to have a clear national vision on how to integrate cultural knowledge in development, at the level of individuals and civil society groups several efforts are in progress in areas like health and nutrition, agriculture, rural livelihoods, and education, to name a few. Among programmes of multilateral organisations responding to this policy context, the RCE network is unique as a local-global collective learning space for ESD. Being sensitive to the need for diversity in development options, the community of RCEs has initiated a variety of projects, with some of them presented in this volume, of co-engaged learning in integrating TK in addressing sustainability challenges.

Learning Together in Development Context and Challenges

The United Nations University Institute of Advanced Studies Education for Sustainable Development Programme aims to, among other objectives, foster and mainstream intercultural approaches within a social learning process through multi-sectoral, collaborative and interdisciplinary methods. Bio-cultural diversity has been central to the Decade of Education for Sustainable Development (DESD) since the Earth Summit, yet it necessitates increased attention today in the wake of mounting challenges in the nexus of conservation and development. Learning institutions have a critical role in examining strengths and weaknesses of pedagogical approaches to initiate culturally and ecologically sensitive, transdisciplinary, transformative practices at all levels. Approaches that will, eventually, lead to transformation of developmental models. Some of the considerations for such change are presented in the following text.

The complex nature of the relations between human and natural encompassed by the social-ecological approach need to be addressed within the knowledge and learning system that appreciates dynamic complexity and inseparability of such relations. Furthermore, in order to produce change, the learning practices should go beyond change of values and attitude.

Changing practices is a complex process of behavioural shifts that are to be facilitated, in addition to cultivating new biodiversity attuned values, by the change of practices and culture of the society. Ultimately, the educational systems that seek transformation might need to engage multiple stakeholders that, through joint learning, simultaneously facilitate favourable conditions for the attitude-behaviour shift in individuals as well as gradual institutional shifts in the communities.

With accelerated speed of changes dramatically impacting the state of the ecosystems as well as global climate, fiscal, market, development, cultural and social conditions, we look for learning that links understanding of the society-biodiversity relations with the ability to collectively and continuously develop and test new models of production and consumption more fitting for maintaining ecosystems and improving lifestyles. Impact of climate change, pollution, overuse of ecosystems that feed into livelihood practices of small and large communities are the most evident points of current and future innovations for sustainable ecosystems use. In a way the point is demonstrated by the attempts of the farmers in the costal areas of Bangladesh – earlier biodiversity rich and currently dramatically degraded from the population and production pressures – to develop more environmentally benign and biodiversity friendly practices of organic agriculture – practices that are called upon by the impossibility to continue unlimited resource exploitation.

In various world regions, there is a major untapped potential for poverty alleviation and local development as a major percentage of global community that continues to have livelihoods in the nexus of biological and cultural diversity. Enhancing capacities of local communities for capitalising on this strength is another area that needs attention in ESD programmes.

The profound impact of biodiversity and TK on the various aspects of human existence – from culture and health to opportunities to sustain communities' livelihoods – call for the education that portrays the topic of biodiversity from multiple standpoints. Serving as entry points into the subject, angles that discuss gender, engaging the disenfranchised, and ecosystem services, to name a few, highlight the foundational value of biodiversity for many aspects of life but also the ways of dealing with it from the different perspectives.

For example *gender perspective* highlights the fact that while both man and woman depend on ecosystems (and have to be kept in mind in development efforts), their practices in using ecosystem services differ. Women in poor communities often provide most of the food but are seldom engaged in the decision-making. Their knowledge potential is rarely acknowledged and skills seldom harnessed in the developmental processes. *The ecosystems services perspective*, on the other hand, brings to the fore the need to question if the customary measurement of the biomaterials in tonnes or cubic metres is justifiable and calls for learning to focus on opportunities for different forms of valuation.

In different corners of the world, there *have now been many local initiatives that link TK and biodiversity*. It is important for learning institutions to critically examine the strengths and weaknesses of these approaches and to explore ways to upscale them and mediate their interplay with global policies and processes. In doing so, higher education institutions play a particularly significant role. They are widely regarded as capable to establish mechanisms that adequately bring TK forward and integrate with other knowledges through teaching and research programmes based on appropriate collaborative and interdisciplinary methods. Yet, to fulfill this role, the institutions of higher education themselves would need to undergo critical transformation leading to susceptibility of different forms of knowledge and engagement.

There are several socio-political as well as methodological challenges to integrating TK in sustainability-oriented learning processes. In many regions, research and education systems are externally mediated by universal standards paying little attention to the local knowledge and practices. In the cases where TK is used, predominantly by academia or private research entities, it is regarded as a subject, studies or deliverer of utilitarian functions. *Long term, coherent and critical engagement between various knowledges – engagement motivated by a sound development vision – remains rare.*

Appropriate learning methods with sensitivity to both the development aspirations of communities as well as epistemic integrity and coherence of local 'knowing' systems are essential. This may be achieved through culturally inclusive pedagogies and their integration into formal and informal learning processes.

Collective learning and inclusive co-engagement as requirements of knowledge development are critically important to address any aspects of sustainability. Work with such communities of practice is not an easy matter. Going against often dominant notions of consensus, which ultimately relies on similar principles and approaches, means learning to work with different perspectives within a particular practice, often accompanied by many conflicts and contradictions. Trans-sectoral, transdisciplinary co-engagement means developing new competencies of partnership, in acting and learning. This particular issue of collaborative learning and a perspective that, in the view of the authors, needs to be adopted by the multidisciplinary local consortia are addressed in the next section.

Regional Collectives of Learning Action at the Community Level

Since its emergence, the RCE network for ESD had immediate affinity to a more collaborative approach to learning. Within the community, the idea of regional centres that bring together local expertise appears to offer a better prospect of inclusivity, and better alignment for understanding and responding to social-ecological risks. Learning is more situated and reflects co-engaged, value driven approaches and reflexivity.

Changing practices is a complex process of behavioural shifts that are to be facilitated, in addition to cultivating new biodiversity attuned values, by the change of practices and culture of the society. Ultimately, the educational systems that seek transformation might need to engage multiple stakeholders that, through joint learning, simultaneously facilitate favourable conditions for the attitude-behaviour shift in individuals as well as gradual institutional shifts in the communities.

Central to an understanding of this shift is the idea that learning is both internally and externally mediated within processes of co-engaged practice. Elias (1987 and 1991) in his works on a long term social process reading of knowledge production, notes a continuous interplay of involvement and detachment. An emergent interplay of processes such as these can provide reflective distance often allowing one to get around problems to a more object congruent grasp of things. Similarly, Margaret Archer (2010) notes the role of internal conversation in emergent social processes that reproduce or change the understandings that inform the valued doings, beings and ways of knowing that people share.

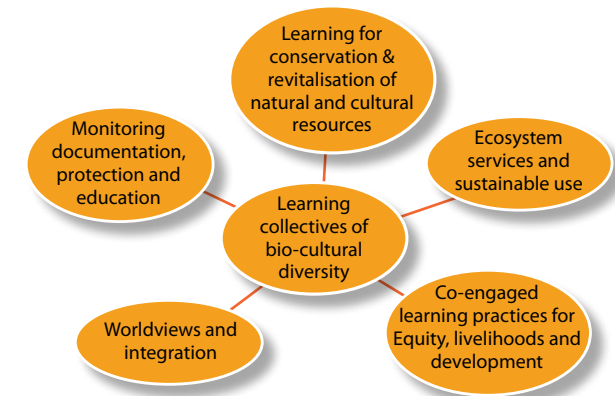
Here learning is approached as reflexive social processes that are at once place-based, individual and yet shared, cultural social practices within prevailing cultural capital (Bourdieu, 1990) and within surprisingly robust practice architectures that Kemmis and Mutton (2012) map in their recent study of education for sustainability (Efs). Working with an open-ended perspective on learning is producing a realisation that cultures cannot simply be treated as differing world views but as diverse perspectives within practice architectures that refer to a real world of objects and that lend themselves to diverse effects that all have consequences.

Once again the RCE offers promise as a site for co-engaged participants to be engaged in learning and action at a community level in a real world that is responding to and producing risk. Here worlds apart might be re-read as worlds co-engaged in deliberative change practices towards the production of more just and equitable worlds of practice with less risk and rectifying some of the degradation produced over a period of widening modernist exploitation and marginalisation.

The case studies presented in this volume highlight how local and regional consortiums that consist of educational institutions, government agencies, and civil society organisations can harness local resources and address challenges relating to sustainable development in the area of bio-cultural diversity. Keeping in mind the practice as well as policy context they are classified under five sections: Conservation and revitalisation of natural and cultural resources; Ecosystem services and sustainable use; Equity, livelihoods and development; Monitoring,

documentation, protection, and education; and Worldviews and integration.

Area of RCEs Contributions



Learning for Conservation and Revitalisation of Natural and Cultural Resources

We live in a time of catastrophic species extinction (e.g. according to IUCN Red List, between 12 and 52 species are threatened with extinction) which calls for local and global stakeholders of biodiversity to take urgent measures for their conservation. Benefits, such as provisioning, regulating, supporting and cultural services of ecosystems, were already mentioned earlier in this editorial. Preservation of biodiversity, as long established, is reasonably possible only keeping in mind the ecosystem approach. The ecosystem approach (EA) to management is defined by the Convention on Biological Diversity (CBD) as a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way".

Twelve interlinked Principles of EA emphasise, among other factors critical for management of biodiversity, the importance of involving all relevant sectors of society and scientific community, the need to balance local and wider public interests and the rights of the stakeholders, including indigenous peoples, to make their choices. (CBD 2012).

Looking at biodiversity through the prism of EA management one realises that the state of biodiversity and the dynamics of its use are defined by the multiplicity of policies, institutions, actions initiated by individual organisations and civil society. These make projects of the RCEs ever more important as they could not only pilot ambitious biodiversity projects but, being long-term functioning networks, might lead to engagement with alliances, strategies and projects leading, in time, to institutional arrangements for preservation of bio-cultural diversity in a particular region.

Although the case studies have been classified under specific categories based on the dominant focus of work, these projects have implications in other areas as well. For instance, RCE Penang's case study is mentioned under the equity and livelihood category, but the project also focuses on strengthening healers' networks and promoting sustainable use of medicinal plants. Similarly RCE Cebu, though categorised under ecosystem services and sustainable use, is actively involved in conservation of protected areas. Apart from revitalising cultural practices of the region, RCE Kodagu also engages in conservation of sacred groves and promotion of livelihood activities through forest products.

Suffering from the past forestry, mining and smelting activities that led to barren and contaminated land in the region, more than 30 years ago, the City of Greater Sudbury (the key partner of **RCE Greater Sudbury**) has initiated the Regreening Program. The new biodiversity action plan "Living Landscape" adopted in 2009 called for new efforts in developing self-sustained ecosystems. Through its multiple stakeholders RCE Greater Sudbury aspired to realise a comprehensive programme that included research, education and community engagement in regional regreening. Transplant of the forest floor from the healthy ecosystems has become the main technique of re-growth with other activities including creation of the seed bank by the local college, tracking and monitoring animals by the members of the public, on-line surveys for amphibians, research by higher education institutions, a variety of trainings and other capacity development activities. Partnerships, based on 'learning by doing', resulted in a holistic model for community development and led to lasting ecological recovery of the area.

RCE Porto, whose overall goal is development of human capital and preservation of natural capital, has initiated the "FUTURE – The 100,000 Trees" project in the Porto Metropolitan Area. Increase of urban biodiversity and care about ecosystem services are recognised by the partners as critical for delivering their multiple functions to human habitats. Through social learning and action networks, the RCE aspired to develop 100 hectares of native woodlands by the year 2015. Complex work ranging from reforestation areas identification to making landowner agreements, to needs identification and to volunteer training, engages 30 organisations. Among the partners are the Porto Metropolitan Area Coordination (16 municipalities), non-governmental organisations, the Portuguese Catholic University, several governmental offices, private companies, and private forest landowners associations. Collaboration of the partners, which is centred on mutual acknowledgement of responsibilities, an understanding of strengths and opportunities and focused on developing local capacity for future sustainable development of the forests, have resulted in increased public engagement, generation of new innovative ideas, zero-budget for project development and, ultimately, successful growth of urban forests. The practice of RCE Porto serves as an inspiration for similar projects in other parts of Portugal.

Priority work for **RCE Srinagar** and **RCE Guwahati** is reducing anthropogenic pressure on Himalayan ecosystems. In three cases reported by the RCEs local communities took a lead in conserving flagship species of Hoolock Gibbon in Assam (where agro-forestry practices are synergised with Gibbon conservation), Blyth's Tragopan in Nagaland (where youth was engaged in wildlife management and villagers in hospitality services for sanctuary visitors) and development of community owned wildlife sanctuary in Meghalaya. The RCEs' educational interventions range from awareness programmes on conservation for schools, communities, NGOs, youth, teachers, and faith organisations to training on management of biodiversity projects.

Apart from these, RCE Greater Dhaka's coastal area and mangrove ecosystem programme and RCE Cebu's project on protected areas also have a strong conservation focus.

Ecosystem Services and Sustainable Use

Ecosystem services on which humanity relies have become the benchmark for the success of local and global environmental governance. Studies provided by the RCEs demonstrate how ecosystem services contribute (or could potentially contribute) to the well-being of the communities. Interestingly, among the RCE partners, it is traditional knowledge and the holders of such knowledge that demonstrate the direct link between ecosystem services and food, health or other human needs. By being able, even in the absence of efforts for valuation of ecosystem services, to show the critical role of the ecosystem services on local resilience, the TK perspective reaffirms its own value. The contribution of TK becomes especially evident in cases where on going economic and financial struggle is combined with socio-political circumstances that eliminated or severely diminished knowledge of traditional practices (by either emphasising other forms of knowledge or eliminating TK as an inferior form of knowing). Rekindling TK related to food security, health of populations and livelihood production dependent on ecosystem services becomes not only an opportunity but an urgent need.

Management of ecosystems and their services in the context of multistakeholder initiatives, such as RCEs, and through co-engaged learning, provides an important opportunity for developing new, more flexible and adaptive approaches. Such approaches appear to be most suitable for engagement with complex systems in the situations of quick change, uncertainties and limited resources.

RCE Cebu works in Campo Siete (Camp 7), Minglanilla, which is an area included in the Central Cebu Protected Landscape (CCPL). Spanning an area of 29,062 hectares of adjoining forestlands and watersheds located in the middle of the island-province, this area is home to several endemic species, ecological resources including springs, rivers, caves, and a watershed. Communities in the nearby area are dependant on this forest for livelihood including timber and non-timber produce, agricultural land, or activities such as eco-tourism. RCE Cebu has done extensive biological resource and traditional knowledge mapping in this area through interactions with local healers. They have documented patterns of use of resources for food and medicine. Livelihood initiatives are

being supported through cultivation of medicinal plants and promotion of their sustainable use.

Once biodiversity-rich and today mostly densely populated floodplains and deltaic, Bangladesh suffered massive loss of biodiversity especially during the times of the Green Revolution. **RCE Greater Dhaka** is involved in restoring the biodiversity and management of the Ganges-Brahmaputra-Meghna floodplains with appropriate crops diversification strategies. It has started a study on crop diversification, traditional multiple and multistory cropping culture and also engaged graduate students to study the local indigenous rice varieties which are in culture in different parts of Bangladesh. The RCE creates awareness through programmes for youth and women that highlight the importance of biodiversity and the genetic resources for food and nutrient security as well as to protect the region from environmental degradation. The RCE also works on coastal area and mangrove conservation.

The RCE offers promise as a site for co-engaged participants to be engaged in learning and action at a community level in a real world that is responding to and producing risk. Here worlds apart might be re-read as worlds co-engaged in deliberative change practices towards the production of more just and equitable worlds of practice with less risk and rectifying some of the degradation produced over a period of widening modernist exploitation and marginalisation.

Co-engaged Learning Practices for Equity, Livelihoods and Development

A well recognised fact is that mega-diverse regions are faced with a complex dilemma of resource richness on the one hand and, poverty on the other. Recognising the critical developmental role of bio-cultural diversity studies suggest that organised advancement of bio-enterprise has potential not only in enhancing the livelihoods and well-being of both individuals and communities, but also improving conservation and sustainable resource use, as well as participation of different stakeholders in such measures. Creating appropriate policy frameworks, promotion of community-based livelihoods and related capacities, enhancing their access to national and international markets with ethical and equitable trade, and implementation of access and benefit sharing (ABS) frameworks are important goals in the direction (Jaramille 2010). Better awareness on the potential of bio-enterprises for eradication of poverty, assuring equity, and ethical practices are essential apart from delivering capacities and appropriate technologies for value addition.

Fair and just ABS evolved as an international mechanism for facilitating equitable partnerships of local communities (mainly with multinational industries or researchers) while sharing bioresources or traditional knowledge for

commercial purposes. Even after two decades of policy developments in this direction, its implementation largely remains in the form of pilot models lacking upscaling strategies. Whereas several communities have been actively pursuing such an approach, support for such initiatives within the policy processes has lagged behind. Studies show that ABS as a mechanism within local communities has key potential in improving livelihoods (Suneetha and Balakrishna 2009).

ABS as a model to promote local equity through a contractual agreement between multinational companies and communities, local initiatives such as bioresource cooperatives, producer companies, local protocols, and customary practices are to be supported, and could be seen as a critical element of developing new livelihood practices. Such livelihood models based on the principles of "growing from within" have shown that a health ecosystem and revitalised traditional knowledge can contribute to better livelihoods as well as well-being (Suneetha et al. 2010). This is in line with the Nagoya protocol preamble which notes "... the interrelationship between genetic resources and traditional knowledge, their inseparable nature for indigenous and local communities, the importance of the traditional knowledge for the conservation of biological diversity and the sustainable use." As many issues that become critical elements of ABS and are important for new livelihood models are still not adequately considered under the national legislations on ABS, RCEs have an important educational role in putting the ABS strategy into practice.

RCE Greater Phnom Penh works with two major stakeholders in the region: elementary schools and farmers. Promoting food, agriculture and environmental education has been a major thrust area in the initiative. In order to reduce the threat to local biodiversity as well as to maintain a healthy population, the partners have been involved in sustainable farming practices such as producing and applying compost, pellet compost, liquid bio-fertiliser and bio-pesticide promoted at elementary schools as well as local communities. For elementary schools, school gardens have been a key activity. Awareness creation and capacity building are conducted regularly for local farmers in organic farming.

Being a domain of aging healers, surrounded by neglect and misunderstanding, traditional knowledge of household health and nutritional care has been disappearing in many parts of the world in spite of its critical importance to local communities. To address the challenge in its own region, **RCE Penang** has engaged representatives of research institutions, industries, the agricultural sector and local communities in exploratory and action research of TK by documenting, learning and developing regional livelihood practices. Learning that resulted from engagement of multiple partners has been participatory, informal and has led to rich results. The awareness programme developed for the schools and the communities by the researchers and students of the university brought appreciation of the conservation and sustainable use of the medicinal plants. Understanding of the values of the TK and biodiversity-supported development of the livelihood activities around development of more than 30 commercial products from torch ginger, led not only to financial gains but to the enhanced sense of self esteem and further entrepreneurial innovations. The project has also become a catalyst for innovative experiments such as using abandoned agricultural lands for cultivation through partnership. RCE Penang plays a critical role as a liaison between the industry and the agricultural clusters. Ongoing engagement in the inter-RCE TK and biodiversity group assists the RCE in engagement with research and development partners across other RCEs and beyond.

A key activity of **RCE Yogyakarta** is the preservation of Pandanus species in the region and revitalisation of traditional knowledge in local communities. The region is rich in natural fibres. Consequently, there has been rich traditional knowledge related to weaving here. However, this tradition has been slowly eroding. As an economic incentive for local participation in conservation of natural resources and TK preservation, the RCE has developed an enterprise activity with products made of Pandanus fibre. The activity is carried out in a unique model of university-local community collaboration called Student Community Service-Community Empowerment Learning (SCS-CEL). The benefits of this social learning programme are that it sensitises the students on the need to look at issues in the immediate neighbourhood and address them through a multistakeholder, participatory approach.

Monitoring, Documentation, Protection, and Education

Inadequate monitoring and documentation of biocultural resources has been a major challenge in most countries. In certain regions of the world only a fraction of biological resources have been identified. The case of traditional knowledge is no different, with hardly sufficient systematic documentation of cultural practices in various biogeographic regions or sectors. In most local communities the knowledge is transferred in oral form and there is a rapid erosion of these knowledge practices. This raises two major concerns: the challenge of preventing loss of biodiversity or erosion of traditional knowledge as well as protection from misappropriation of resources and associated TK. There are several other related issues such as assuring safety and quality of resources or knowledge, valuing resources and related knowledge, creating awareness and so on. Development of community biodiversity registers is considered a *sui-generis* mechanism under the national biodiversity legislations to protect traditional knowledge. Since last decade, there are several initiatives to document and sensitise the communities on their right to resources and knowledge with developed registers or databases being used for education and piracy protection purposes.

The Nagoya Protocol (article 21) indicates the critical need to raise awareness on the importance of genetic resources and traditional and related rights of communities. Stressing the role of education it urges the need for building capacities of various stakeholders in equitable and sustainable practices related to biodiversity. Several RCEs have taken up activities related to resource monitoring, documentation, education and protection using different strategies.

RCE Cha-am is involved in a biodiversity study “Education for Sustainable Development Center (ESDC)” in the Sirindhorn International Environmental Park. The focal areas have been: environmental and natural resources conservation (e.g. restoration of mangrove ecosystem, soil erosion and coastal erosion protection, deforestation, soil and water management, green energy); eco-tourism; fisheries and agriculture; community uniqueness and indigenous knowledge; and general understanding of sustainability by following a “Sufficiency Economy Philosophy”. The methods used are Environmental Education Curricula for students, Natural and Environmental Camp, Volunteer Development Camp and Other Camps. For encouraging partnership between business and communities for biodiversity and to showcase best practices, RCE Cha-am has also participated in the activities related to the multistakeholder forum on biodiversity.

RCE Chandigarh is focused on understanding wetland ecosystems and the importance of wetlands, as well as providing opportunity for learning by doing, field experiences and hands on training by exploring wetlands. The project described in this publication aims to reach out to local communities from a grassroots level by inspiring students, educators and district level officers of state government to protect and conserve wetlands. It works on preserving wetland ecosystems so as to preserve the important repository of biodiversity and sustainable exploitation of resources for environmental protection. The RCE partners hope this project helps improve public recognition of wetlands, encourages exploration into associated livelihood benefits and creates sustainable development.

For its involvement in the Biodiversity Cyber Dialogue Project, **RCE Chubu** is using a Social Networking Service (SNS). This is to develop a deeper common understanding of stakeholders in different world regions on the importance of biodiversity, need for changing lifestyle choices and socio-economic institutions. The major impact of this initiative was cross-boundary, national and international mutual-learning among the members of civil society (especially among the members of Japanese NGOs who have an interest in biodiversity ranging from a particular ecological issue to different social and

economic aspects). The cyber dialogue project, and related collaborative projects with Japanese NGOs, gave the RCE an opportunity to expand its network to promote ESD with the concept of biodiversity as an entry point. Topics such as “Indigenous Peoples and Biodiversity,” “Gender and Biodiversity,” “Local Community Life and Biodiversity”, as well as “Traditional Wisdom and Biodiversity” have been crucial in the cyber discussions.

Knowledge of edible plants kept communities of Finland supplied with food at the difficult time during the war and postwar periods. Such knowledge, while remaining relevant for the resilience of the society, has recently become of importance due to immigration from countries that are not familiar with various species of plants in Finland and, as a result, suffer from consumption of poisonous varieties. In one of its projects, **RCE Espoo** aspires to educate the population about ways of using herbs, fruits and mushrooms in a manner that enhances their well-being and, at the same time, protects biodiversity. Expertise of different partners in biodiversity, techniques of species identification, ability to visually present them as well as understanding of the impact of various plants on health and ecosystems are reflected in the teaching materials. These materials deal with questions of integration of ecologically, economically and socially sustainable development. They are going to be further used for creating new applications for NatureGate – an online learning platform used by schools and other partners in Finland.

RCE Kyrgyzstan is engaged in a programme that aims at documenting and sustaining traditional knowledge related to local ecosystems. Such practices are particularly critical for maintaining the health of communities as well as biodiversity, which suffers from exploitation from local and foreign users. As the first step of the programme, the RCE partners have undertaken research to map the extent and type of TK holders in the area, the methods they use, the extent of success of their practices and awareness of the local population of these traditional activities. The knowledge obtained through the research, as well as contacts established in a process, will be used for creating awareness about TK practices as well as for developing enabling conditions for the TK practitioners.

Worldviews and Integration

There are certain socio-political and methodological challenges in integrating or mainstreaming TK. An important question in the integration of TK and institutional knowledge systems is of the hegemonic relationship between these knowledge systems. Institutions commonly assume that TK can and must be validated with the logical positivist epistemology of scientific institutions (Haverkort et al. 2003, Shankar and Unnikrishnan 2004, Haverkort and Reijntjes 2010). Jenkins (2000) notes how modernisation has dramatically devalued traditions by universalising abstract norms of action, valuing along with individualised patterns of socialisation. In these processes, tradition has often been seen as an impediment to progress or an ideal to return to so as to resolve the problems that modernity has brought. The modernist attitude towards TK has been ‘either modernise or disappear’ with what reads as being strongest and thus most coherent being rational. (Couze and Featherstone 2006). On the question of optimising the tensions between present and traditional, note that “older knowledge may be readmitted but subject to the critical and skeptical judgment of a rational method, uncluttered by faith and dogmas” (Couze and Featherstone 2006: 459).

In the efforts to achieve ‘development,’ emphasis has been placed on economic growth and related practices. In the same vein, the role of culture in contemporary societies has been examined through the lens of direct relevance to commercial activity. Social analysis has been largely documented by rational behaviour models that abstract economic action from the complex dynamics of its historical contexts (Jenkins 2000) and without cognisance of the ‘practice architectures’ within which these dynamics are inscribed and function (Kemmis and Mutton, 2012). For example, cultural artifacts or art forms are seen as vehicles for economic empowerment with less focus on their contextual functions in and for the communities in question. Another example is the increasing focus on traditional medical drugs in bioprospecting while neglecting the holistic dimension of traditional medicine. There is also often emphasis on aggregate growth rather than distributional effects or equity.

A view of TK as unchanging, inscription of antiquity, relegating it to the status of a commodity that should be documented and preserved is a matter of concern. The discourse has been centred on the protection of intellectual property rights, often overlooking and neglecting a need to consider and strengthen the social and cultural processes of continuity and contemporary utility around such knowledge. Whereas the documentation and preservation of TK (which are on the verge of extinction with the receding of language diversity) are needs of the hour, the promotion of contemporarily relevant TK and encouraging continued creativity and dynamism are vital.

Traditional knowledge is often considered exotic and confined to indigenous communities. While the presence of TK might be obvious in such communities, sociological analysis amply reveals that such knowledge and related practices are embedded in all sections of societies. However there may be a dominant influence of social classes or caste or ethnic groups on such knowledge within the communities. There is also a contested idea that promotion of TK in certain sections of society where modern science and technology benefits are not available or accessible, create double standards within a society and further deepen inequity in less developed countries.

RCE Espoo has initiated an innovative project called “Encounters” led by Keinumäki’s school project with around 40 other partners in the region. Encounters seeks to find ways in which sustainable development and methods become rooted in the school’s daily activities by developing methods that involve networking with local stakeholders, authorities, researchers and experts and by choosing those pedagogical methods that support social interaction and participation and enrich the working methods within the school’s learning environment. Various dimensions of sustainability such as local, social, technical, didactic-pedagogical aspects are explored for better learning in schools. Learning packages focus on ecological, economic, social and cultural dimensions and include aspects such as historical mapping cultural heritage, mapping of present environment, interactions with informal learning centres such as national parks, and transforming schools into learning domains for sustainable lifestyle.

In Guatemala, 42 percent of the population is indigenous. There are several challenges in the current education system. Government spends only meagre resources for education in the region, and the existing education system is a predominantly Western model that ignores the traditional cultural wisdom. A transformative education model which can ingrain values of cultural diversity and national identity within communities while fulfilling ambitions of scientific and technological capacities of a developing country is a vital need. The Mayan cultural worldview based on principles of sustainability fits well into this model. **RCE Guatemala** has taken the lead in integrating this Mayan worldview and principles of sustainability in various levels and forms of education. Wisdom dialogues and curriculum reforms are important strategies for this programme, with active networks of university faculty, school teacher and students, and community members.

A major focus of **RCE Kodagu's** biodiversity and traditional knowledge related activities is conservation of sacred groves through research and outreach programmes. Their field programmes involve livelihood initiatives through the promotion of bamboo cultivation; organic farming, creation of a forest protection battalion; ecosystem services valuation; and educational initiatives in schools and colleges. Through ecoclubs, several schools and colleges have undergone training in the area of sacred grove conservation. Identification, documentation and conservation of medicinal plants and associated knowledge in the region is another thrust area. A heritage interpretation centre depicting the local cultural and biodiversity has also been created.

RCE Makana has become a hub for local organisations to collaborate in support of environment and sustainability initiatives. What has been most notable is that issues that ranged from water to biodiversity have each been found to have a local knowledge practice that had been previously overlooked. An emphasis on biodiversity conservation has thus become a matter of local importance to people and the environment. The RCE does not have funded projects but is a community-based initiative where funding can be pooled and change practices can be initiated at a level that local family resources allow. The two reported in this case report are compost gardening and the planting of

indigenous food trees of cultural significance that serve to restore biodiversity-based food production and health in a small but significant process of indigenous knowledge and practices recovery.

Learning in RCEs

The case studies in this publication demonstrate how, in the context of RCEs in Asia, Africa, Europe and the Americas, different RCE stakeholders are able to express their concerns and address them through co-engaged practice and learning in developing regionally appropriate solutions to the challenges of bio-cultural diversity. Such individual articulation and collective contextualisation demonstrate the biodiversity problematic (ranging from protection of species and ecosystems to poverty eradication, health and livelihood security), its relevance for the variety of stakeholders and an opportunity that the RCEs' learning spaces could offer for mainstreaming issues of biodiversity into development agenda.

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RCE Greater Sudbury: Biodiversity Planning and Management

Stephen Monet

Tina McCaffrey

RCE Greater Sudbury

The City of Greater Sudbury is committed to enhancing the health and well-being of residents by accepting the honour of being designated as a Regional Centre of Expertise (RCE) by the United Nations University Institute of Advanced Studies. As a result of accepting RCE status, Greater Sudbury is required to promote and empower the community to reach sustainable development through education. The City of Greater Sudbury has been active in developing and implementing healthy community strategies and initiatives since the 1970s. As a result, a strong network of committees, boards, and panels has been established, which continues to move the city forward in a healthier direction.

Creating healthier communities and overcoming complex societal problems requires collaborative solutions that bring communities and institutions together as equal partners and builds upon assets, strengths and capacities of each. Greater Sudbury has pledged to advance the objectives of the local RCE by forging strong relationships with educational institutions and interested organisations to raise public awareness and understanding of sustainable development. The ultimate goal of the Greater Sudbury RCE is to encourage behaviour change among large numbers of individuals about sustainable development. The Greater Sudbury RCE faces many challenges, including aging and outdated infrastructure, family poverty, illiteracy, out-migration, homelessness, and, impaired ecosystems, the focus of this case study.

The virtual elimination of vegetation over tens of thousands of hectares has had direct impacts on the plant communities and the organism communities present in the soils that subsequently eroded. Dramatic losses of vegetation cover also resulted in the loss of habitat for the numerous animal species inhabiting the former forests.

Background

Past forestry, mining and smelting activities have had profound impacts on the City of Greater Sudbury's local environment both directly and indirectly. The virtual elimination of vegetation over tens of thousands of hectares has had direct impacts on the plant communities and the organism communities present in the soils that subsequently eroded. Dramatic losses of vegetation cover also resulted in the loss of habitat for the numerous animal species inhabiting the former forests. For decades, plant species richness was reduced to mainly those species that were either metal tolerant or that were able to persist on micro-sites shielded to varying degrees from sulphur dioxide fumigations emanating from local smelting facilities.

Since 1978, the Regreening Program has limed more than 3,400 hectares of barren land, fertilised and seeded more than 3,100 hectares, planted more than 9.3 million trees, and created more than 4,500 temporary employment opportunities. Conifer seedlings have been planted on all of the barren land that received lime as well as on an additional 15,000 hectares of semi-barren land. Calculations using a geographic information system show, however, that 35,000 hectares of land within the original impacted zone have never been limed or planted with conifer seedlings. This does not include vast tracks of land that are considered 'behind the mining company gates' (i.e. areas for which mine closure plans exist), urban land, or various rights-of-way. While not all of the remaining 35,000 hectares of land requires lime, most likely need to be planted with conifer tree seedlings to at least supplement the tree seedlings that have naturally colonised some sites.

In March of 2009, the Ecological Risk Assessment (ERA) portion of the Sudbury Soils Study was released. One of the most comprehensive studies of its kind ever undertaken in North America, the ERA evaluated the ecological risks associated with seven chemicals of concern (COCs): arsenic, cadmium, cobalt, copper, lead, nickel, and selenium. While the COCs occur naturally in the area, their levels in the soil have increased over the years through particle deposition from smelter emissions. The ERA found that terrestrial plant communities in large areas of Greater Sudbury have been and continue to be impacted by the COCs in soil. The study also found that local plant



communities are affected by other factors, such as soil erosion, low nutrient levels, lack of soil organic matter, and soil acidity.

As for wildlife, the ERA concluded that the COCs are not exerting a direct effect on local wildlife populations. The impact of COCs on area plant communities, however, has affected habitat quality and therefore is likely having an indirect influence on birds, mammals and other animals in Greater Sudbury.

In response to these findings, the city and VETAC, City Council's Regreening Advisory Panel, in partnership with the local mining companies, Vale and Xstrata Nickel, released Living Landscape – A Biodiversity Action Plan for Greater Sudbury in December, 2009.

This Plan, which was developed with considerable input from the local community, provides a comprehensive way to address the risks to plant communities and wildlife habitat identified by the ERA.

RCE Interventions

As the Action Plan is implemented, ecological recovery in Greater Sudbury will enter a new phase that should lead to the establishment of healthy, diverse, self-sustaining ecosystems on formerly barren lands. Social aspects of ecological recovery, including research, education and community engagement in regreening actions and ecological monitoring are also components of the Action Plan.

The small conifer seedlings that were subsequently planted on the limed soil more than 30 years ago, have now become stands of trees measuring up to 8 metres (25 feet) tall. As identified in the ERA, this is not enough – trees alone don't make a forest. A healthy, self-sustaining forest requires soil microorganisms and insects, fungi, lichens, mosses and a broad variety of forest floor plants, as well as the birds, mammal, amphibians and reptiles that call the forest 'home'.

To help jump-start the forest development process and address the limitations outlined in the ERA, the Regreening Program embarked on a new initiative in 2010 – forest floor transplants. Thanks to a partnership with the Ontario Ministry of Transportation, the Regreening Program was

able to salvage forest floor vegetation from areas (donor sites) cleared to accommodate a new four-lane highway just south of the city.

From June to October in 2010 and 2011, crews dug up the top 4 inches (10 cm) or so of soil containing small plants, seeds, microorganisms and insects and brought them to older reclamation sites for transplanting (receptor sites). Plots established using the transplanted materials each measured 4 metres by 4 metres. Over the two seasons, almost 400 plots were completed for a total of 0.61 hectares (nearly the size of one and a half football fields).

Approximately 100 different species of plants (including lichens and mosses) were collected and transplanted into Greater Sudbury's reclamation sites. Over time, these nodes of diversity will provide a seed source for these species to disperse and colonise adjacent areas. Two small-scale test plots of this type were established in 2004 and are now thriving, spreading up to 1.5 metres from the original plot.

The process is slow, but without these transplants, natural colonisation by these native plants could take hundreds of years. The forest floor transplant technique cannot be applied throughout the 84,000 hectare impacted zone due to cost and availability of material. But with enough small diverse pockets strategically placed over the landscape, the recovery of forest floor vegetation should be faster than leaving nature to do the job alone.

The Regreening Program has also drastically increased the diversity of species used in its reclamation work over the past several years by planting additional species of deciduous trees and shrubs. To date, more than one third of all shrubs planted by the programme were planted in the 2011 season.

The Biodiversity Action Plan identified the importance of working with the community and committed to providing opportunities for the general public to get involved in restoring the ecosystem, creating and managing wildlife habitat and tracking plants and animals in the city. In 2011, two online surveys were developed for the general public to engage in tracking animals in the city: FrogFind and the Whip-poor-will Survey.

Outcomes and Achievements

The process that was followed in the development of the Biodiversity Action Plan involved a variety of community engagement exercises aimed at eliciting key priorities and concerns relating to local biodiversity. The process, which was initiated in the 2nd quarter of 2009, took several months to complete and resulted in the release of the final Biodiversity Action Plan by the end of that year. Greater Sudbury recognises the sizeable and long-term financial commitments to the ecological recovery efforts by Vale and Xstrata Nickel. These commitments not only allow the City's Regreening Program to step up its activities, but also helps it provide resources for additional educational and community engagement efforts.

The most important lesson learned through the decades of regreening work in Greater Sudbury is that partnerships with various groups and individuals in the community are critical.

The Action Plan is written for a general audience and, although comprehensive in scope, is intended to only highlight many of the issues surrounding local biodiversity. The Action Plan stresses the need to build on what has already been accomplished through the municipal Regreening Program and that much land has yet to be limed and tree planted. Some planted areas are now more than 30 years old and the target for these stands of trees is now the development of healthy, diverse, and self-sustaining forest ecosystems. The Action Plan addresses issues relating not only to the actions needed to accomplish this, but also the need to do so in the context of watersheds, climate change and, in some instances, urban environments. The latest version of the Action Plan can be viewed at www.greatersudbury.ca/biodiversity.

Importantly, the Action Plan also addresses the social dimension by including sections on education, research and community engagement recognising that local ecological recovery efforts reflect a strong sense of shared responsibility. Since its inception, the city's Regreening Program has offered multiple opportunities for community participation in liming and tree planting

and city personnel have offered tours of the successes of the programme to thousands of people. Regreening efforts have also attracted considerable research from post-secondary educational institutions. Not only must these efforts continue, but these should also expand and adopt a broader and more comprehensive perspective on ecological recovery.

The Regreening Program attempts to design its operations to allow for collaborative learning where possible. The forest floor transplant plots established in 2010, for example, were precisely delineated so that they could serve as long term research plots for current and future researchers. Some plots were established on high school grounds to serve as ongoing learning opportunities for students through active multi-year monitoring. As another example, the Regreening Program is collaborating with a local college to develop a local seed bank from which shrub seedlings will be propagated. Attempts have also been made through garden groups to solicit the help of gardeners to propagate specific native plants. These initiatives help to build capacity and local expertise and provide various opportunities to different members of the community to actively participate in the ecological recovery of their city.

To expand on community engagement in the form of education, research, collaboration and participation, a Greater Sudbury Biodiversity Partnership was formed in March 2009. The Partnership includes local offices of provincial and federal government agencies and ministries, local naturalists groups, local First Nations communities, professors from Laurentian University, Cambrian College, and Collège Boréal, the four local school boards, two mining companies – Vale and Xstrata Nickel – and local fishing and hunting associations. The formation of this partnership should help in bringing a more coordinated and mutually beneficial approach to biodiversity projects in Greater Sudbury. In 2012, an e-newsletter is planned to keep the partnership informed of each others' actions, challenges, opportunities and successes. In time, an electronic 'plain language' journal is planned to elaborate on local projects and findings of groups, government agencies, professors and students. Finally, an annual public Biodiversity Forum is being planned starting in 2012 to help disseminate information on local biodiversity and promote the work of local naturalists and college and university students.

As an example of community outreach, several events were held in Greater Sudbury in 2010 to celebrate the International Year of Biodiversity. Some events focused on high school students, others on elementary school students and others on the general public. Biodiversity Partners were invited to host information booths at the events that included lively and informative speakers and entertainers. A total of almost 2,000 people attended these events, bringing broad exposure to biodiversity issues and opportunities.

Efforts to involve the community in volunteer monitoring of biodiversity will be ongoing. Engaging people with easy, relatively effortless activities – like watching birds at home feeders or identifying whether or not Whip-poor-wills (a bird species) are calling around their properties at night – can be the start of an enduring relationship with volunteers that can lead to their involvement in more complex forms of community-based monitoring, such as Environment Canada’s Marsh Monitoring Program.

Engaging and educating children and youth through local biodiversity-related activities will remain an important component of the Biodiversity Action Plan. In addition to all of the education opportunities identified above, the City has undertaken an Ugliest Schoolyard Contest since 2005, through the tireless efforts of a local volunteer and through multi-year corporate sponsorship by Xstrata Nickel and donations from numerous other local businesses. The Ugliest Schoolyard Contest has, thus far, provided a much-needed green makeover to 26 local schoolyards. To ensure that the efforts are long-lasting, the contest judging process insists that applications receive support from the school board, principal, teachers, students, parents and school maintenance staff. The schoolyard regreening efforts offer ample opportunities to raise awareness of local native plants and create habitats for wildlife. Biodiversity teaching opportunities will only increase as the naturalised schoolyard landscapes mature.

The Greater Sudbury Biodiversity Action Plan will be integrated into the city’s land-use planning document, the Official Plan. The Biodiversity Action Plan also satisfies several objectives of Ontario’s Biodiversity Strategy, Canada’s Biodiversity Strategy, and, ultimately, the Convention on Biological Diversity.

Conclusion

The most important lesson learned through the decades of regreening work in Greater Sudbury is that partnerships with various groups and individuals in the community are critical. These partnerships take time to develop and nurture, but in the end are worth the effort since they help ensure that the community takes ownership of the recovery of its ecosystems. Partnerships with schools and post-secondary institutions are especially important to help leverage resources for monitoring, researching and learning about the best methods for ecological recovery. These partnerships also allow students to learn by doing and to gain insights that connect their actions to environmental health.

By addressing the financial, operational, educational, research, and social aspects of ecological recovery, the Greater Sudbury Biodiversity Action Plan provides a holistic model for community renewal. Greater Sudbury has now shed its ‘moonscape’ image and is fully engaged in the next phase of its community-supported ecological recovery that will benefit this and future generations. The RCE project provides yet another important means of achieving multistakeholder collaboration aimed at achieving lasting ecological recovery that will enhance the sustainability of Greater Sudbury.



Coniston Hydro Road – 1981



Coniston Hydro Road – Sept 29, 2008

RCE Porto: The 100,000 Trees Project

Marta Pinto Margarida Silva

RCE Porto

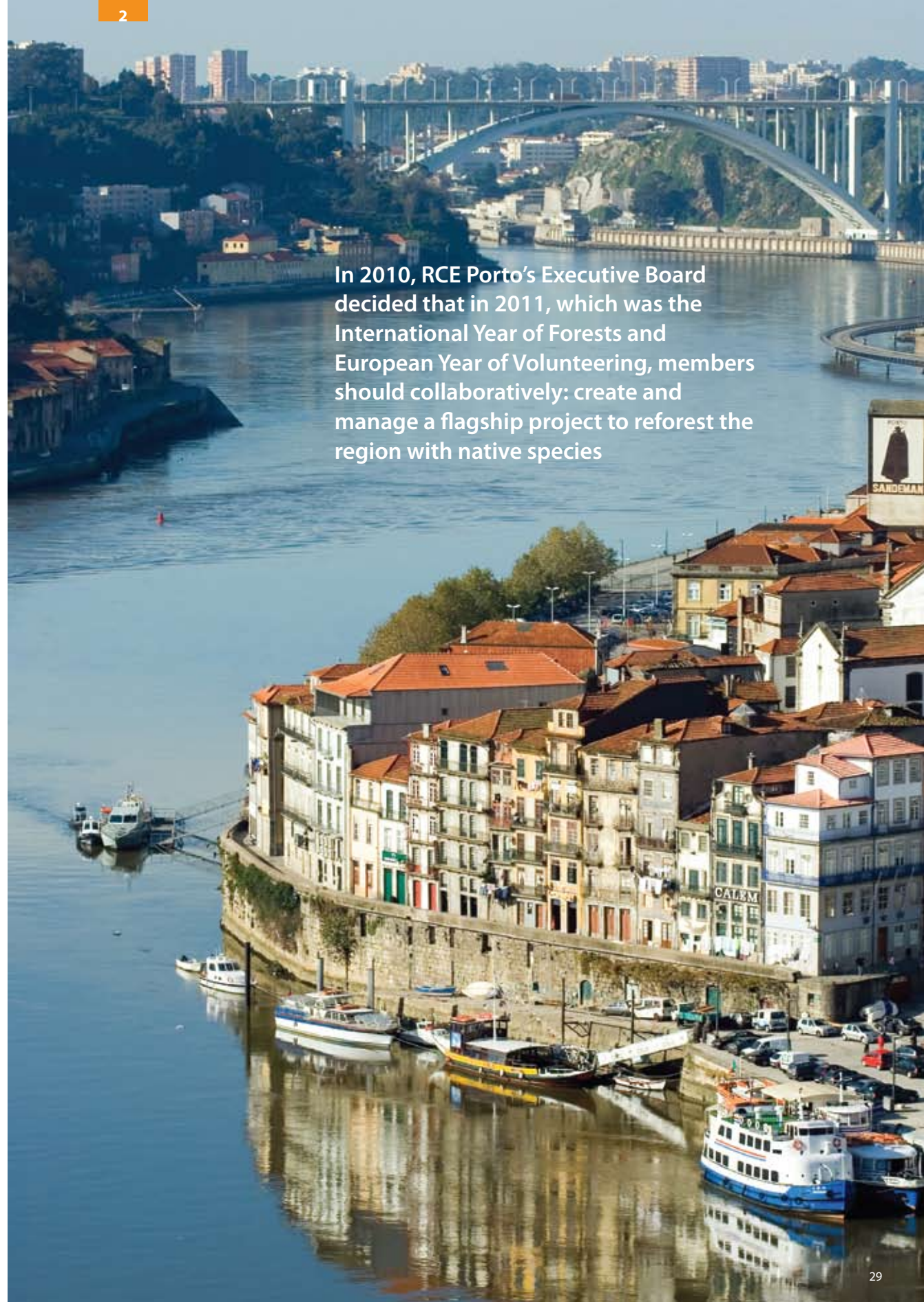
The Porto Metropolitan Area Regional Centre of Expertise on Education for Sustainable Development (RCE Porto) was established in 2009 to address the regional environmental priorities that came out of the Porto Metropolitan Area Environmental Strategic Plan (PMA-ESP). The RCE's establishment was a logical step by stakeholders to advance dialogue, learning, and action begun by the PMA-ESP. All 30 members of the RCE signed a Collaboration Agreement, which committed them to a main goal to make a difference in the region: to do more with less, to share and build knowledge, to build trust and enroll organisations and citizens in thinking and action for change. Operations would be based on the best available knowledge and practices, collaboration and better coordination, enhanced use of regional resources, social learning, and public participation.

There are two main panels working within RCE Porto. The first is a forum for representation of local and regional stakeholders and its main functions are to help outline joint actions and to make a contribution to their implementation. At the moment this panel, known as the Executive Board, is comprised of 30 member organisations, including local governments, non-governmental organisations, foundations, higher education institutions, and decentralised offices of the central government (education, youth, environment and regional development). The second key panel is the Coordinating Office which is the engine of RCE Porto. It is committed to making things happen, to prompt collaboration, to managing joint projects, to identifying and preparing funding applications, and to organising meetings between partners. RCE Porto is coordinated by the Catholic University of Portugal College of Biotechnology, the Porto Metropolitan Area Coordination representing 16 local governments within the metropolitan area, in collaboration with Regional Office of the Ministry of Education (DREN).

Some of RCE Porto's initiatives in 2011 included an Advanced Training Course on Public Procurement for public organisations officials (28 hours; 36 officials) and a Sustainable Schools Project to reduce water and energy consumption by 15% through soft/educational actions (10 schools).



In 2010, RCE Porto's Executive Board decided that in 2011, which was the International Year of Forests and European Year of Volunteering, members should collaboratively: create and manage a flagship project to reforest the region with native species



Background

The Porto Metropolitan Area (PMA) is a 1.575 square km territory in northern Portugal. About 16% of the Portuguese population lives in the area (1.67 million people) (INE, 2011). The area is structured around the municipality of Porto with 15 other municipalities included both in the PMA territory and the political and administrative body: Arouca, Espinho, Gondomar, Maia, Matosinhos, Oliveira de Azeméis, Póvoa de Varzim, S. João da Madeira, Santa Maria da Feira, Santo Tirso, Trofa, Vale de Cambra, Valongo, Vila do Conde, Vila Nova de Gaia.

The Porto Metropolitan Area Environmental Strategic Plan (PMA-ESP), a broad participatory regional planning process conducted from 2003 to 2008, concluded that citizens, decision-makers, researchers, experts and government staff consider forest ecosystem management a major environmental challenge in the region, to a large extent because of forest fires. It also identified the need to improve riverside areas and enhance the natural corridors effect. Education and training for sustainability as well as the need for more and better inter-municipality cooperation also came up as a priority issue (GEA, 2006; GEA, 2008). The PMA-ESP integrates the contributions of more than 5,000 citizens and 200 organisations and represents a shared view of the environmental challenges and solutions for the region.

In 2010, RCE Porto's Executive Board decided that in 2011, which was the International Year of Forests and European Year of Volunteering, members should collaboratively: create and manage a flagship project to reforest the region with native species; help manage urban forests with goal of making a difference in the territory; create training and action opportunities for citizens with a goal of having a positive impact in people's awareness and practical knowledge about trees and woodlands; and structure a volunteer programme for reforestation and management tasks with a goal of contributing to social change and promoting public participation. This meeting was seed for the FUTURE – the 100,000 trees project.

Why did RCE Porto Embrace the Native Woodlands Challenge?

As reported by the PMA-ESP and reaffirmed later (AFN, 2010), the PMA territory is a jigsaw puzzle of urban, agricultural and forest areas. Roughly 41% of the land has forest cover. However, native trees species (*Quercus sp.*, *Castanea sp.*, *Ilex sp.*, *Fraxinus sp.*, *Alnus sp.*, *Laurus sp.*, *Salix sp.*, etc.) cover less than 6% of forested territory, which is dominated by extensive monocultures of *Pinus pinaster* and *Eucalyptus sp.* (representing a higher risk of fire and pest expansion, as well as biodiversity loss). In addition, the loss of forest and agricultural land to urban expansion is a constant. From 1991 to 2008 urban development spread at a rate of 1,8 hectares per day (GEA, 2006; GEA, 2008). This trend in forest loss to urban expansion matches the reality in other parts of Europe as reported by Konijnendijk (2003). Urban forests refer to all forest and tree resources in and around urban areas, including woodlands, parks, trees and other green areas (Konijnendijk, 2003). These urban forests, particularly when based in native species – which are suited to the local environment – are extremely important as they provide multiple and highly demanding goods and services to society. In fact, a recent report (Vibrant Cities and Urban Forests Task Force, 2011) describes how the urban forest, working as green infrastructure, plays multiple roles in the ecology of human habitats: they filter air, water and sunlight, moderate harsh local climates, cooling the air and slowing wind and storm water runoff, reduce the urban heat island effect and air pollution, act as carbon sink against climate change, provide recreational opportunities, improve wildlife habitat and biodiversity and create other countless health, social and economic benefits. Konijnendijk (2003) and Dwyer et al (1992) also detail these benefits and consider that the social and ecological stability of urban ecosystems can be enhanced by urban forests. Increasing resilience, reducing vulnerability, restoring natural capital and improving social well-being are some of the competences attributed to urban forests as central green infrastructures in Europe (Dige, 2011).

The importance of forests was recently acknowledged by the United Nations General Assembly. It proclaimed 2011 as the International Year of Forests, inviting governments and the UN system, major groups and other forest-related organisations, to come together and raise awareness on strengthening the management, conservation and sustainable development of all types of forests for the benefit of current and future generations.



Why did RCE Porto Embrace the Social Capital Improvement Approach?

As reported by the PMA-ESP there is a need for more and better collaboration, public awareness and participation opportunities in the region if the main environmental challenges are to be solved (GEA, 2006; GEA, 2008). The SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis conducted during the study evidenced several weaknesses, such as the lack of human and financial resources, the nonexistence of collaboration and synergies between organisations and, often, competition for the same resources (including the school community that reported being overwhelmed with dozens of distinct projects each year), fragile public participation, and the general absence of project continuity (and no evaluation or feedback efforts). Strengths in the region include the large number of organisations enrolled in education for sustainable development (ESD) initiatives and the abundance of non-financial resources in these organisations.

This regional scenario led to the creation of RCE Porto and the start of an expansion and social capital improvement process, as introduced by Putnam (1993), particularly in the creation of social networks that facilitate coordinated action and cooperation (with knowledge, trust and resources) that help move towards sustainability by overcoming the dilemmas of collective action. This 'human dimension' of sustainability has increased in significance over recent years, shifting the core of sustainability from goal attainment to a social learning process (Tàbara and Pahl-Wostl, 2007). Social learning implies a change in understanding of the individuals involved, goes beyond the individual, becomes situated within wider social units and occurs through social interactions and processes between actors within a social network (Reed et al, 2010).



The Project

The FUTURE – the 100,000 trees project in Porto Metropolitan Area addresses the two previously documented priority issues at the regional context: the need to expand and improve the *natural capital*, particularly native urban woodlands, which are related to a broader environmental quality context, and the social capital, particularly through the creation of social networks that facilitate the action, cooperation and public participation required to move the region to a more sustainable status.

The project, collaboratively designed and managed, comprises the creation of 100 hectares of native woodlands in the region (100,000 trees) until 2015, mainly in areas that were previously subject to human pressures such as fire or invasive species, while simultaneously setting up a group of citizens that are aware, skilled and motivated enough to promote and care for these native woodlands in close cooperation with regional organisations.

The project comprises reforestation area identification (both public and private), characterisation and selection, landowner agreements, reforestation plan design, needs listing, resource procurement (plants, machinery, professional human resources, hours of volunteer work),

volunteer training and coordination before, during and after field activities, partnership management, stakeholder information and feedback (website, e-mail, newspapers, facebook), centralised record keeping (species planted per area, number of trees, hours of volunteer work offered, volunteer participation in each activity, etc.), reforestation results evaluation, and planning and training sessions. The RCE Porto executive team (the Environmental Studies Group of the Portuguese Catholic University) operates as the coordinating office for the FUTURE project. The institutions most directly implicated in this project include the PMA Coordination, 10 municipalities (Arouca, Gondomar, Maia, Matosinhos, Oliveira de Azeméis, S. João da Madeira, Santo Tirso, Trofa, Valongo, Vila do Conde), Forestis (forestry association), Quercus (non-governmental organisation) and the Portuguese Catholic University. Several governmental offices are also implicated: Portuguese Youth Institute; Regional Office of the Ministry of Education (DREN), and the Regional Office of the Ministry of the Environment (CCDR-N). Several non-governmental organisations, private companies, private forest landowners associations have also joined the project. At the moment of this writing the project involves 30 organisations.

Planning and Implementation

As mentioned earlier, the 100,000 trees project in Porto Metropolitan Area was born in October 2010 at an RCE Porto executive board meeting. The main stakeholders absent from that first meeting were later invited and incorporated in the design phase of the project. Several one-to-one and stakeholder phone and face-to-face meetings took place between December 2010 and April 2011. The objective was to consolidate the methodology, identify active partners and list both the resources needed and those provided by partners. From this dialogue several core issues arose: (1) the need to focus the reforestation efforts on a small number of pilot areas throughout the region, (2) the need to respect the various municipality agendas (reforest burned areas, create fire barriers, improve urban parks, regenerate areas dominated by *Eucalyptus* sp.), (3) the need to address post-planting challenges like tree replacement and short term management, and (4) the need to train and promote active citizen involvement, both in tree planting as well as previous tasks (germination/reproduction) and subsequent care.

By June 2011, after several meeting rounds, the project was able to bring together the basic resources needed for the startup phase: (1) eight planting areas (public and private; in mountain, urban, and riverside areas) totaling around 40 hectares, (2) human resources for planting and management (these forest management teams resulted from the cooperation between landowners associations, the central government and municipalities), (3) indigenous tree seedlings (from state nurseries, through a partnership with a non-governmental organisation), and (4) a growing goodwill movement to help with planting and management (NGO, schools, companies and organisations with social responsibility departments).

Two citizen enrolment programmes were created: a training programme (Forest Ambassadors) and a stewardship programme (Forest Curators). The training package was collaboratively developed and implemented by researchers and experts of the RCE Porto partner organisations. Forest Ambassadors is a 16 hour programme that imparts a broad forest insight: characteristics, history, biology and ecology, management, and economic, social and environmental impacts on society. It is composed by theoretical and practical study units and focuses on providing people with sensorial experiences (for example taste workshops with sensorial products like honey, teas, berries, chestnuts, etc.). The stewardship package invites residents from the region to donate 40 volunteer work hours to the forest, planting and caring for trees in one or several of the areas under the 100,000 trees project intervention. It was promoted exclusively over the web, through the network previously created by RCE Porto. The main implementation phase of the 100,000 trees



Public participation in the project has been surprisingly positive. Around 1,900 participation records (800 individual volunteers) were registered in tree planting and caring (160 hours) and 76 people made a long term commitment to give 40 hours per year to these activities

project started in September (training) and October 2011 (planting).

Outcomes and Evaluation

From October 2011 to February 2012, which is the suitable planting period at this latitude, 11,140 native trees were planted in six areas within the metropolitan area. The area under intervention in 2011/2012 was approximately 24 hectares. The planting goal for this period was achieved at 74% (as a consequence of the dry climatic conditions observed during this winter time, the 15,000 tree target could not be reached).

After the interventions, these new woodland areas accommodate more than 20 species of native trees and shrubs: *Quercus robur*, *Castanea sativa*, *Crataegus monogyna*, *Corylus avellana*, *Arbutus unedo*, *Acer monspessulanum*, *Betula celtiberica*, *Ulmus minor*, *Ilex aquifolium*, *Fraxinus* sp., *Alnus glutinosa*, *Sambucus nigra*, *Laurus nobilis*, *Prunus lusitânica*, *Quercus suber*, *Pinus pinea* and *Viburnum tinus*. The selection of the exact species considered the ecological characteristics of each area.

The tree survival rate in the areas examined during May 2012 was more than 95%. The environmental results have not been quantified but it is expected that biodiversity, the soil's biocapacity and water regulation improve and that about 125 tonnes of carbon dioxide are stored per hectare planted per year (annual average for a 40 year period). The trees planted are very young, with lengths ranging from 10 cm to 50 cm, and the expected results can only be measured over the next decades.

From the social capital perspective (civic engagement and social connectedness) several outcomes are to be highlighted. As a consequence of the collaborative design,

the project is currently managed with a zero budget, relying exclusively on stakeholders' resources. Around 30 organisations are enrolled: municipalities, landowners, forestry, environmental and social non-governmental organisations, companies, governmental organisations, education institutions and political parties. Several of these organisations are officially in charge of woodland management, allowing the project a good degree of sustainability.

During the planning period it could be observed that mutual acknowledgment of the responsibilities, available resources, difficulties and opportunities took place and exchange between actors increased (projects, ideas, etc.). In addition, the debate about making the project happen and the role each organisation would play in it generated a collective learning and action process, based on dialogue and collaboration. The few initial gaps were figured out and, as a result of this process, the regional social capital grew richer. Several of the previously diffuse activities of tree-planting and caring were upgraded and integrated.

Public participation in the project has been surprisingly positive. Around 1,900 participation records (800 individual volunteers) were registered in tree planting and caring (160 hours) and 76 people made a long term commitment to give 40 hours per year to these activities. Besides this, more than 100 people attended the Forest Ambassadors training course and 49 completed it. Some of these Forest Ambassadors offered woodland related ideas and initiatives. One such case is the kindergarten (Casa do Cuco) which created a cork collection programme for children to help recycle this tree product and learn about trees and forest, planted 32 native trees in a nearby riverside area with the help of families and created a task calendar for subsequent tree caring activities (watering, weeding). The 100,000 trees project is being replicated elsewhere in the country as of 2012. The Common Forest Project (a nationwide project promoted by a non-governmental organisation and the government office for nature protection and forests) was launched in March 2012 and its guidelines and procedures reflect the lessons learned over the development of this project.

Experience to date shows that moving towards sustainability through a two-prong approach (simultaneous enhancement of social and natural capital)

anchored on an agreed tangible goal is desirable and possible. Progress, however, has been achieved in small steps and more data needs to be collected.

The project's qualitative assessment is based on semi-structured interviews to be conducted amongst partners, volunteers and Forest Ambassadors. With this assessment, complemented with the quantitative results already presented, an understanding can be reached about how the project makes a difference, both in people's awareness and practical knowledge about trees and woods and in terms of social change, long-lasting public participation and social capital improvement.

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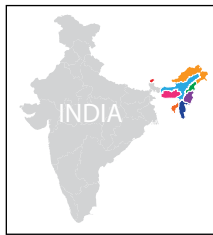


RCE Srinagar: Community Initiatives for Biodiversity Conservation in North-Eastern India

Pradeep Boro Rashmi Gangwar Abdhesh Gangwar

RCE Srinagar

RCE Srinagar is based in Jammu and Kashmir (J&K), the northernmost state of India bordering Pakistan and Afghanistan to the west and China to the east. Srinagar is the summer capital of J&K, a major tourist destination built around the beautiful Dal Lake. RCE Srinagar was acknowledged as a Regional Centre of Expertise on Education for Sustainable Development in September 2011. The RCE builds local capacities to enhance understanding on the eco-sensitive development of the area and brings attitudinal change to reduce anthropogenic pressure on the fragile Himalayan ecosystems. Its efforts are supported by its partners, including the J&K Education Department, two universities in Kashmir, technical institutions, likeminded NGOs and civil society organisations focused on education, climate change, slum development, disaster management, wetland management, improvement of livelihoods, biodiversity conservation and sustainable development.



RCE Srinagar is working towards:

- Integration of ESD in academic curricula and the orientation of school teachers and higher education instructors through teacher training programmes;
- Promotion of locally suitable alternate sustainable technologies through training camps and extension of technologies by concerned academic and government departments;
- Raising awareness in communities on local environmental issues through awareness programmes, campaigns, rallies and competitions;
- Advocacy and policy interventions for sustainable development by building pressure groups to influence policy decisions;
- Community-based disaster preparedness through awareness programmes in schools, village contingency planning in communities, and disaster preparedness training for youth, local and state administrations; and
- Research on traditional practices and appropriate technologies to document traditional lifestyles and coping mechanisms.

Eastern Himalaya – A Biodiversity Hotspot

North-east India harbours a unique and rich biodiversity. Indeed, Eastern Himalaya is a hotspot of biodiversity. In the region there are still areas that have not yet been explored for the richness of biodiversity and there may therefore be many species that have not yet been identified. However, with increasing population, consumerism, development of infrastructure, environmental degradation and for several other reasons, the region's biodiversity is depleting rapidly. It is feared that many species will become extinct before they even get catalogued. Multi-pronged efforts are therefore underway to help conserve the rich and unique biodiversity of the region.

North-eastern India has a unique land tenure system. The land belongs to the community and not to the government. Forest conflicts in the hill regions of northeast India have a long history, with intertribal disputes occurring periodically ever since the region was settled more than 1,000 years ago. Tribal resistance to British colonial incursions into the hills of north-east India in the early 19th century resulted in special policies enacted to allow customary systems of forest management and respect for traditional systems of governance. This policy



reflected recognition by the British colonial government that the hill communities could not be centrally administered and were best allowed to function under their own governance systems.

Table 1
Forest and Community Land Control in North-eastern India

State	% of total forested area	% of total community control
Arunachal Pradesh	82	62
Assam	30	3
Manipur	78	68
Meghalaya	70	90
Mizoram	87	33
Nagaland	85	91
Tripura	55	41

To establish conservation areas, the government has to procure and/or purchase land from the community and pay compensation. The several tribal communities that inhabit the region live in close harmony with nature and depend on the forest and other natural resources for most of their basic needs. The Centre for Environment Education (CEE) has been working in the region since 1993 and has tried to encourage community initiatives in environmental conservation through various initiatives, including the RCE initiative. Through the RCE networks in Srinagar and in Guwahati, these efforts are being further strengthened using the experience and expertise gathered from other parts of India and overseas, such as the Asia-Pacific region in particular.

This chapter showcases three case studies where the community has taken the lead in conserving biodiversity in their respective areas and set commendable examples. The first two case studies highlight community efforts to conserve flagship species of Hoolock Gibbon in Assam and Blyth's Tragopan in Nagaland while, in turn, helping to conserve the entire gamut of biodiversity found in those ecosystems. The third case study is from Meghalaya and centres on protecting a patch of community-owned forest to allow regeneration of forest species as well as protection to wildlife.

Hoolock Gibbon Conservation

One of the unique species in the rainforests of Assam and environs is the Hoolock Gibbon. They are smallest amongst all apes, arboreal, close to humans also known as 'lesser apes'. They are exclusively found in the protected areas of North-eastern India. Two species of Hoolock Gibbon have been recorded in the region: the Eastern Hoolock Gibbon (*Hoolock leuconedys*) and Western Hoolock Gibbon (*Hoolock hoolock*). The Hoolock Gibbon is a highly endangered species.



Gibbon populations have declined to the point that long term survival of the species in the wild is in serious jeopardy. The challenges facing the species' conservation are so immense that their number has declined to a few thousand only. The main reasons for this are habitat fragmentation, forest loss from slash and burn cultivation, timber felling, and hunting of the species for its meat. They are also often caught as pets and their body parts used in traditional medicine and in religious ceremonies. Hoolock Gibbons generally prefer upper and middle tree canopy for living and never come down to the ground. Rapid destruction and degradation of their habitat results in canopy interruption, thus compelling them to come down and thereby exposing them to predators and poachers.

The Barekuri Gram Panchayat (i.e. Barekuri local government district) is located in the Tinsukia district of Assam under the Hapjan Development Block. It has done commendable work to conserve the Hoolock Gibbon. The Gram Panchayat is a cluster of 23 villages with a population

of roughly 11,500, predominantly from the Motok Assamese community. The main occupation is agriculture. Prior to 1950, the Barekuri area used to be a contiguous patch of canopy connecting Dibru-Saikhowa National Park. The current Gibbon population in the area perhaps got fragmented from the main population of Dibru-Saikhowa after a small drain from River Brahmaputra bloomed into two tributary rivers, Dibru and Dangori, creating isolation. The Barekuri Gram Panchayat (BGP) is a distinct site for Gibbons, thus isolated, living in close proximity to the villages. The Gibbons feel secure and live free from fear of harm as villagers offer protection, care, food, and water. The community even started agro-forestry, planting plenty of tall trees bearing fruits liked by Gibbons such as orange, lemon, banana, and pineapple, thus promoting Gibbon conservation.

This is a unique case of synergy between humans and Gibbons, not found anywhere else. In this region, many community traditions and beliefs are associated with Hoolock Gibbons, revealing the sign of village prosperity. However, in the current economic climate, tea plantations are quickly replacing agro-forestry efforts and this has led to the felling of tall trees and barren small fruit trees due to pesticides and fertilisers. The Gibbons have therefore been forced to thrive on tender bamboo shoots and leaves, banana and jack fruit, among others.

Further initiatives based on this exemplary model of age-old community conservation practice for Gibbon conservation in Assam can lead to the replication of community-based species conservation.

RCE Srinagar was acknowledged as a Regional Centre of Expertise on Education for Sustainable Development in September 2011. The RCE builds local capacities to enhance understanding on the eco-sensitive development of the area and brings attitudinal change to reduce anthropogenic pressure on the fragile Himalayan ecosystems.

Blyth's Tragopan Conservation

Khonoma in Nagaland is an Angami Naga tribal village about 20 kilometres south-west of the regional capital town Kohima. Khonoma is the site of a unique conservation endeavour, the Khonoma Nature Conservation and Tragopan Sanctuary. This 70 square kilometre reserve is the fruit of a predominantly local initiative to preserve the endangered pheasant, the Blyth's Tragopan as a flagship species, along with the ecosystem as a whole. The sanctuary has a variety of ecosystems ranging from semi-evergreen forest to savannah grasslands and is ideal for trekking and research work.

Conservation had little place in people's lives when the CEE began its conservation education initiative in Khonoma. Much of the change was due to the CEE's awareness programme. But the real impetus came from the village council. The council passed strictures to regulate hunting in 70 square kilometres of forests near Khonoma. The implementation of customary laws also helped the conservation effort. Some examples include: limited hunting of crop-destroyers like wild boars and deer; a ban on the sale of wild meat; the imposition of fines on violators; a ban on hunting during mating and breeding season; a ban on hunting juveniles and pregnant animals; and the rationing of timber and firewood extraction based on family size and requirement.

Village youth were trained in wildlife management and protection, and were then used to guard the forest and wildlife. This community managed wildlife sanctuary was linked to tourism through the Khonoma Green Village project supported by the Ministry of Tourism, Government of India. The Khonoma Tourism Development Board was constituted to implement this project. The agency encourages youth in the village to work as tour guides, tour operators, and interpreters. It also provides equipment to wildlife wardens. Infrastructure such as a circular road, solar street lights, toilets for each household, community toilets, improved water supply and sanitation, and waste disposal have been supported to further encourage tourism.

Select houses in the village, having adequate infrastructure and facilities, were identified for home stays. Attention was given to hygiene and sanitation, with people trained in housekeeping and hospitality. Handloom handicrafts were

promoted as souvenirs and village troops were trained in cultural performances and practices. The Khonoma Nature Conservation and Tragopan Sanctuary and the Khonoma Green Village initiatives serve as successful role models not only for other Naga villages but for the entire community.



Kharshati Community Conservation

In the Ri Bhoi, district of the Khasi Hills, Meghalaya there is a board that reads 'Kharshati Wildlife Sanctuary'. This is neither a sanctuary under the Wildlife Protection Act nor managed by the Government Forest Department. It is a community initiative, an informal sanctuary declared and managed by the local people. This 1,000 acre land belongs to a clan of chieftains of the Kharshit Community.

Forest cover in the Khasi Hills is poor and so is the status of wildlife and biodiversity. Environmental degradation is also rapid. In response, the enlightened and environmentally conscious clan in the region gave away their land for free, for the purpose of environment and wildlife protection. The Meghalaya Environment and Wildlife Society (MEWS) showed a keen interest in the initiative and took up the task of managing the wildlife sanctuary. As such, the sanctuary is provided social fencing.

MEWS promotes the rehabilitation of wild animals in this area. Injured, stray animals caught elsewhere are released in the area and are taken care of. Because of this protection, regeneration has begun at a good pace. Presently dominated by pine trees, the habitat type is that of a moist evergreen forest, with species like *Eugenia*, *Quercus*, *Castanopsis*, and *Mitchellia* emerging as the climax species when full regeneration is attained.

Birds, reptiles, rodents and other smaller animals have been reported since regeneration. Hunting is totally discouraged in the area by the local people. All efforts are being made voluntarily to protect the area and to allow for regeneration.

RCE Srinagar Activities

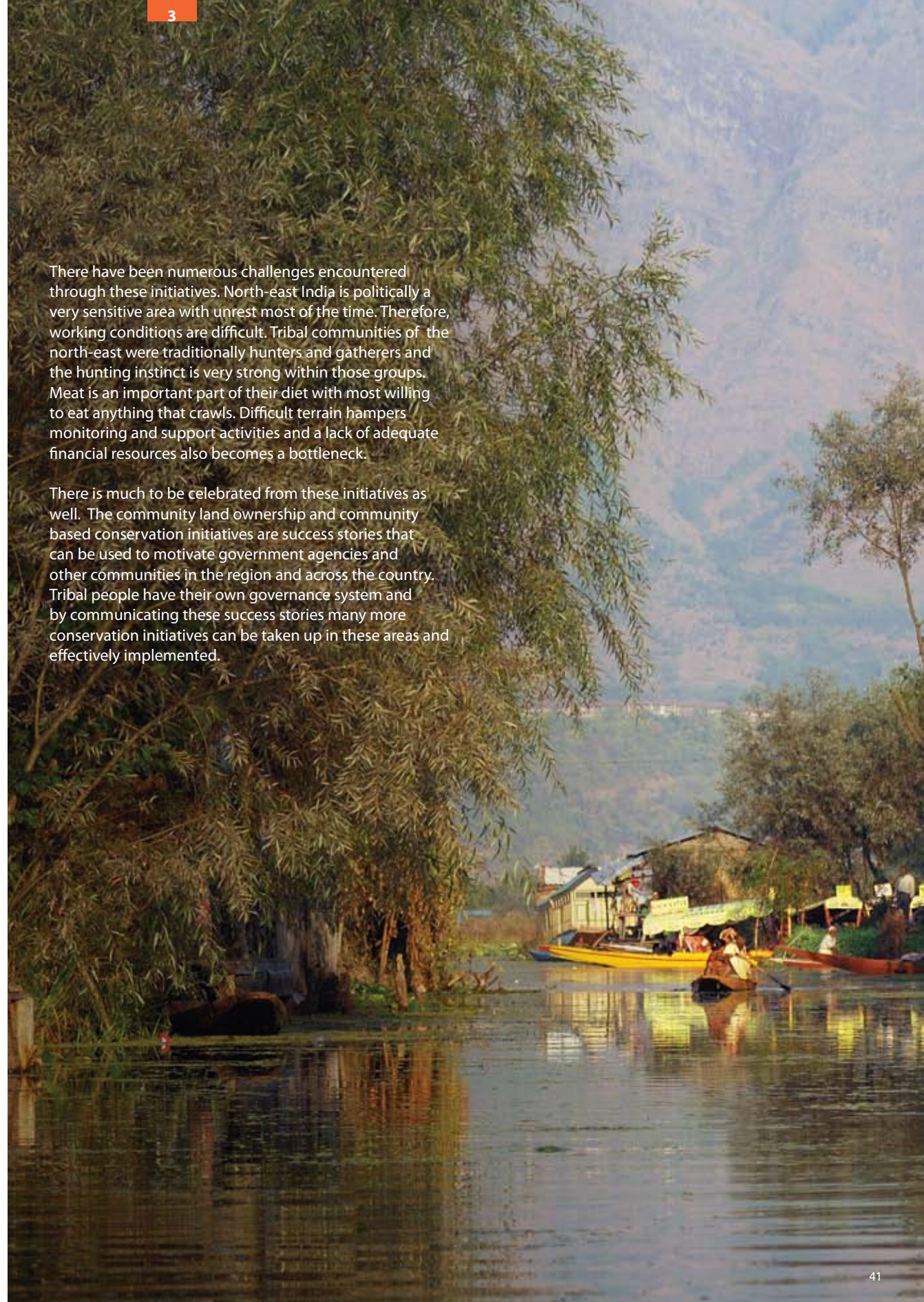
RCE Srinagar and RCE Guwahati with CEE Himalaya and CEE North-East are working to strengthen and sustain these initiatives. Conservation education programmes have been launched in these areas and are aimed at important stakeholders like schools, local communities, village governance, NGOs, youth, churches and other influential organisations. Teachers are also being trained. Students are guided to take up small-scale conservation projects. Local NGOs are trained and given biodiversity conservation projects. Environmental days are celebrated and various competitions are organised from time to time. Besides raising awareness, a range of information education and communication (IEC) material is being produced; already available and relevant IEC material is being adapted and translated into local languages. Local governance systems are being influenced to impose regulations that help conserve biodiversity.

Local youth are frequently taken to Kaziranga National Park, Guwahati Zoo, and other suitable places where they can be trained in wildlife management. They see the management practices adopted by the park and the zoo and get hands-on training. RCE Srinagar is popularising these initiatives to encourage their replication elsewhere and to encourage donors and government agencies to link their programmes with these initiatives.



There have been numerous challenges encountered through these initiatives. North-east India is politically a very sensitive area with unrest most of the time. Therefore, working conditions are difficult. Tribal communities of the north-east were traditionally hunters and gatherers and the hunting instinct is very strong within those groups. Meat is an important part of their diet with most willing to eat anything that crawls. Difficult terrain hampers monitoring and support activities and a lack of adequate financial resources also becomes a bottleneck.

There is much to be celebrated from these initiatives as well. The community land ownership and community based conservation initiatives are success stories that can be used to motivate government agencies and other communities in the region and across the country. Tribal people have their own governance system and by communicating these success stories many more conservation initiatives can be taken up in these areas and effectively implemented.



RCE Cebu: Toward a Sustainable Forest Community – Ethnobotany of Campo Siete Forest Community

Cielo Inocian Geofe O. Cadiz Ian Vincent C. Manticajon

RCE Cebu

Cebu is an island province located in the Central Philippine region of Visayas, which is comprised of 167 islands. Its main hub is Cebu City, the oldest and second most important city in the country. Historically, its central location made Cebu an ideal trading centre in the south and the metropolis is now known as “The Queen City of the South,” in recognition of the important role it plays in tourism and the economy. The Regional Centre of Expertise on Education for Sustainable Development in Cebu (RCE Cebu) has noted that efforts to promote sustainable development in the region have been advocated by various stakeholders, owing to Cebu’s strategic importance and its scarce natural resources. RCE Cebu identified pressing issues on gender, governance, poverty, and resource management and conservation, which require creative and continuing commitment and collaboration. (RCE Cebu Concept Paper 2006).

RCE Cebu was acknowledged by United Nations University Institute of Advanced Studies in 2006. The RCE is engaged in creating an active, stable, regional resource, communication centre and network that documents, disseminates, and shares best practices and responses related to education for sustainable development (ESD) on poverty alleviation, responsive governance, environment, and gender issues, among others. With the University of the Philippines Cebu as its central node and secretariat, RCE Cebu aims to form a multi-sectoral network of partners and stakeholders from the academe, civil society, youth, differently-abled, local government units and agencies, business, and media, among others. RCE Cebu is organised as a non-stock, non-profit corporation duly registered with the National Securities and Exchange Commission. Upon its establishment in 2006, RCE Cebu committed to working on three focal projects, in addition to its function as a platform for dialogue and collaboration among relevant ESD stakeholders in the region. (RCE Cebu Concept Paper 2006).

These projects are:

1. **Integrated Water and Resource Management (I-WARM-CEBU):** I-WARM-CEBU sustainably taps water resources in response to water shortages in Cebu. It envisions the sustainable management of water resources in the entire Cebu province through the use of innovative and sustainable technologies.
2. **Regional Resource, Poverty, and Poverty Response Mapping (REPORMA):** REPORMA aims to inventory all available resources in the region starting with Cebu, especially those that would have the most impact in addressing poverty.
3. **ESD Resource Centre:** The resource centre aims to set up a multimedia library, training resources and publication facility for Information, Communication and Education (ICE) materials. One of its main features is the Knowledge Network (KNOWNET), which bridges the forest and urban communities toward ESD through the use of Information and Communication Technology (ICT). (RCE Cebu Concept Paper 2006).

The focus of RCE Cebu’s attention in the past few years has been the forest mountain community of Campo Siete in Minglanilla, Cebu. The community is one among many biodiversity-rich areas in the region that has been experiencing pressures from human population, poverty and climate change. As a first step to saving these areas from further degradation, RCE Cebu embarked on an inventory of forest community resources that was aimed, among other things, at generating knowledge of and an appreciation for indigenous and sustainable methods in the use of these resources.

These initiatives are part of a project launched in 2008 entitled, “Asia-Pacific Forum for Environment and Development (APFED) Showcase Project Promoting Education for Sustainable Development Through Conservation and Sustainable Use of Forest Resources and Empowerment of the Regional Centre of Expertise



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Campo Siete

on Education for Sustainable Development in Cebu.” The project is being implemented in partnership with the Japan-based Institute for Global Environmental Strategies (IGES). RCE Cebu established a multi-sectoral approach in establishing partnerships with the community. It collaborated with different stakeholders (i.e. farmers, women, multipurpose cooperatives, youths, students and teachers in elementary and secondary schools, and the community council of Campo Siete) to promote the importance of education in the sustainable development of the region in the following areas: (a) livelihood (b) health, (c) governance, (d) eco-tourism, and (e) environment protection. The overall objective of the project is to bring together the community, local stakeholders and regional stakeholders, in collaboration with global stakeholders to develop and implement an innovative project for the conservation and rational use of the 123 hectare forest reserve in Minglanilla, Cebu towards effective poverty alleviation options and sustainable development. Its specific objectives are the following:

- Develop an ESD knowledge base and materials to learn options and good practices on poverty alleviation. Create effective and innovative knowledge sharing systems including community baseline maps, inventory data on resources and resource management and poverty indicators and responses as well as good practices.
- Build the capacity of people in the local community to identify their poverty levels by using recently established research methods. Mobilise as many stakeholders as possible through participatory research on poverty levels and an inventory of natural resources.
- Develop and implement concrete alternative options to enable conservation and the reasonable use of the proclaimed 123 hectares Experimental Forest Station (DAO 51 Series of 2004) managed by the Ecosystems Research and Development Service (ERDS) of the DENR Region 7.
- Build capacity through conservation and the effective use of the 123 hectare forest resource, and by empowering RCE Cebu.
- Involve the broad, multi-sectoral interdisciplinary stakeholders within the project site (the 123 hectare Experimental Forest Station and nearby communities of Minglanilla) including the local teachers’ association, women’s association, youth groups, tourism association,

business council and local communities in the planning and implementation of forest conservation, natural resource management and poverty alleviation through job creation and livelihood enhancement, especially through eco-tourism.

Ethnobotany Project

Holistically addressing environmental degradation and biodiversity loss starts with an inventory of what and how local communities use the resources in their midst. This paves the way for more relevant and responsive adaptation and mitigation measures that will both promote environmental sustainability and address livelihood issues. Biodiversity and its link to livelihoods and development are well known, with plants being important sources of people’s basic needs such as food, medicine etc. These resources can become profoundly relevant in the context of rural poverty. However mapping of biodiversity resources in the form of biodiversity registers and related knowledge – both biogeographic and socio-cultural – is central to any intervention.

To make such an exploration within RCE Cebu, Campo Siete (Camp 7), Minglanilla was selected since it is included in the Central Cebu Protected Landscape (CCPL) under Republic Act No. 9486, a law for the protection and maintenance of reforested areas in Cebu, Philippines. The CCPL spans 29,062 hectares of adjoining forestlands and watersheds located in the middle of the island-province that is home to 74 endemic fauna species, 11 of which are classified as “highly threatened.” Campo Siete is home to a 123 hectare forest reserve with a population of around 2,500 amid rich ecological resources, including seven caves, 64 species of trees, diverse species of fauna, six springs, one river, and a watershed.

The forest reservation supports the residential livelihood of the community through the provision of timber and other forest products, agricultural plots, an abundant water supply, and through eco-tourism. It also serves as one of the few adequate sources of water and provides ecological balance in the whole narrow island of Cebu. Politicians have assured the poor communities in the midst of the forest reserve that they can continue to rely on the land for livelihood support as long as their activities do not destroy the forest and they contribute to its preservation. Under the law, local residents are considered tenured migrants.

As ‘eco-managers’ of the forest, they are ideally placed at the forefront of efforts to protect, develop and manage the resources in their midst.

RCE Cebu conducted a Socio-Demographic Community Survey of Barangay Campo Siete, Minglanilla, Cebu, Philippines. The survey showed that the majority of Campo Siete residents live on marginal income, relying merely on sustenance farming and income from service-oriented jobs. Most of the respondents who were engaged in farming had started the activity around 1991. Some residents used what little savings they could earn from their harvests as capital for small business activities. Yet still their income is barely enough to meet their basic needs or provide them economic security. Thus, many farmers are enticed to engage in illegal economic activities like slash and burn farming and charcoal making. The low sanitary standards of people living near rivers and creeks also affect the forest, contaminating the water supply in the nearby towns and cities. People also lack the skills and education in sustainable forest use. Undeniably, this situation puts ecological pressure on the forest.

Ethnobotanical data was collected from the locals of Campo Siete. A total of 35 interviews were conducted with 27 randomly selected locals and eight pre-consenting local healers and local plant enthusiasts. Plants were categorised according to their uses: food, medicine, cash crops, construction and fuel. Seventy-five plant species were identified belonging to 35 families and 63 genera.

The study was the precursor to the overarching theme of RCE Cebu to promote initiatives related to economically and environmentally sustainable cultivation and use of forest resources. With the publication of an ethnobotany booklet based on this study, RCE Cebu hopes to raise awareness on the traditional use of local plants and encourage people to cultivate these plants and use them to contribute to the improvement of their livelihood. Likewise, the study hopes to stimulate more relevant interactions between local knowledge and sustainable development planning.

Observations and Reflections

Barangay Campo Siete is located at 10.333° N and 123.750° E. The barangay is made of five different *sitios* (sub-villages) – Campo Siete Proper, Cadulawan, Minaga, Kalbasaan and Lubas. Different *sitios* have different land terrains. The *sitio* proper, also known to the locals as Siete is the area near the main road. This area is covered by tall trees and is primarily on a less elevated level. Cadulawan is a more elevated area than the *sitio* proper and is also covered by trees. Minaga, Lubas and Kalbasaan areas are the farthest areas, where local inhabitants walk by foot around hills and across streams for three or four hours in order to reach their houses. The roads to these areas are not cemented and have limited access to electricity. The residents therefore have difficulty in transporting food and other basic needs in these areas. However, these areas are abundant in plant sources, as some of these areas are not covered by tall trees. Such areas offer a good condition for planting crops. The barangay is rich in water resources, with flowing streams, rivers and tributaries. Water is free in the community and built-in wells and water pumps are provided by the government for communal use. Plant species are abundant because of this abundance in water. Many trees and different types of plants abound.

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For the purpose of creating a biodiversity register 27 local people from nine *sitios* from the barangay were interviewed, in addition to eight interviews with previously identified local healers and herbal garden owners. It was observed that there were only a few local healers in the town and these healers do not practice treating diseases as their primary source of income. Most were farmers,

while others took jobs in other towns in addition to being healers (locally known as *manghihilot* and *mananabang*).

In the study, about 73 plant species were identified belonging to 36 families and 63 genera. Out of the 73 plant species, plants from the Malvaceae, followed by the Fabaceae and Rutaceae were most frequently mentioned and therefore have a high importance index in all categories. According to Toledo and colleagues in 2009, medicine and foods among other plant uses have high importance because they are vital to human survival. (Toledo et al 2009). This was also observed in the result of the study as 41 species (55.4%) of plants were identified to have medicinal value, followed by 34 species (51.4%) obtained as food sources, 11 species (14.9%) used as cash crops, 10 plant species (9.5%) for construction and nine species used as sources of fuel.

Most inhabitants of the area have their own *kaingin* or cultivated areas of land granted to the local people, which can be used for agricultural purposes. Some residents do not use these lands anymore because they work in the neighbouring towns and therefore do not have time to tend their *kaingin*. However, some also prefer to work as farmers and plant crops in their *kaingin* because the nearest markets are very inaccessible. They would have to travel to Lutopan or Tabunok, the neighbouring progressive barangays. They therefore need to plant their own crops in case they don't have money to spend to go to neighbouring towns. Some plants are also readily available because they grow almost everywhere in the area.

Plants consumed by the locals, planted and sold in the markets, and cash crops were mapped. *Kamote* (*Manihot esculenta*) is planted for food and sold as well. Saging or banana (*Musa paradisiaca*) and *gabi* (*Colocasia esculenta*) are plants that are almost ubiquitous in the area. Fruits of *nangka* or jack fruit (*Artocarpus heterophyllus*), *lubi* (*Cocos nucifera*), *saging* (*Musa paradisiaca*) and *kamatis* or tomato (*Solanum lycopersicum*) are sold by the residents in the *sitio* proper and are also sources of income.

Generally, the locals rely on commercial and traditional medicine for treatment of diseases. Many residents still use herbal knowledge for treatment of common ailments, but some residents have also adapted to recent advancements

in medicine and do not rely on herbal treatments anymore. Some residents also use medicine only if the herbal plants seem to have no effect against the ailments. Others who do not have easy access to the local markets, especially those on the remote *sitios* rely heavily on herbal medicine.

Most of the plants identified in this study are used for medicine. The residents were able to name 41 plants that had medicinal value to them. Plants used for medicine were usually weeds, shrubs and trees. The most common plant part used are the leaves. Most common preparations of these plant medicinals was boiling or soaking parts or the whole plant in water. The plants were usually used for treatment of bughat (relapse from illnesses), wounds, stomach problems, diarrhea, fever and high blood pressure. Most of the plants are shrubs or trees and are available and abundant in the area. *Tambuko* (*Kyllinga monocephala*), *dila-dila sa iro* (*Elephantopus scaber*), *mangagaw* (*Euphorbia hirta*), *sinaw-sinaw* (*Peperomia pellucida*), *cogon* (*Imperata cylindrica*) and *bila-bila* (*Eleusine indica*) are very common weeds but were identified by some informants to have specific medical uses.

The study also identified some plants with multiple uses in a variety of categories. *Cocos nucifera* is the plant with the most uses, as it is used in all categories. *Gmelina arborea*, *Mangifera indica*, *Artocarpus heterophyllus*, *Musa paradisiaca* and *Sandoricum koetjape* are utilised in at least three use-categories.

Conclusion

Today, the creation of community biodiversity registers (CBRs) is central to any biodiversity related intervention and it is a strategy that is being increasingly recognised by many National Biodiversity Authorities. It is also becoming an increasingly important component of Local Biodiversity Strategic Action Plans (LBSAP). Such systematic documentation gives precise data for preventing loss of biodiversity resources, their sustainable use, as well as protection of community knowledge from piracy.

In this case, the study was able to identify a total of 73 species of plants belonging to 35 families. These plants were recognised as having numerous ethnobotanical uses. Plants used for food and medicine have the most frequency of identified species because they are important

for survival and therefore have a greater importance to locals. Most of the residents have their own *kaingin* and therefore get their food sources from their own harvests. Trees were also significant sources for construction and fuel. However, only a few species were identified for these categories because residents were not able to point to individual stands of specific trees and would instead use general terms such as *kahoy sa lasang* (trees in the forest) to refer to those trees. Medicinal plants have the highest number of species among all categories. The use and preparation of these medicinal plants can be verified by studying their biochemical components.

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RCE Greater Dhaka: Biodiversity Conservation

Mohammed Ataur Rahman

RCE Greater Dhaka

RCE Greater Dhaka's region of focus includes the Dhaka megacity and the coastal zone of Bangladesh. The RCE aims to develop understanding on sustainable development and to introduce it into educational content and practices. The Centre for Global Environmental Culture (CGEC) at the International University of Business, Agriculture and Technology is the leader of this RCE. Other partners include: Khulna University, Shahjalal University of Science and Technology, University of Science and Technology Chittagong, Rotary District Greater Dhaka Club, Gono bishwa bidyalaya, WWOOF Bangladesh, FEPPCAR, and Red Crescent Youth. The RCE works with educational institutions, Ministries of Education and Environment, municipal bodies, NGOs and development authorities to achieve its goal. The initial activity of the RCE was an extensive baseline study on existing sustainable development learning activities and required organisational capacity focusing on multifaceted problems such as food, water and energy crises, biodiversity loss, pollution and waste management, malnutrition, and epidemics. The study began with a special emphasis on biodiversity conservation, followed by the collection of information regarding challenges identified for sustainable development in RCE Greater Dhaka. Subsequently, discussions were held among various stakeholders to identify potential solutions.

Crop diversification was selected as a major focus of intervention. Special emphasis was given to bring more species and varieties of different plants under cropping culture. Food-tree crops were also considered for supplementing nutrients. Natural defense mechanism management, traditional floodplain management, homestead farming and permaculture have been the key elements of RCE activities to enrich biodiversity, livelihoods and protection from natural disasters.

Coastal area conservation was another key focus area. The RCE Greater Dhaka network has studied coastal and regional biodiversity extensively. Such study reveals that more than 34 species of tropical rainforest plants – viz. *Podocarpus neriifolia*, *Entada phaseoloids*, *Magnolia pterocarpa*, *Buchanania lancifolia*, *Holigarna longifolia*, *Vitex peduncularis* and *Pterospermum semisagittatum*, among

others – are facing extinction (National Herbarium 2001, Encyclopedia of Flora and Fauna of Bangladesh, 2009). Animal species like cats, bear, porcupine, wild boars, pythons and anteater are rarely spotted. Among the marine and coastal species, red crabs, jellyfish, sharks and dolphins are rare, though these were the major species before 1980. The great migration of *Hilsa ilisha* towards Myanmar is observed but marine Hilsha used to breed in the fresh waters of the Ganges, Brahmaputra and Meghna about 100-150 kilometres inside Bangladesh. There has been a great crisis in regard to prevailing fish and aquatic resources and huge numbers of fishermen have lost their means of livelihood. The biodiversity has also been affected due to pollutants from upstream and less water flow during the dry season (Rahman 2011).

There has been a great crisis in regard to prevailing fish and aquatic resources and huge numbers of fishermen have lost their means of livelihood.

Project and Achievements

RCE Greater Dhaka works on a variety of learning actions related to biodiversity and ecosystem services.

Public Awareness Campaigns and Educational Interventions

As an action strategy to create awareness about biodiversity, the RCE considered the regular commemoration of important days. The International Day for Biological Diversity was observed throughout the RCE region with awareness and practices campaigns, workshops and seminar, training, tree plantation programmes, exhibitions, the collection and propagation of rare plants, and advocacy against habitat loss and pollution, among others. These activities resulted in an increased understanding among the communities of the role of biodiversity for human well-being, as well as understanding of ecosystems functioning. Similarly, World Environment Day on 5 June 2012 was celebrated with seminars, exhibitions and tree plantation programmes. The members of the RCE Greater Dhaka network arranged their programmes with the goal of raising the significance of the Green Economy theme.



30-month old *Entada phaseoloids*, an endangered plant, climbing over Krishnachura (*Delonix regia*) tree in IUBAT Green Campus, the only climber grown outside Chittagong Hill Tracts in Bangladesh

Conservation Action and Research for Coastal Areas

The huge mangrove forest of the coastal zone is one of the most unique biodiversity-rich forests in the world. The Sundarbans consists of 64 plant species and these mangrove species have the capacity to withstand estuarine conditions and saline inundation during tidal effects. *Heritiera fomes*, *Excoecaria agallocha*, *Bruguiera gymnorrhiza*, *Xylocarpus mekongensis*, *Rhizophora spp.*, and *Ceriops decandra* are particularly important among those species.

The major birds found in this region are open-bill storks, black-headed ibis, water hens, coots, pheasant-tailed jacanas and pariah kites. Some of the fish and amphibians found in the park are sawfish, butter fish, electric rays, silver carp, star fish, common carp, king crabs, prawn, shrimps, genetics dolphins, skipping frogs, common toads and tree frogs. The Sundarbans National Park houses an excellent number of reptiles as well, including estuarine crocodiles, chameleons, water monitors, hard-shelled batgun terrapins, mouse geckos, monitor lizards, and Cuvier's dwarf caiman, turtles (Olive Ridley, hawksbill, and green turtles), and snakes (pythons, King Cobras, rat snakes, Russell's vipers, dog-faced water snakes, chequered killbacks, and Common Kraits).

Some endangered species of the Sundarbans include Royal Bengal tiger, estuarine crocodile, river terrapin, Olive Ridley turtle, Gangetic dolphin, ground turtle, hawksbill turtle, and king crabs.

Though there is tough protection in the park there are a few loopholes that poachers and others can take advantage of. The park's topography, with hostile terrain crisscrossed by several rivers and their distributaries and a long international border with India, as well as the fishing trawlers and launches nearby help provide access to those interested in poaching or cutting wood and this also affects the mangrove forests. Lack of staff, infrastructure and funding also influences the situation.

Vulnerabilities in the coastal zone are increasing with accentuations of natural hazards caused by environmental degradation, climate change and human activities, as well as the exploitation of mangrove. It has already affected Bangladesh through land erosion, salinity intrusion and a loss of biodiversity. In the future, its

potential threats will be even greater. Due to climate change effects, the incidences of tropical storms and tidal surges have already increased along the coastal belts of Bangladesh, India, Myanmar and Sri Lanka. Cyclones such as Sidr, Aila and Nargis are typical examples of incidences that have caused significant damage or loss of life and property in coastal zones.

It is therefore essential to manage and conserve the mangrove forests. Khulna University, a partner in the RCE Greater Dhaka network, started doing research that found illegal logging and poaching of rare animals – especially the Bengal tigers and saltwater crocodiles – as well as the destruction of the largest mangrove forests. It helped the Government of Bangladesh to impose stringent measures by increasing patrols, coast guards and punishments for illegal activities.

The Shahjalal University of Science and Technology has been working on the management of red-listed flora and the wetlands of Hakalooki Haor and Tangoir Haor. They developed awareness programmes for the local community and NGOs against poaching of migratory birds and their safe stay in the Haors.

A seminar on education for sustainable development (ESD) was organised on the behavioural study of rural villagers, in which a six-member delegation headed by Professor Koji Matsuoka from Kobe University, Japan and Kiichi Oyasu, Head of UNESCO Dhaka Office, participated. They shared their experience and emphasised the importance of ESD and learning from social and traditional cultures in the perspective of social development and enrichment of biodiversity.



The city of Dhaka

Crop Diversification

Once biodiversity-rich and today mostly densely populated floodplains and deltaic, Bangladesh suffered a massive loss of biodiversity especially during the time of the green revolution. To restore the biodiversity and to manage the Ganges-Brahmaputra-Meghna floodplains with appropriate crops, RCE Greater Dhaka has started study on crop diversification, and traditional multiple and multi-story cropping culture, and engaged graduate students to study the local indigenous rice varieties which are in culture in different part of Bangladesh. The RCE increased awareness through programmes for youth and women that highlighted the importance of biodiversity and the genetic resources for food and nutrient security, as well as the protection of the region from environmental degradation. Other important projects of the RCE related to biodiversity are listed in Box 1.

Another member of the RCE, CGEC, has been working on the Chittagong Hill Tracts on the eastern coast. The tracts are within 48 kilometres from the coastline and biodiversity and the conservation of the ethnic cultures and traditions of 11 tribal and indigenous people are important issues. At one time, Chittagong and the Chittagong Hill Tracts had deep mixed rainforests with diversified flora and fauna. The folded ranges are very important for the coast of the Bay of Bengal and their existence is essential to protect the coastline as well as the forest flora and fauna. The mysterious Halda River is the only natural fresh-water fish breeding ground for the genetically pure Indian carps, including *Catla catla*, *Labeo rohita*, *L. calbasu* and *Cirrhinus marigala*, as well as other species of fish of South Asia. Upstream dam and deforestation that decreased fresh water flow from upstream, as well as salinity intrusion from the Bay of Bengal, have combined to push the breeding centre upward and egg production has declined sharply. A special awareness programme has been organised with students, youth, women, NGOs and local bodies against deforestation in the hills as well as in the coastal mangroves. The causes are being identified and protection measures have also been taken to ban fishing during the spawning season from the full moon of April to June. Although it was a difficult task, it has been successfully achieved by motivating local people and authorities.

Box 1 RCE Greater Dhaka has been working on various projects to save biodiversity:

1. Formulation of a specific rule/law for ship-breaking industries to save coastal and marine environments.
2. Bringing more species under cropping culture to enrich biodiversity and for food and nutrient security.
3. Awareness programmes for protecting multiple cropping cultures like Jhum cultivation in the hilly zones of the monsoon climatic region.
4. A case study on the Uttara Model Town, Dhaka to encourage better environment, nutrition and health opportunities by connecting urban dwellers with nature and respecting the value of biodiversity.
5. Urban remodelling to keep sufficient space for biomass recycling and gray water use for food production.
6. Awareness programmes to protect Sal Forest from urban industrial pressure.
7. Protection of migratory birds in Hakaloki and Tangoir Haor lakes.
8. Homestead farming for self-employment and to ensure biodiversity.
9. Indigenous cultures, practices and wide range uses of hundreds of species in a limited space widened the implication of biodiversity.
10. Programme of WWOOF Bangladesh (RCE member) for learning from the farmers to respect organic culture, as well as an education programme to involve the students in sustainable agriculture.

Learning and Actions to Save Mangrove Forests

RCE Greater Dhaka has placed an emphasis on natural triple-tier defense mechanisms of mangrove forests and the hill ranges as a strong wind barrier along Chittagong and Cox's Bazar shoreline. Sundarban, Chokoria Sundarban mangrove forests are under threat of destruction due to uncontrolled logging, agricultural expansion, and shrimp culture and for ship-breaking industries. Along with the forests, many flora and fauna, including the great fish resources, are destroyed in many areas. Khulna University and University of Science and Technology, Chittagong has been conducting an awareness programme involving local communities to help save them.

At the beginning of the process, the local communities were not aware of the naturally grown triple-tier defense mechanism of the coastal zone, which includes dense bushes along the shoreline and the estuarine rivers, and a strong middle tier with hardy plants and long palms and nuts at the top which gradually reduce the speed of storms and river and sea currents. Among the immediate results, some animals like deer appeared for grazing in newly planted zones.

It has been a great lesson to undertake such sustainable works with limited resources. It has also been an inspiration to work collaboratively to save vulnerable resources

The mangrove zone of the coast is a muddy area with plants able to specially adapt with pneumatophores. The growth of plants is very slow but the plants become very strong in order to withstand cyclonic storms and tidal surges. The under-story is rich with diversified flora and fauna, and the Sundarbans are a unique habitat for deer, monkeys, tigers and crocodiles, turtle, birds, shrimps and crustaceans, snakes, honey bees and many other insects.

This RCE project presented an opportunity to develop awareness of the people about the impacts of indiscriminate logging, poaching and the extraction of Gol Pata (leaves of *Nipa fruticans*), and also around the creation of pockets created by extracting forest trees and excavating ponds and lagoons for shrimp. Such actions can result in strong cyclones in the pockets, as happened during Cyclone Sidr in 2007 and Cyclone Aila in 2009. Today people continue to suffer and the region has not yet emerged from the salinity effects, with millions still living in the urban areas to which they escaped.

In an attempt to combat the problem, there have been recommendations made to create pockets in the coastal forest by clearing trees and planting only suitable species, such as coconut, keora, goran, bain, kakra, and sundri in the coast. Some other recommended species should be planted in the immediate interior. Shallow-rooted fast-growing rain trees, such as *Albizia spp* and mahogany, must not be planted in the coastal region as it was observed that during storms these trees are more prone

to damaging nearby structures, utility lines, bridges and crops. The recommendation was also made to excavate big ponds (traditionally called Dighi) with raised banks planted with coconut trees. These ponds would serve as a fresh water source during calamities.

These are the more effective lessons of RCE Greater Dhaka that were communicated to stakeholders through formal and informal educational processes. In response to these and some other activities, the Government of Bangladesh has already taken some measures to make shelterbelts and adopted strict measures not to extract mangrove forest for shrimp culture and for excavation of large ponds. It is further hoped that in the course of implementation, rural communities will benefit during the extreme events, as rural-to-urban migration will be reduced and urban life will be made more resilient and comfortable as a result of the fruitful management of coastal zone.

A participatory mangrove plantation involving nearby coastal communities has been organised by RCE Greater Dhaka into a sustainable mangrove and as a natural protection mechanism, as well as to protect coastal biodiversity. For effective shoreline protection as well as windbreak, appropriate plants of mangrove species and strong wind-resistant trees like coconut, fishtail palm, areca nut, and Palmyra palm were planted following an appropriate design. Local stakeholders, especially students, youth and NGO members were motivated to implement the work voluntarily under the supervision of the Institute of Forestry and Environmental Sciences, Chittagong University of Science and Technology (USTC), Chittagong and CGEC Dhaka, all partners in the RCE. It was a great challenge to motivate and organise these individuals to plant such slow-growing plants, as they were used to working with fast-growing trees that had some short term benefits but which were very prone to strong winds. Elderly people supported the programme and they used their experience to suggest other species that could help control erosion as well as reducing the wind speed of cyclonic storms. Through this programme, ideas and traditional wisdoms help in sustainable development and creating collaborative livelihoods through the application of both scientific and traditional knowledge. Successful motivation and implementation of the work were significant achievements. The need for naturally adaptive species and their multipurpose uses, including environmental protection, has been realised.

Conclusion

It has been a great lesson to undertake such sustainable works with limited resources. It has also been an inspiration to work collaboratively to save vulnerable resources from disasters and calamities. These efforts can serve as an example for others in similar situations to replicate. In this case a CGEC expert of RCE Greater Dhaka developed the mechanism and partner organisations were selected at the beginning of the project.

Through the scientific management of coastal ecosystems, especially in the case of mangroves and a diversified plantation establishment with a triple-tier mechanism, it is possible to reduce natural calamities, control erosion, save biodiversity and the loss of crops. Thus, the whole coastal zone can be made more productive and sustainable while, at the same time, reducing rural-to-urban migration.

Since Bangladesh is a fertile country with a huge population, a diversified cropping culture with proper landscape management can solve most problems, especially those related to food and nutrient security. Moreover, through human resource development with appropriate knowledge about sustainability, the targets of the UN Decade of Education for Sustainable Development can be achieved.

The stakeholders of RCE Greater Dhaka are continuing their efforts to enrich their knowledge and experience through research, dialogue and action. Through their active participation, they have been contributing to the transition towards a green economy, more sustainable livelihoods, sustainable use and functional ecosystem services.

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RCE Greater Phnom Penh: Promoting ESD through Food, Agriculture and Environment Education in Elementary Schools and Rural Communities

Lalita Siri wattananon Machito Mihara Bunthan Ngo

RCE Greater Phnom Penh

Agriculture is one of the important sectors of the Cambodian national economy, with more than 70% of the population engaged in the agricultural sector (MAFF, 2009). Phnom Penh is the capital of Cambodia and has more than 1.3 million inhabitants. Rapid development of agricultural technologies, dependant on chemicals such as synthetic fertilizers, herbicides or pesticides, has significantly increased agricultural production since the late 1990s. However, the overuse of agricultural chemicals is damaging long term soil fertility and the productivity of farmlands. Agricultural chemicals released from farmlands downstream are also degrading water quality. This means that intensive farming practices dependant on agricultural chemicals are causing various problems for the natural environment and human health. In response, attention has been paid to education for sustainable development (ESD) in the agricultural sector for achieving food safety, as well as for environmental conservation in Cambodia.

RCE Greater Phnom Penh (RCE GPP) was established in December 2009 to promote ESD in Cambodia. It builds public awareness around the importance of creating harmony between agricultural development and natural environment conservation. The stakeholder organisations are: Royal University of Agriculture (RUA) and Institute of Environment Rehabilitation and Conservation, Cambodia Branch (ERECON CaM), which work as coordinators of RCE Greater Phnom Penh in the Secretariat Committee; Ministry of Agriculture, Forestry and Fisheries (MAFF); Ministry of Rural Development (MRD); Ministry of Education, Youth and Sports (MoEYS); Ministry of Environment (MOE); elementary schools; local communities; and private sector partners in target areas. In addition, Tokyo University of Agriculture (TUA), the Institute of Environment Rehabilitation and Conservation (ERECON), and the Association of Environmental and Rural Development (AERD) sit on an external advisory panel of RCE GPP.

RCE GPP and ERECON have been collaborating on a project entitled "Promoting ESD through Food, Agriculture and Environment Education in Elementary Schools and Rural Communities in Cambodia", which will be described in detail throughout this chapter.

Background

Phnom Penh, the capital of Cambodia is the economic, industrial, commercial, cultural, tourist and historical centre of the country. The number of people living in the capital has been steadily increasing, from 1.28 million in 2004 to 2.1 million in 2010. The average annual growth is at 16.37%. The rapid increase in population causes many problems related to the environment, life quality, education and health, among others. Although education is the key to developing human resources to help resolve those problems, improving the education system in Cambodia is difficult, due to a lack of teachers, school facilities and financial resources. The net admission ratio for elementary school is 93.3%. However, the net enrollment ratio for lower secondary school is 34.8% and for higher secondary school only 14.8% (MoEYS 2007, 2008). Female students from rural areas or students from lower income families are all grossly underrepresented in education statistics. The majority of students who don't continue onto secondary school often start working in the agricultural sector. In the area of Greater Phnom Penh, the provinces of Kampong Cham, Kampong Chhnang, Kampong Speu, Kandal, Pray Veng and Takeo have education systems that are very insufficient when compared to the system in Phnom Penh. In these rural areas, poverty is a barrier for children to continue their study at elementary or secondary schools as farmers often ask their children to stay at home to work the land.

Despite the challenges inherent in improving the education system, the regional environmental challenges related to the use of agricultural chemicals, chemical fertilizers, herbicides and pesticides have helped to draw attention to the transformative potential of ESD and sustainable farming practices in rural development. In the area of Greater Phnom Penh, food, agriculture and environment education was the main focus of the collaborative project. The project would not just target elementary schools but also rural communities. Activities were focused on: forming farmers' groups and promoting organic farming based on natural resource circulation; promoting the distribution and sales of products with low chemical input; and promoting food, agriculture and environment education for agricultural successors. All of these activities were undertaken in collaboration with government, universities, local NGOs and the



Female students from rural areas or students from lower income families are all grossly underrepresented in education statistics. The majority of students who don't continue onto secondary school often start working in the agricultural sector

local community.

Planning and Implementation

Elementary Schools

As education is the key for developing human resources and skills, the Cambodian government and many international and non-governmental organisations try to provide better education in the country. However, more time and support is needed to achieve the same level of education as other Asian countries. In Greater Phnom Penh, schools outside the city lack buildings, desks, chairs, books and materials for studying. Many families in rural areas are poor and their children are spending less time in the classroom than their higher income counterparts, as they have to work in the fields or seek additional jobs elsewhere. In some schools, the teachers – who are grossly underpaid – charge their students unofficial fees.

In collaboration with government, universities, local NGOs and the local community, the project partners began promoting food, agriculture and environment education in 16 primary schools in Phnom Penh and Kampong Cham as a pilot. The types of education implemented included: establishing school gardens; composting; holding seminars on sustainable development in agriculture through composting and organic farming; and conducting surveys to evaluate perceptions around organic agriculture and environmental conservation for sustainable development at elementary schools. In addition to its focus on students, it was suggested that education or training for teachers in this regard should also be strengthened.

Local Farmers

These days, traditional agricultural systems have been replaced by mono-culture systems that are heavily dependent on agricultural chemicals. To promote and enhance the understanding of sustainable development in agriculture among local people, including farmers, the project partners focused specifically on local farmers' acceptance of sustainable farming practices. Activities included: promoting sustainable farming practices by demonstrating how to make compost, pellet compost, liquid fertilizer and bio-pesticides; leadership training; and workshops to enhance understanding of sustainable development in agriculture. Regular surveys were also

conducted to help evaluate the acceptance levels of sustainable farming practices by local farmers throughout the project.

Outcomes and Evaluation

Elementary Schools

Education on food, agriculture and environment was enhanced through the collaborative efforts of the government, universities, local NGOs, the local community and elementary schools in Phnom Penh and Kampong Cham. In elementary schools specifically, the following activities were conducted: leadership training; establishment of school gardens as well as compost boxes; and holding seminars to deepen the perception of sustainable development in agriculture through composting and organic farming. Questionnaire surveys were conducted to evaluate the perception of organic agriculture and environment conservation for sustainable development at elementary schools. The project successfully increased teachers' motivation and understanding more than 75 percent from the beginning of the project. Student understanding also increased. To sustain or increase teachers' and students' motivation and understanding, offering knowledge, practices, materials and equipment are very important.

The results of an evaluation done by external evaluators of the project are summarized in Table 1. As teachers, in particular, and students in elementary schools integrate sustainable agriculture in school curriculum, high sustainability of the activity can be expected.

Table 1
Results of evaluation done by external evaluators

Viewpoint	Outcome
Relevant	Activities on the food, agriculture and environment education at elementary schools are appropriate as many students become farmers
Effectiveness	Teachers and students have learned about education for sustainable development through sustainable agriculture
Impact	Teachers and school administrators see the benefit of the activities
Sustainability	Teachers, in particular, and students integrate sustainable agriculture in school curriculum

Local Farmers

As the level and degree of farmers' participation in the project is important for their level of acceptance of sustainable farming practices, interviews and questionnaire surveys were conducted to gauge the attitude of local farmers and their participation in the collaborative project.

Although many local farmers attended the first workshop, the evaluation showed low levels of true engagement in the issues. After one year passed and the farmers had learned about the use and application of composting, local farmers were more interested in using organic fertilizers, such as compost, pellet compost or liquid bio-fertilizer, so as to decrease their expenses for chemical fertilizers. In addition, local farmers became more active after understanding the benefits of organic fertilizers through the experience of applying those organic fertilizers themselves, as well as attending excursions to farms where sustainable practices have been conducted. Farmers' participation became very high and local farmers were willing to adapt sustainable farming practices. It was considered that building local farmers' confidence through various activities and enhancing farmers' communication with each other is remarkably important to increase local participation as well as acceptability.

The results of the evaluation are summarized in Table 2. Local farmers have learned from the activities and are planning to continue the system even after the activity term completes, as local farmers are very satisfied with the experience they gained.

Table 2
Results of evaluation done by external evaluators

Viewpoint	Outcome
Relevant	There are strong linkages between sustainable farming and sustainable livelihood
Effectiveness	The numbers of 450 key farms and those owners (farmers), along with the products with organic fertilizer and low chemical input are likely to be achieved as planned by the end of the activity term
Impact	The activity shows concrete and tangible benefits to the farmers
Sustainability	Farmers have learned from the activity and are planning to continue the system even after the activity term completes, as they are very satisfied with the experience they gained

As education is the key for developing human resources and skills, the Cambodian government and many international and non-governmental organisations try to provide better education in the country. However, more time and support is needed to achieve the same level of education as other Asian countries.

Conclusion

The RCE GPP activities described in this chapter are highly relevant, as they are directly linked to government policy regarding green agriculture and the real needs of increasing agricultural productivity while achieving clean and green practices. These efforts respond to the challenges of the rapidly increasing population in the area and are in full support of government strategy. The activities are also fully aligned with the global goals of sustainable production and consumption and embrace the three pillars of sustainability - economic, environmental, and social. Through these activities, ESD is introduced in schools and the school curriculum integrates sustainable farming and ESD. Accordingly, the activities of RCE Greater Phnom Penh are contributing to green growth, sustainable production, and sustainable consumption, to achieve global sustainable development. Although this project was a pilot project implemented at the sub-district level, it is expected to be scaled up to the provincial or regional levels with the collaboration with the Ministry of Agriculture, Forestry and Fisheries of Cambodia.

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RCE Penang: Traditional Medicine, Biodiversity and Health in Rural Communities

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RCE Penang

RCE Penang is the sole RCE of Malaysia, located on the island of Penang. The main secretariat is a public higher learning institution, Universiti Sains Malaysia (USM). RCE Penang capitalises on the strength of the vibrant networking between the public sector, private sector and the civil societies of Penang in an effort to promote education for sustainable development (ESD). That strength is reflected in various activities conducted by USM in collaboration with its stakeholders, particularly 10 key NGOs and two grassroots communities, under various themes (i.e. socio-economic outreach programmes, enhancing socio-cultural values and creating biodiversity with community). USM has used its academic role and position to bridge gaps among the relevant stakeholders through community development programmes, especially in terms of knowledge transfer. The emphasis is on transforming higher education for a sustainable tomorrow, which has helped USM become the only Accelerated Programme for Excellence (APEX) university in Malaysia.

For rural communities in Penang, traditional medicine is still an important source of community health services, despite the progress of allopathic medicine. However, this tradition has slowly eroded. There is a lack of documentation and traditional knowledge is often misunderstood. RCE Penang, under a formal research capacity and in collaboration with the healers' community, embarked on a project to document and link community, biodiversity and traditional medicine.

Background

In Penang, an industrialised state in Malaysia, all development – particularly in protected areas such as in reserved forest and national parks – must comply with the National Policy on Biodiversity, introduced in 1998. The National Policy also mentions the potential of traditional herbal plants for economic gain, therefore emphasising the need for conservation of biological diversity. However, traditional knowledge on herbal medicine has diminished and is only guarded by aging healers. Dissemination of knowledge to the younger generation is not common, to the point of being almost non-existent. Thus, there is a danger of losing this important cultural heritage forever, if it is not documented.

Revitalisation of traditional health knowledge, and promoting medicinal plant conservation and sustainable use of natural resources have been two of the major focus areas of RCE Penang at present. Discussions and initiatives between several RCEs in the Asia-Pacific region toward conserving biodiversity via the promotion of traditional medicine knowledge were launched shortly after the International Healers' Conference in Bangalore, India in November 2009. RCEs involved in research or implementation programmes of traditional medicines were invited to share their experiences, including RCEs Cairo, Cebu, Yogyakarta, Penang, Kyrgyzstan, Makana, Bangalore and Kodagu. Although the degree of advancement in research and ESD activities varied among different RCEs, most agreed that the current effort was not yet extensive and comprehensive enough for strengthening traditional health practices. Among the identified challenges were: lack of documentation and preservation of traditional medicinal plants; the need to recognise traditional healers and reduce misconceptions about them; lack of legitimacy regarding the contribution of traditional healers and their role in society; lack of interest and opportunities among the younger generation to learn and continue the practices of traditional healers; gap between policies and practices at community level and women's needs and roles in traditional medicine. It was felt that more research and ESD activities needed to be organised by utilising the strengths of each RCE through collaboration and partnerships. Following the event, RCE Penang planned to create more awareness about the importance of promoting traditional medicine towards conservation of biodiversity through a Training of Trainers (TOT) programme and awareness programmes including conferences on traditional medicine.

Consequently, RCE Penang has been systematically working with traditional healers by comparing the existing knowledge of herbal plants in the region with past documentation done by Burkill and Haniff in the 1930s. This effort was followed by efforts to build education and awareness programmes to recreate home gardens and create interest around the importance and the usage of herbal plants in Balik Pulau, Penang. Importance is also given to improving local livelihoods through village-based enterprise activities. A local enterprise named 'Torch Ginger Products' is a scaling up project to upgrade local common herbal plants into commercial products by

Revitalisation of traditional health knowledge, and promoting medicinal plant conservation and sustainable use of natural resources have been two of the major focus areas of RCE Penang



linking the community of Permatang Pasir, Balik Pulau with private firms, through corporate social responsibility (CSR) programmes.

Project Activities

RCE Penang has been involved in the documentation of traditional knowledge through exploratory and action-oriented research, creating awareness and fostering partnerships through networking and capacity building. The main goal of the project is to create a different, more participatory, and at times informal, approach to learning, through engagement of multiple stakeholders. In terms of contributions to well-being, awareness programmes have instilled confidence around the need and importance of conserving herbal plants. Planting them in home gardens and utilising them in food and to some extent for primary health care purposes has been a motivating factor.

... traditional knowledge on herbal medicine has diminished and is only guarded by aging healers. Dissemination of knowledge to the younger generation is not common, to the point of being almost non-existent. Thus, there is a danger of losing this important cultural heritage forever, if it is not documented.

The development of torch ginger into commercial products has not only contributed positively towards socio-economic attainments, but also enhanced self-esteem and a sense of entrepreneurship and motivation among villagers. The project has become a catalyst, spurring more innovative models of action, such as: the use of abandoned agricultural land for torch ginger farming; the development of a cooperative market for the products; and the opening up of a small shop within the village to market the products at village level. Integration of knowledge was achieved through collaborations among the main partners of RCE Penang – including Sidratul Enterprise – and various stakeholders involved in the programme, especially the villagers, community children, community housewives and the agricultural cluster of

Permatang Pasir. RCE Penang acts as a liaison between industry and the agricultural cluster group. Sidratul Enterprise, as a private sector industry, develops the product through their CSR scheme while the agricultural cluster provides the sustainable supply of torch ginger to meet the demand of the industry.

Exploratory Research: Documenting of Socio-economic Profiles and Practices of Indigenous Traditional Healers

In Malaysia the most detailed inventory of medicinal plants was prepared in 1930 by Burkill and Haniff and had never been updated since. There was an urgent need to investigate the current practice by revisiting areas covered by Burkill and Haniff and by identifying the differences in the use of herbal plants knowledge then and now. The exploratory research was planned as the first activity to create baseline data, including demographic, socio-economic profiling and the practice of healers. The exploratory study was also important to identify genuine traditional healers and establish contacts with them for future action-oriented research and awareness programmes.

Findings of the exploratory research show that traditional healers are still an important source for health management among local communities in the Northern part of Malaysia. It also shows that healers have their own specialties and niches, although in some cases some can be a general practitioner as well. Most of the healers carry the legacy from their family, while several learn from other healers. The roles come with responsibilities and accountabilities and traditional healers are also subjected to scrutiny by villagers. Traditional healers are often looked up to by the villagers as contributing to the wellness of the people in the village, thus they need to maintain their good reputation and image by delivering a good service. They have not been fully integrated into the mainstream health system. In order to promote their integration, a better understanding of their practices is needed, and thus more studies need to be done in other parts of Malaysia.

The most important contribution of this study is the development of a traditional healers' database as a point of reference for future research and implementation. In terms of partnership, the research has identified 48 traditional healers in the northern states of Peninsular Malaysia,

including their socio-demographic profiling and specialty. When compared with Burkill and Haniff, the study shows that traditional indigenous knowledge still exists, though it is not widely practiced especially among younger generations. Hence, there is an urgent need to document and promote the knowledge but at the same time ensure safety and efficacy of these practices.

Capacity Building and Dissemination

Though there are active community-based health traditions, quality, safety, efficacy, rational use, and lack of systematic documentation of these practices remain major challenges in the field of traditional health knowledge. This indicates that there is an urgent need for improving capacities of local knowledge holders as well as other stakeholders, such as community-based organisations, and educational institutions. This has led to the creation of capacity development modules and programmes for various stakeholders such as healers, researchers, civil society organisations and policymakers through the RCE programme.

A key focus of these training programmes has been to build capacity of traditional health practitioners and researchers in the area of traditional medicine and to deliberate on the role of traditional medicine in the emerging sustainable healthcare systems. This includes identification, documentation, assessment and promotion of safe and effective traditional health practices for community health care. The programmes are targeted to revive traditional knowledge in local communities related to health and nutrition for addressing complex community health needs and recognising their roles and highlighting the silent contributions of traditional health practitioners in health care.

The capacity building programmes incorporate diverse perspectives of researching and engaging with traditional medicine, including the pharmaceutical perspective on herbal product standardisation and the social and anthropological perspectives of documenting and researching indigenous medicinal knowledge. Themes like Technology and Biodiversity Products; Environment, Policy and Biomedical Sciences; and Social Policy and Alternative Medicine are also part of the focus. These programmes have created more awareness about the importance of documenting traditional medicinal knowledge in more

systematic ways. They have also impacted other RCEs through regional and global networking and generated new partnerships among RCEs for focused research projects in the area of community health and nutrition.

Another awareness programme conducted by the RCE on identification of herbal plants by young children, "MAI KENAI POKOK HERBA", involved four kindergartens and one preschool in the Balik Pulau district of Penang. The purpose of the programme is to promote awareness on the identification and use of herbal plants among pupils between four to six years of age. The programme was organised by research officers and students from Universiti Sains Malaysia. The importance of conserving herbal plants in relation to biodiversity were also emphasised in the programme. The programme used interactive learning activities to create awareness among children about the importance of herbal plants. Activities included games, singing, dancing, the use of a mascot "Mat Herba", and through hands-on planting of herbal plants at nursery and school compounds. The programme has created linkages among schools, younger generations in the community and the villagers as a whole.

Challenges and Results

This programme was based on exploratory and action-oriented research. The exploratory research brought together researchers from different fields and specialisations, making the findings more interesting and rich. Networking with communities through a participatory approach to research was the foundation of the programme. The programme is a continuation of a previous project of revitalising home gardens in the district of Balik Pulau, Penang. The main challenge in applying this approach was the difficulty in sustaining documentation in a situation where there was a severe lack of financial resources.

All of the programmes have different levels of evaluations, which indicate that transformation from mere fundamental research to action-oriented research actually makes a major difference in the communities. These differences may be incremental, but they also have potential. For example, the development of more than 30 local products through the torch ginger programme indicates how indigenous knowledge of herbal plants can be transformed into high value-added commercial products

that can contribute towards improving the livelihood of the villagers. The partnership with various sectors – from grassroots levels to the private sector – with USM as the liaison is an example of how regional networking can contribute towards greener economy through bio-prospecting and match-making of biodiversity resources through the right kinds of industry partnerships.

RCE Penang, and particularly USM as a higher learning institute, has benefited from the programme in many ways. The fundamental research opened up new, previously disregarded, avenues with regards to traditional medicine. As a result, more transdisciplinary research focusing on different aspects of traditional medicine is currently being conducted. The documentation techniques shared by RCE Bangalore have also benefited USM with tangible outcomes, such as enhanced capacities and increased publications on local herbal use that are more structured and holistic. ESD at the community level has also heightened awareness on the need to preserve traditional medicine knowledge and has changed the paradigm of teaching into more interactive and participatory methods, benefiting all relevant stakeholders.

A list of the key project results include:

- The development of an herbal medicinal plants database has increased awareness about the importance of biodiversity conservation among various stakeholders;
- The development of a traditional healers database contributed to an increase in the understanding of traditional healers' practices and associated natural resources, while increasing interest in conservation of biodiversity;
- Revitalisation of home gardens under a ex situ conservation programme has promoted informal learning and revitalised social capital within communities;
- A module for young children, from kindergarten age, has been developed to promote interest around the importance and use of herbal medicinal plants;

- Organising events like Training of Trainers, workshops and conference created networking and unique learning experiences for RCEs on the contemporary relevance of traditional medicine and its role in community health; and
- Development of a local enterprise 'torch ginger products' could create sustainable livelihoods for local communities.

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These programmes have created more awareness about the importance of documenting traditional medicinal knowledge in more systematic ways. They have also impacted other RCEs through regional and global networking and generated new partnerships among RCEs for focused research projects in the area of community health and nutrition.

RCE Yogyakarta: Traditional Knowledge on the Use and Conservation of Pandanus

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RCE Yogyakarta

RCE Yogyakarta is administratively based in a Special Region of Java island called Yogyakarta. From the time of its establishment RCE Yogyakarta has had a vision to play the role as a centre which cares and proactively engages in sustainable development challenges in the region. RCE Yogyakarta develops concepts and technologies that support sustainable development. It implements them at and with local communities through: appropriate education in the field of sustainable development (SD) through formal, non-formal and informal education; sharing information, increasing awareness, providing space for learning and action as well as community mobilisation towards establishing a nation with more sustainable future; and actively involving and playing roles in national and international networking to share and collaborate in education for sustainable development (ESD).

The initial establishment of RCE Yogyakarta started as a response to the earthquake in 2006 with an aim of rehabilitation of disaster victims. At the same time it was also designed to respond to illiteracy challenges in local communities, support small and medium-sized enterprises (SMEs) and to work in line with university commitments for a green campus and renewable energy. Now the focus of RCE Yogyakarta has expanded to include other problems related to the region, such as the development of a green city, restoration of coastal land, disaster management and rehabilitation (DERU), zero waste agriculture, and capacity building among youth, among others.

RCE Yogyakarta has a slogan, "Together with Community, Promoting Changes towards Sustainable Development through Education". Apart from Gadjah Mada University, State University of Yogyakarta, a local school Pondok pesantren Nurul Ummah and NGOs such as Komunitas masyarakat Code Utara, Lembaga Lestari, Yayasan Satu Nama, Pesantren Budaya Ilmu Giri, Yayasan Dian Desa Yogyakarta, Rumah Budaya tembi Yogyakarta, and SHEEP Yogyakarta are the members of RCE.


Introduction

There are many traditional knowledge practices related to natural fibers in Indonesia. One is the use of the natural fiber sources from pandanus. The pandanus species consist of *Pandanus tectorius*, *P. silvestries* and *P. terrestris*. Their local names are Pandanus Sea (Sunda); Pandanus Palm (Maluku); Pandanus Ponele (Gorontalo); and Pandanus Ash (Sumatera). These species have been part of weaving and knitting traditions for generations. This tradition was originally used to complement traditional ceremonies.

Pandanus generally grows around coastal forest. It is limp but tough, long, easily coloured, easily woven, and can be found in almost every area in Indonesia. The products made from it are not only for mat-woven materials, but also fashionable hats, handbags, chairs, laundry boxes, pillowcases, curtains and others.

The tradition of weaving with Pandanus fibers usually can be found in coastal areas of Indonesia using simple technologies and mostly passed on from generation to generation. The tradition is also found in Kemadang village, Gunung kidul, Yogyakarta, a village which has the great potential of raw material from Pandan. Kemadang is a region within the southern area of Gunung Kidul district in which most of the people rely on fishery, agriculture and tourisms. The economic development in this area is still conventional and needs further innovation to increase local incomes. Pandanus is one of the raw materials to be developed further. The materials have been processed into various kinds of handicrafts, however this tradition tends to be declining as there is less community commitment to transferring the knowledge to future generations and there are limited conservation activities to preserve its biodiversity.

Therefore, some activities were delivered by the Faculty of Forestry and Faculty of Biology, Gadjah Mada University on behalf of RCE Yogyakarta in order to overcome those problems. The activities are mainly conducted through the Student Community Services – Community Empowerment Learning (SCS-CEL) programme, a mandatory subject for final year undergraduate students.



The tradition of weaving with Pandanus fibers usually can be found in coastal areas of Indonesia using simple technologies and mostly passed on from generation to generation.

This community service is conducted three times a year for a two-month period. The programmes are conducted based on principles of win-win solutions, co-creation, co-finance, sustainability and flexibility. The activities conducted by SCS-CEL programmes are also accompanied by independent activities conducted by the Faculty of Forestry in terms of product development and cultivation, and conservation by the Faculty of Biology through the IM-HERE project.

Project Activities Dissemination of the Benefits of Pandanus and its Conservation

The goal of these activities is to disseminate the economic value of pandanus when it's processed into products with commercial interest. If villagers know the benefits, they will be aware of the value of traditional knowledge on the use of pandanus and transfer this knowledge, especially to young generations. This socialisation also convinces people of Kemadang Village to use the natural resources of the village wisely and to work towards its conservation. The dissemination of the commercial value of pandanus and the importance of its conservation was conducted at the Village Hall and attended by more than 100 people, including the forum of village women members, reef cadets, the Gajah Mada University students that will be deployed through SCS-CEL, farmers and fishermen. In this community meeting, SCS-CEL students demonstrated how to make handicrafts using pandanus, while pointing out the importance of conserving the plants to ensure sustainability.

The target groups of activities were villagers of Kemadang, since pandanus leaf processing is widely done in this region. Based on the proposals from residents, villagers, community leaders, village heads, 20 people were selected for training.

The Apikri Association of Indonesian Handicraft products will accommodate pandanus rope products and the Tourism Department will market similar products in the southern coastal region.

Training

Training on the use of pandanus was done for more than two months, with face-to-face meetings every Monday and Tuesday. Wednesdays were dedicated to self practice in the homes of community members. Training for processing and manufacturing of pandanus leaves was done in collaboration with the instructors of the Center for Craft and Batik, while the cultivation training was done with instructors from the Faculty of Biology. Training included: processing of pandanus (colouring); making good products from thin strips; and weaving thin strips into rope. At the end of the training, sessions were held on pandanus cultivation – both vegetative and generative – as well as pilot demonstration plots. The results of this training were encouraging; because of the meetings, participants became capable of producing saleable craft products, such as beach sandals, rope, carpets, chairs, anglers, fans, bags, towels, mats, key chains and so on. As an outcome, participants formed a group to begin joint venture projects. The group was named “Makmur Pandan” and the hope is that the enterprise will help Kemadang villagers take full advantage of pandanus. After the training ended, joint venture groups resumed activities by holding meetings every 35 days for further development and evaluation. The meetings consist of skills training.

Methodology

The purpose of this activity is for stakeholders to give special attention to the results of research and training that can be followed up. Focus Group Discussions (FGD) were held at the Village Hall to review progress and source raw materials. These were attended by more than 120 people from joint venture groups (Makmur Pandan) and village forums, as well as by students, reef cadets, members of womens groups, the Department of Plantation and Forestry, Department of Tourism, Social Services, the Tourism Office, the Office of Industry and Trade, Bank (BNI'46) branch composed of Gajah Mada University and resource persons from Apikri Association of Indonesian Handicraft, Regional Craft Board of Yogyakarta Province, Center for Craft and Batik, Faculty of Economic and Business, Faculty of Biology and RCE Yogyakarta committee board members.

FGD results were very encouraging and the local government agreed to follow up on this activity, through activities such as establishing the first pandanus craft

centres in the region of Gunung Kidul. The Apikri Association of Indonesian Handicraft products will accommodate pandanus rope products and the Tourism Department will market similar products in the southern coastal region. In this regard, concerns of stakeholders are necessary to help the community develop activities beyond its initial stages. Follow up programmes must be done in order to form financially self reliant communities.

Conclusion

These programmes have benefited the local community by helping locals learn about the benefit of pandanus, by increasing their incomes and by teaching them about the importance of conservation. RCE Yogyakarta plays a proactive role in promoting sustainability and continues to promote this activity through monitoring and supporting follow up of activities independent of SCS-CEL. In addition to the economic benefits, the programme helped local work together to form small enterprises and helped them preserve their heritage, since their culture is passed on to younger generations through these enterprises. RCE Yogyakarta is now looking to for further support and funding from the private sector while continuing to increase the skills of those in the local community.



Pandanus tectorius

RCE Cha-am: Biodiversity and Education for Sustainable Development

Areeporn Sittiyapaiboon Sonjai Havanond Mario T. Tabucanon

RCE Cha-am

RCE Cha-am was acknowledged by United Nations University on 28 March, 2008. As the coordinating body, the Sirindhorn International Environmental Park (SIEP), located in Rama VI Camp, Cha-am District, Phetchaburi Province of Thailand, is the headquarter for the RCE.

The network is comprised of educational institutions, royal projects in Phetchaburi Province (e.g. Huay Sai Royal Development Study Center; Hupkrapong Royal Project; Somdej Phra Srinagarindra Park; Leam Phak Bia Environmental Study Research and Development Project Under Royal Initiatives, Phetchaburi Province), governmental agencies (e.g. Ministry of Natural Resources and Environment, Ministry of Education, Ministry of Energy), local administration, NGOs, local communities, private companies, public enterprises, and other organisations from within Thailand.

Foreign and international organisations are also involved, such as the United Nations Environment Programme (UNEP), Swedish International Development Cooperation Agency (SIDA), ASEAN Centre for Biodiversity (ACB), and the Foundation for Global Peace and Environment (FGPE), Japan, among others. They provide support in terms of collaboration, funding, human resources, knowledge exchange, and ideas for the development of future plans.

Challenges and Activities

RCE Cha-am covers two important provinces of south-west coastal Thailand - Phetchaburi Province and Prachuap Khirikhan Province. Both provinces are closely linked to the history of modern Thailand and to the Chakri Dynasty, with several royal palaces and residences located within their geographic boundaries. Moreover, both provinces share common coastal and terrestrial ecosystems that contain some of Thailand's highest biodiversity reserves and most intact forests and coastal habitats. The key regional sustainable development challenges faced by the two provinces include economic challenges (e.g. eco-tourism, fisheries, agriculture, increasing indebtedness of poor), environmental challenges (e.g. restoration of mangrove ecosystem, soil erosion, coastal erosion, deforestation, green energy, soil and water management), as well as social challenges (e.g. lack of understanding of sustainability and of social issues affecting communities).

Major education for sustainable development (ESD) activities of the RCE include: energy, environmental and natural resources conservation (e.g. restoration of mangrove ecosystem, soil erosion and coastal erosion protection, deforestation, soil & water management, green energy); eco-tourism; fisheries and agriculture; community uniqueness and indigenous knowledge; and creating a general understanding of sustainability by following the "Sufficiency Economy Philosophy" of His Majesty King Bhumibol. All the ESD activities undertaken are translated into public actions by following the "Sufficiency Economy Philosophy". These activities will help lead to the sustainable development of the region in the future, including a green economy, green society, sustainable livelihoods, and sustainable use of ecosystems, among others.



Biodiversity and ESD Initiatives

Decades ago, the region where SIEP is situated was degraded as a result of the irresponsible intrusion of the public for economic and agricultural purposes. The original serene and fertile natural resources and environment were destroyed. The royal initiative to rehabilitate and restore the natural environment of the region was the main motive behind the establishment of SIEP. The strategy was to not only achieve the restoration and rehabilitation goal but also to use SIEP as a learning facility for the general public, local communities and schools. Biodiversity and ESD initiatives are important integrated parts of the overarching goal of SIEP. Additionally, the role of the RCE is a tremendous contribution mobilising a host of stakeholders, each making contributions based on their mandates and capacities.



After rehabilitation, during the stage when the park is contributing to education and research as a learning centre on biodiversity and ESD, many stakeholders, especially from the business sector and local communities, joined forces.

During the rehabilitation of the area, government agencies were the primary actors. After rehabilitation, during the stage when the park is contributing to education and research as a learning centre on biodiversity and ESD, many stakeholders, especially from the business sector and local communities, joined forces.



Biodiversity Study at the Sirindhorn International Environmental Park

The Biodiversity Study at SIEP is a collaborative project of RCE Cha-am. The partners are the Department of Environmental Quality Promotion (DEQP), Ministry of Natural Resources and Environment, and the Faculty of Forestry of Kasetsart University, which is the institution that carried out a study on biodiversity in the park in 2007-2008. This was a seminal collaborative project in that it served as a baseline for mapping a future strategy for biodiversity conservation in the region.

Results revealed that the SIEP area covers three kinds of forests: 1) mangrove forest 2) beach forest 3) successional forest/secondary forest. There were 88 species of birds found in the area. In 2010 there were more than 100 species found. These were a mix of vulnerable, near threatened, least concern, resident, winter visitor, and passage migrant species. In the past, there were nine fish species found in the present park area, however the study carried out in 2007-2008 revealed 66 species of fish, four of which were found in the past and the rest, 62 species, were newly found. Furthermore, there are 118 insect species found in the park as well as some benthos.

Due to the richness in natural resources, flora and fauna species of the park, SIEP provides RCE Cha-am with facilities for ESD learning on biodiversity and an important place to carry out research on biodiversity.

The ESD Centre

The aforementioned biodiversity project, where the park's current stocks and potentials for biodiversity preservation were studied, was the impetus to expanding RCE Cha-am's education and research agenda.

The project to establish the ESD Centre (ESDC) was a joint effort of SIEP, Toyota Motor Thailand (TMT), the Department of Environmental Quality Promotion (DEQP) of the Ministry of Natural Resources and Environment, and the World Wildlife Fund (WWF), as well as the Border Patrol Police Bureau, Mrigadayavan Foundation, and many other sponsoring business organisations and foundations.

SIEP hosted the ESDC facility and made available its nature laboratories. TMT not only provided the funds but also shared its inspirational corporate vision and strategy on sustainability – the vision was presented at a UNU-IAS-organised side event at the tenth meeting of the Conference of the Parties of the Convention on Biological Diversity (CBD COP 10) in Nagoya. WWF took the responsibility of delivering the education and training programmes, as well as managing the centre in conjunction with SIEP. DEQP provided technical support and linkages with other government partners. The provincial local government encouraged the local people, schools and communities to avail of the ESD facility utilised by RCE Cha-am.

ESDC's objective is to promote the conservation of biodiversity and natural resources, and advocate conservation and rehabilitation activities to all target groups at both the national and international levels. It provides services on environmental education curricula for students and hosts a natural and environmental camp, volunteer development camp and other camps especially for school students and teachers.

Under the environmental education curricula, ESDC offers study topics such as:

1. ESDC Biodiversity Study, which covers the biodiversity of ecosystems, species, and genetic, food chain, lifecycle and relationship of living species;
2. Mangroves Study, which deals with vegetation structure, the adaptation of mangroves, photosynthesis, the distribution zone, the impact and sustainable utilisation of mangroves;

3. Bird Species Study, which deals with the evolution of birds, physical characteristics, habitats, food, migration, and the biodiversity of birds in the park, as well as the environmental problems with the red list species and the solution for balancing between humans and the environment; and
4. Marine and Coastal, Sand Beach and Benthos Study, which focuses on the ecosystem of marine and coastal areas, sand beach, tidal effect, adaptation and classifying of benthos, including environmental problems and monitoring of the quality of mangroves and beach forest.

The exhibition at ESDC presents the environmental messages of His Majesty the King regarding mangroves and types of beach. It also includes an ecosystem from mountains to the sea, a map and many kinds of visiting birds in the world. The Nature Theatre of ESDC shows environmental documentaries and changes in nature and the environment from around the world.

ESDC provides knowledge on environmental study to all target groups through the process of environmental education and immersion in the ecological community of the park. Visitors can experience the different ecosystems and the biodiversity of natural resources. ESDC also offers biodiversity studies that cover biodiversity of ecosystems, species, and genetic, food chain, lifecycle and relationship of living species in the ecological community involving mangrove, beach and mixed-deciduous and other kinds of forest, aquatic animals, territorial animals, and more than 100 bird species.

The ESDC, as an RCE Cha-am facility, is a tool that can help build the sustainable preservation and utilisation of natural resources and sustainable development in the region. It does this by bringing knowledge and a better understanding of the environment and biodiversity to people, teachers, students and the public at large.

The principal targets of the learning programmes of ESDC include, but are not limited to, both primary and secondary level schools. Thousands of school students benefit from the facility every year, learning about biodiversity. The programme curricula vary in content and duration depending on the interests of students. The learning is not just theoretical, but rather experiential. Learning principles

rely on a combination of general knowledge, as well as local and traditional knowledge. Research is undertaken by investigating the species and succession in the area, as well as the new species that could be raised, and the kinds of environmental conditions that are conducive to these living species. The facility is a venue for many seminars and workshops, both local and international.

Other Biodiversity and ESD Initiatives

The 'Billion Tree Campaign', which is under the auspices of FGPE and UNEP in collaboration with DEQP in Thailand, is a showcase in which local communities and the public at large are participating to 'save the planet'. Learning is done on how indigenous plant species survive and the kinds of conditions essential for survival. Aside from contributions to generate more forests, the campaign provides members of the RCE to learn the characteristics and usefulness of plants as they grow.

The park also uses natural biodiversity classrooms for learning by Boy Scouts across the country by way of camping and learning the species' natural habitat by being immersed in the habitat themselves. This activity is in collaboration with the Ministry of Education of Thailand. The environmental curriculum based on the RCE Cha-am experience is considered a good model for environmental education that could be used or replicated nationally.

Conclusion

The contributions of RCE Cha-am in its ultimate objective of the royal initiative to rehabilitate and restore the natural environment of the region and as a learning centre on energy, natural resources, environment, and biodiversity are significant. The act of mobilising the RCE's multiple stakeholders to make contributions that are in line with their respective mandates, makes the efforts all the more effective. There is learning by all concerned, and through knowledge learned and new research findings revealed, RCE Cha-am offers more to biodiversity and ESD learning with the participation of all partners.

RCE Chandigarh: Enhancing Understanding about Wetland Ecosystems among Students

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RCE Chandigarh

RCE Chandigarh, led by the Punjab State Council for Science & Technology (PSCST), works on education for sustainable development (ESD) activities and issues in Chandigarh and the state of Punjab, India. PSCST runs programmes at international, national and state levels, working with organisations and institutions such as UNESCO, UNDP, The Energy Research Institute (TERI), the Ministry of Environment and Forests, the Department of Science and Technology, and other government and semi-government departments and institutions. PSCST also works with universities, colleges, schools and other non-governmental organisations (NGOs) in its work.

To involve partners in the RCE network, PSCST interacted with various educational institutions, including institutions of higher learning, government agencies, and NGOs in the state of Punjab and Union Territory, Chandigarh.

The ESD issues to be taken up by the RCE were discussed in detail in a consultation meeting, in which representatives from 27 different institutions participated. These included three participants from education departments, three from universities, nine from colleges, six from schools and six from NGOs, all of whom take up education and awareness programmes in various parts of the Punjab State and Chandigarh.

RCE Chandigarh partnering agencies also include educational institutions, institutions of higher learning, government agencies and NGOs in the state of Punjab and Union Territory, Chandigarh. The organisations in the network already work to improve access to quality basic education via formal and informal education to address sustainable development, by taking steps such as strengthening existing education programmes, enhancing public understanding and awareness, and by providing training in various sectors. Overall, these organisations intend to create a learning space so that, globally, a world is created where everyone has the opportunity to benefit from quality education and learn the values, behaviour and lifestyles required for a sustainable future and positive societal transition. The major sustainable development challenges affecting the region are degradation of the state's fragile agro ecosystem, water-related problems, pollution, biodiversity loss, and loss of indigenous and traditional knowledge. The case study covered in this chapter explores an initiative that addresses the degradation of the fragile ecosystem of the Punjab State.

Project Overview

This particular project is aimed at creating awareness about wetland ecosystems and their importance, as well as providing an opportunity for 'learning by doing' through field experiences and hands-on training by exploring wetlands. By inspiring the youthful, energetic force of students, educators and district level officers of state government to protect and conserve wetlands, the project plans to reach out to local communities at a grassroots level. A focus on preserving wetland ecosystems will help preserve the important repository of biodiversity and ensure sustainable exploitation of resources for environmental protection. Further, it is hoped that this project will help raise public recognition of wetlands and raise awareness of the associated livelihood benefits and sustainable development.



Master Trainers during demonstration session

Project Background

Wetlands are important ecosystems, infused with aquatic, semi-aquatic and terrestrial characteristics. They are an integral part of larger landscapes that provide numerous services and benefits to mankind, such as provisions (e.g. food, fuel), regulation (e.g. control of floods, climate), support (e.g. nutrient cycles), culture (e.g. recreational, spiritual) and preservation (e.g. maintenance of biodiversity). With increasing urbanisation and industrialisation, large amounts of wetlands are disappearing. Thus, wetlands need to be preserved and conserved in order to ensure sustainable development, a key proposition when one understands the mechanisms involved in the evolution and degradation of wetland ecology.



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Students at the Wetland Education Centre

The state of Punjab has been left with less than 1% of the area under wetlands. About 30 wetlands, most of which are of natural origin, were reported to have existed in the state. Some, such as Rahon De Chhamb and Bhupinder Sagar, have already lost their wetland characteristics. Punjab now has 12 important natural wetlands and nine manmade wetlands. Harike, Kanjli and Ropar are three major manmade wetlands that have been recognised as Wetlands of International Significance (i.e. Ramsar sites). These wetlands are important habitats for waterfowl, fish and a diversity of other flora and fauna. Two other wetlands, namely Ranjit Sagar and Nangal, were declared as national wetlands in 2006 and 2008 respectively. Ranjit Sagar is located on the Ravi River and spreads out over three states, Punjab, Himachal Pradesh, and Jammu and Kashmir. Nangal Lake is located on the Sutlej River a few kilometers downstream of Gobind Sagar (Bhakhra Dam). Five wetlands, namely Keshopur Chhamb, Kahnuwan Chhamb, Jastarwal Jheel, Mand Bharthala and Dholbaha Reservoir, have been designated as Wetlands of State Importance owing to their ecological importance.

Keshopur Chhamb has also been declared as a Community Reserve. It is the first declared Community Reserve of India, as per Section 36(C) of the Wildlife Protection Act 1972 and as amended in 2003 in which it states "the State Government may, where the community or an individual has volunteered to conserve wild life and its habitat, declare any private or community land not comprised within a National Park, Sanctuary or a Conservation Reserve, as a Community Reserve, for protecting fauna, flora and traditional or cultural conservation values and practices". This is managed through a Community Reserve Management Committee, which consists of members of the Forest Department and village panchayats within the state. PSCST has conducted a preliminary survey of these wetlands and published a number of pamphlets on the subject. Growing urbanisation, industrialisation and population have affected the natural environment and wetland ecosystems. Other identified threats to these wetlands include a lack of public awareness around the public's responsibility for conservation of these ecosystems; drainage of wetlands for irrigation; indiscriminate discharge of domestic and industrial effluents; intensive use of agro chemicals severely affecting the wetland flora and fauna; siltation of wetlands due to erosion caused by deforestation; and loss of vegetative cover particularly around Dholbaha.

To address those threats, various initiatives have been undertaken, such as:

- Creating small live models of wetlands in schools around three Ramsar sites, namely Harike, Kanjli and Ropar;
- Establishing Wetland Education Centres in schools around state wetlands, i.e. Jastarwal Jheel, Kahnuwan Chhamb, Keshopur-Miani Jheel, Mand Bharthala and Dholbaha Reservoir; and
- Organising awareness and capacity building programmes in schools all over Punjab state.

The state of Punjab has been left with less than 1% of the area under wetlands. About 30 wetlands, most of which are of natural origin, were reported to have existed in the state.

The RCE partner agencies, namely PSCST, the Ministry of Environment and Forests (MoEF), Gol, Wildlife Institute of India (WII), Department of Forests and Wildlife Preservation, Punjab and Department of Education, and Punjab (including District Education Officers, District Science Supervisors, and teachers), have collaborated on these initiatives. The schools around three Ramsar sites were selected so that young messengers – the students – could strengthen protection and conservation activities. The Wetland Education Centres were established and educational resource materials were created in order to further capacity building and strengthen the conservation of small natural wetlands ecosystems through the involvement of local communities and relating them to the Ramsar sites. Furthermore, important environmental days are being celebrated and related educational materials are being developed in order to increase the awareness about wetlands conservation. Through this initiative and the educational processes, a youthful energetic force has been harnessed to not only create wetlands in their respective schools but also to spread the message of wetland conservation to communities for sustainable development.

Planning and Implementation

Under this initiative, the partner agencies PSCST, National Green Corps (NGC) and National Environment Awareness Programme of the MoEF mobilised the NGC school network for wetland conversation by creating awareness about values and the importance of wetlands. In Punjab, the NGC school network consists of 5,000 operational Eco-Clubs. Many of these NGC schools carry out awareness and action programmes on wetland conservation.



Planner and Snakes and Ladders game on the wetlands

The NGC schools of Tarn Taran, Kapurthala and Ropar Districts are located near three important Ramsar sites, Harike, Kanjli and Ropar, respectively. These schools were the focus of a special initiative in which school wetlands were created to serve as live ecological models to help students better understand the unique and vital importance of these ecosystems. Funds for the creation of wetlands were raised with financial support of NGC, the National Environment Awareness Campaign (NEAC) programmes, and from the Global Environment Fund (GEF) of the United Nations Development Programme (UNDP) Small Grants Programme.

The schools constructed wetlands of varying sizes and depths, depending on the available area. Since these wetlands were constructed in the schools, the safety of young children was of the utmost importance; hence, the depth of these wetlands was kept at less than one metre. Well-known aquatic plant species, such as water lilies and lotus, were planted in the school wetlands by the active participation of students. With the active involvement of students, these and other rooted floral species were initially planted in jute baskets half-filled with soil and then immersed in wetland water. To avoid mosquitoes breeding

in the standing water of school wetlands, fingerlings of *Gambusia gambusia* fish, which feed on mosquito larvae, were released. Students are taking care of these wetlands and regularly clean them.

In the process of this initiative, Eco-Club teachers-in-charge have been trained as Master Trainers about wetland issues and provided with interactive multimedia CDs, brochures and posters on the wetlands of Punjab. Eighty Master Trainers (four from each district) have been trained by partner agencies who, in turn, train teachers within the district. The teachers educate students about the role of wetlands in biodiversity conservation, ground water recharge, and related issues. The trained teachers and students further impart awareness to the communities about the benefits of these ecosystems.

These initiatives have motivated teachers and students directly and, through them, local communities are being approached with various activities, such as the celebration of World Wetland Day and World Environment Day. A wetlands yearly planner has been developed and distributed to network partners and a wetlands game, based on the Snakes and Ladders game, has been developed and is played with participants on different occasions. Furthermore, PSCST, MoEF and WII, are working in collaboration to distribute equipment such as binoculars and water testing kits to help increase the interest of partners at the grassroots level. In addition, the partner agencies are also in the process of developing signs for Ramsar sites and life-size models of wetland birds for state wetlands, in an effort to enhance knowledge about the wetlands.

Though various initiatives have been undertaken and have been proven successful, there are still some challenges to overcome, such as weed infestation, water hyacinth in the wetlands, and the utilisation of wetland resources for sustainable livelihoods.

Results

The wetlands established by the Eco-Clubs are used as teaching facilities by schools to demonstrate features of an aquatic ecosystem, such as aquatic food chains, aquatic flora and fauna, and adaptations. These small water bodies have attracted a number of faunal species like insects and frogs. In some schools, students have been able to

observe the lifecycle of a frog, making learning a fun-filled experience. These wetlands have also added aesthetic value to the schools.

The above initiative of Tarn Taran, Kapurthala and Ropar schools has motivated the other Eco-Clubs of the state to take up similar activities. They have even gone a step farther by adopting village ponds and wetlands and taking steps to clean those water bodies. The schools have also planted samplings along the periphery of the adopted wetlands to prevent soil erosion and to improve their natural habitat.

The partner agencies have also taken the initiative of establishing Wetland Education Centres in the schools near the three Ramsar sites and at the Nangal wetland. Forty Wetland Education Centres have been established and are actively working to raise awareness through capacity building programmes and wetland conservation.

These action programmes have enhanced understanding among students and local residents about wetland ecosystems and wetlands as a fragile ecosystem of the state. The demonstration, sensitisation and capacity building activities for wetland resources and biodiversity conservation are initiatives to help transition to a more green and sustainable society.

In India, traditionally, livelihoods have been dependent on natural resources, especially for people living in rural regions who were dependent on plants for basic life support. Such activities were less damaging to the environment. However, with the change in times, livelihood options also changed. Modernisation and the growing population are putting pressure on the environment; current lifestyles and activities, like mining, are much less environmental sustainable. This initiative encourages the promotion of sustainable livelihoods through a sustainable approach. To ensure such an approach, it is necessary to have simple, doable and practical options that meet both economic desires and a sustainability point of view. It is hoped that this initiative, along with networking, can help develop a recognition of the values and services delivered by wetlands and the same can be integrated into sustainable development.

In this regard, an effort has been made to utilise the biomass of water hyacinth for preparing handicraft items like bags, files, packaging boxes and baskets. This technique of making handicraft items has already been successfully established elsewhere, such as the KIDS Society, Kotapuram (Kerala, India), in Derabassi, District Mohali (Punjab, India), and replicated by partner agencies PSCST, Department of Forests and Wild Life Preservation, Punjab, and the NGO Sai Dharam Singh Grover Foundation based at Derabassi, Punjab. The selected artisans, field workers and officials of partner agencies were sent to KIDS Society, Kerala to get hands-on experience and learn the necessary skills. In addition, field trials and hands-on trainings have been undertaken to motivate local people in making the handicrafts. The results have been encouraging, with people responding favourably and taking a keen interest in the endeavour. After the training, locals were successful in making various handicrafts such as purses, bags, files, and boxes from water hyacinth; they have showcased those products at a variety of different forums. Efforts are now underway to create suitable marketing strategies to sell these products and to strengthen sustainable livelihood options from the wetlands.



Women making handicrafts from wetland weeds in Punjab, India

Conclusion

Wetlands are unique habitats and vital ecological resources with multi-functional benefits requiring attention for conservation. This chapter highlighted some of the efforts of partner agencies – namely the Ministry of Environment and Forests (MoEF), the Wildlife Institute of India, Department of Forests and Wildlife Preservation Punjab, Department of Education, Punjab, and Punjab State Council for Science and Technology – to enhance understanding about wetland ecosystems among students. To that end, various activities have been undertaken to make learning easy through the promotion of action-oriented activities and the augmentation of education towards sustainable development. The partners, through this initiative, have been able to inspire the young energetic force of Punjab through the National Green Corps Programme's network of 5,000 Eco-Clubs and the National Wetland Conservation Programme of the MoEF by creating small live models of wetlands in schools around the three Ramsar sites of, Harike, Kanjli and Ropar. They have also established Wetland Education Centres

in schools around state wetlands and they have carried out various awareness and capacity building activities in schools all over Punjab state, such as the celebration of World Wetland Day and World Environment Day, and the development of the wetlands yearly planner and a wetlands game. The partner agencies are distributing equipment like binoculars and water testing kits to up increase the interest of partners at the grassroots level. While these initiatives have increased the understanding about wetlands, there is still a need to broaden the importance of wetland resources and their use. The wetlands conservation partners in Punjab state are exploring sustainable livelihoods associated with wetlands so that the wetland ecosystems can benefit individuals and communities economically and help in the move towards greater sustainable development overall.



RCE Chubu: Multicultural Dialogue for Sustainability – The Biodiversity Cyber Dialogue Project

Reita Furusawa

Kinhide Mushakoji

RCE Chubu

RCE Chubu is one of six RCEs in Japan, located in the area of Aichi, Mie, and Gifu prefecture. Instead of using a political or economic district to identify the regional centre, RCE Chubu adopted a natural environmental district with which to identify itself, the Ise-Mikawa Bay Watershed and the river basins draining into Ise-Mikawa Bay. The downstream reaches are heavily industrialised and upstream there has been considerable environmental destruction as a result. RCE Chubu emphasises the perspective of horizontal themes, aligned with the characteristics of the region. The themes to be taken up for promoting education for sustainable development (ESD) include manufacturing, energy, forest conservation, river and tideland conservation, and multicultural harmony (Figure 1).

Figure 1 Ise-Mikawa Bay Watershed and themes of regional challenges



Introduction

The multistakeholder partnership established by RCE Chubu provided a number of benefits to the Biodiversity Cyber Dialogue Project initiative, including:

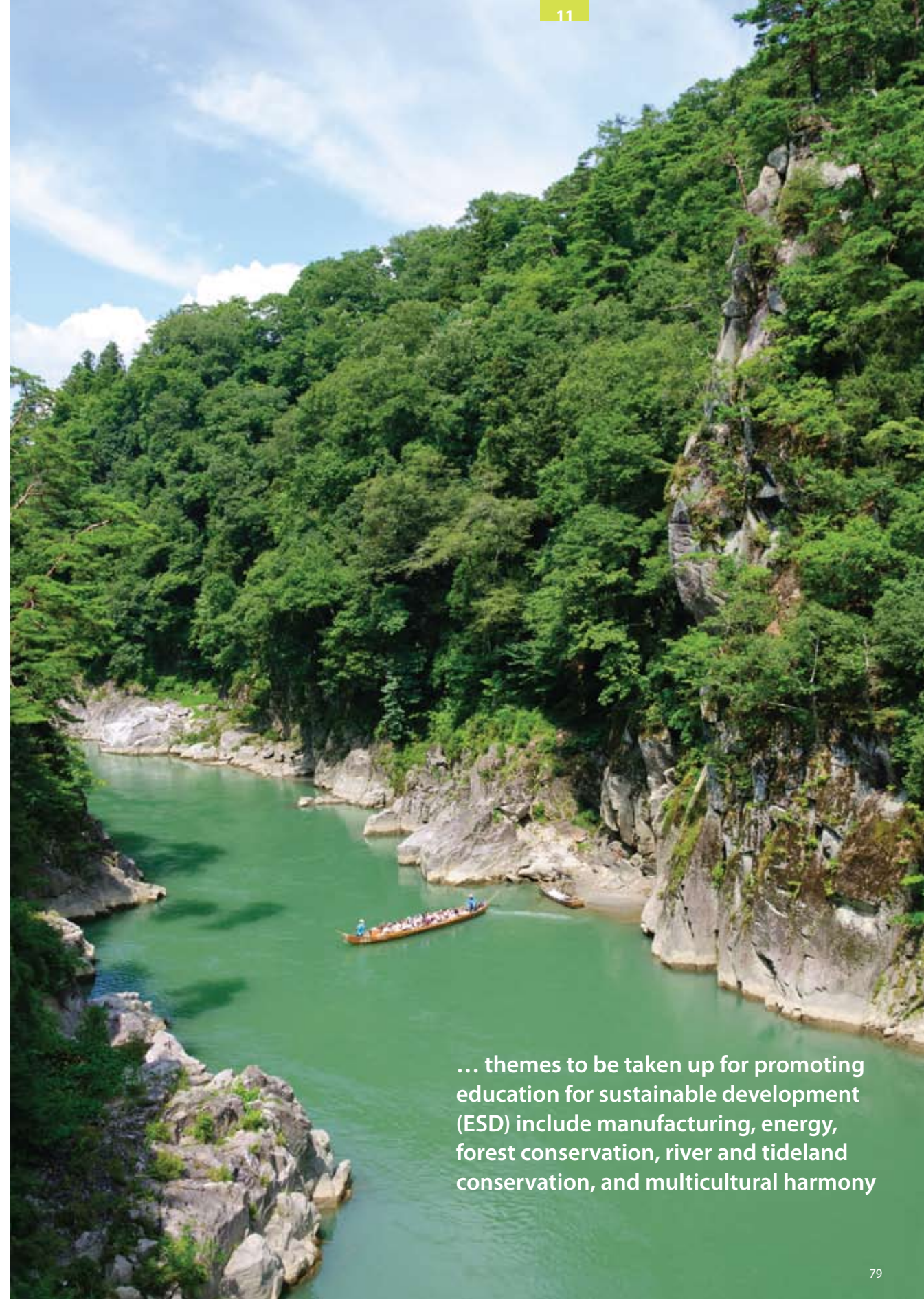
- A focus on both the local and global dialogues on biodiversity and sustainable development issues, thanks to participants who had different specialties and views on sustainability issues.
- A useful means to link RCEs and other groups, such as the indigenous and local communities, to discuss common strategies in the fight against ecological, economic and/or social unsustainability.

- The development of a multicultural approach, which will curb the unsustainable imposition of global standards that ignore the ecological and cultural diversity of the different bioregions.

This chapter will highlight the outcomes of RCE Chubu's Biodiversity Cyber Dialogue Project, which used a social networking service (SNS). The goal of the project was to develop a deeper, common understanding among all the global stakeholders about the urgent need to reduce the loss of biodiversity, as well as to promote ESD as a way to foster a global consensus on changing unsustainable human lifestyles and socioeconomic institutions to sustainable ones.

The Biodiversity Cyber Dialogue Project was conducted before and during the Convention on Biological Diversity Conference of the Parties (CBD COP) 10, which was held in the RCE Chubu region of Nagoya, Japan in Aichi Prefecture from 18 to 29 October, 2010. CBD COP 11, which will be a continuation of what was discussed at COP 10, is going to be held at Hyderabad, India in October 2012. Mutual, cross-boundary, national and international ESD learning among civil society participants was one of the major impacts of this initiative. This was especially true among the members of Japanese NGOs, which have wide ranging interests in biodiversity, with some specialising on particular ecological issues and others covering different social and economic aspects of ESD.

The Cyber Dialogue Project and related collaborative projects with Japanese NGOs were good opportunities for the RCE to expand its network, with the promotion of ESD alongside the concept of biodiversity as the entry point. In addition, the Cyber Dialogue covered all environmental, social, and economic factors, and helped broaden the common point of view that biodiversity is only an environmental issue. Topics such as "Indigenous Peoples and Biodiversity," "Gender and Biodiversity," "Local Community Life and Biodiversity", as well as "Traditional Wisdom and Biodiversity" have been crucial issues in the cyber dialogue. In the second stage of the project, following COP 10, the 11 March 2012 East Japan earthquake and the explosion of the Fukushima Daiichi nuclear plants provided an additional focus for the Cyber Dialogue.



... themes to be taken up for promoting education for sustainable development (ESD) include manufacturing, energy, forest conservation, river and tideland conservation, and multicultural harmony

Multistakeholder Approach of the Cyber Dialogue

Entrenched in the Cyber Dialogue is the idea that ESD broadly invites any individual and group concerned by the unsustainable global trends of development to share their concerns and raise their voices, thereby calling the attention of the State Parties, the corporate sector, media, and research communities on various political-economic and socio-cultural dimensions that negatively impact or reduce cultural diversity and biodiversity (RCE Chubu, 2010). Thus, the Cyber Dialogue attempts to increase the level of engagement by many actors and stakeholders in order to represent the widest possible range of opinions and views from all the diverse sectors of the different societies.

Three Stages of the Cyber Dialogue

The concrete target which gave focus to the project towards COP 10 was a draft declaration by civil society unveiled at COP 10 and drafted through discussions on a SNS site of the Cyber Dialogue. The presentation of a report on CBD at the Hyderabad COP 11 gives a similar target and focus for the second stage of the Cyber Dialogue. The 2014 conclusion of the UN Decade on ESD will provide a target for the third stage of the dialogue in 2013 and 2014.

Prior to COP 10, the Cyber Dialogue was divided into three phases: a preparatory phase from May to December 2009; a second phase from January 2010 to the beginning of COP 10 where discussions were held with the Japan Civil Network for the Convention on Biological Diversity (JCN-CBD); and a third wrap-up phase during COP 10 during which there was a presentation of the outcomes.

Phase 1: Preparation

In the summer of 2009, the Cyber Dialogue did a test-run in Japan of both the SNS and the mailing lists. RCE Chubu created its own Cyber Dialogue SNS site using the Ning system, which was established in 2005 in the United States and is currently one of the most successful SNS service providers.

RCE Chubu proposed the Biodiversity Cyber Dialogue Project to the global RCE network in 2009. RCE Chubu asked other RCEs, beginning with the ones in Asia, to recommend individuals as well as groups of individuals who might be interested in participating in the dialogue.

Initially, topics were Cyber Dialogue Working Group in RCE Chubu. The group set the initial main themes of the discussion, such as Indigenous Peoples and Biodiversity, Gender and Biodiversity, Local Community Life and Biodiversity, and Traditional Wisdom and Biodiversity, among others



English version of Cyber Dialogue

Phase 2: "i-dialog"

Apart from RCE Chubu, another Japanese network involving civil society as it relates to biodiversity was uniting together; the NGO Japan Civil Network for the Convention on Biological Diversity (JCN-CBD) was established in January 2009. The second phase of the project started in January 2010 when RCE Chubu, represented by one of its core members the Chubu RCE-ESD Promotion Network (CREPN), co-organised an ESD Global Forum with JCN-CBD and discussed a possible collaboration on the Cyber Dialogue Project.

A Japanese version of the Cyber Dialogue (i-dialog) was created in April 2010. Since JCN-CBD had thematic working groups – such as a Working Group on Wetland Biodiversity, a Bioregion Working Group, Gender and Minority Working Group – each of the groups soon started using the Cyber Dialogue site for different purposes. Some groups used it to hold public discussions while others used it as a message board for its members.

In spite of these self-imposed limitations, the i-dialog helped develop some interesting debates. As one important outcome of this engagement, JCN-CBD decided to publish a position paper to present at COP 10. Some groups used the site as a discussion space for drafting the position paper. More than 130 people participated

in the Japanese version of the Cyber Dialogue. The Japanese version was linked to the Cyber Dialogue in English, to which only a limited number of participants could be invited to participate. Three separate, yet closely interrelated debates took place. One was the debate on the "Philosophy of CBD", which was organised in Japanese and fed into the international e-conference. A second was a debate on indigenous communities and other communities living in harmony with nature, which was introduced in the i-dialog and evolved into a discussion on the unsustainability of the modern global economy. The indigenous communities and other traditional local communities – including nomad communities in Africa, dalits in South Asia, landless farmers from Latin America, and fisher-folks from the Asian coast regions – proudly called themselves the Climate Communities and were protesting against the Copenhagen Summit for leaving them out of discussions on global warming in spite of the fact that they were the ones who were helping to delay global warming through the subsistence lifestyles they lived in their respective ecological environments. Their lifestyle was difficult for some participants of the i-dialog to emulate. Whether Japan's rapid growth economy could be abandoned fully was posed as a serious question. All i-dialog participants agreed, however, to prepare a document in response to the Climate Community Declaration. These two dialogues were translated in both English and Japanese. A third discussion, held in Japanese, was on selected themes including one on gender and biodiversity, which declared that both women and nature were the object of global trends following colonialism.

In spite of these three Cyber Dialogue discussion outcomes, the organisers had to admit that they could not develop the Cyber Dialogue as fully as they had expected. One identified challenge took place in the first stage of the dialogue. The problem was largely a result of technical difficulties some participants experienced when logging in, probably attributable to a variation in IT literacy and competencies among individuals. In addition, even after logging in, a proportion of the participants became too busy and failed to post comments. As a way of solving this problem, the organisers decided to use mailing lists in addition to the SNS, forwarding comments from the mailing list to the SNS.



Press briefing of the Appeal at COP 10

Phase 3: COP 10

The third phase of the Cyber Dialogue took place during COP 10. At COP 10, JCN-CBD and CREPN organised forums in order to present the outcomes of the Cyber Dialogue Project and the thematic groups of JCN-CBD. The forums were diverse public meetings on the different aspects of biodiversity. They included such sessions as "A Proposal of the 13 Grandmothers to COP 10," "Revival of the Bioregion," "Biodiversity and Peace," and "A dialogue of Japanese and International Citizens to Finalise the Aichi-Nagoya Appeal". All these sessions were held in the Interactive Fair for Biodiversity which was a collective designation of side-events organised by the Aichi-Nagoya COP 10 CBD Promotion Committee.

Draft Declaration by Citizens of Aichi Nagoya

The Cyber Dialogue discussions led to the preparation of a Draft Declaration by Citizens of Aichi Nagoya, the host of COP 10 and the fifth meeting of the Conference of the Parties serving as the meeting of the Parties (MOP 5). The first version of the declaration was drafted by Dr. Kinhide Mushakoji, Ms. Seiko Hanochi, Mr. Hiroo Komamiya and Mr. Junichi Ohnuma, and circulated and modified through further discussions on the SNS site and the mailing lists. The drafters were willing to publish it as a declaration of Japan's civil society, acknowledged by the JCN-CBD Steering Committee. Nevertheless, some groups of JCN-CBD had different sentiments on the draft's suitability for the general public. The criticisms on economic growth, pointing out that "neoliberalism has adopted a 'growth principle', which regards 'economic growth' to be of top priority over anything else (CREPN, 2011 p4)" were not fully accepted. The draft of the declaration was circulated and signatures were collected both outside and inside the venue of COP 10. Finally, the drafters made public the

draft by naming it A Draft Declaration by Citizens of Aichi Nagoya. The appeal was made public, and the drafters had a press briefing on 28 October, 2010 at a press briefing room of CBD COP 10.

With respect to consensus building, SNS did not function as an effective tool, overall. Although the content of the draft was discussed on the SNS, the key debate on economic growth was not visible on the website. Instead of using the SNS site, people opted for discussions in person, during forums for example, or they opted for emails among small groups, such as the members of the steering committee of JCN-CBD and some members of RCE Chubu.

Conclusion

A cross-boundary learning approach was applied to the Cyber Dialogue. Although the target of this project was civil society, many intellectuals, NGO members and people from the business sector participated in the project. Through the Cyber Dialogue, participants learned the different views of multistakeholders. This sharing of knowledge and ideas will be expanded during in the second (2011-12) and third stages (2013-14).

In the second stage of the Cyber Dialogue, which looks toward COP11, both Japanese and English languages are being used on the SNS site and a dialogue among RCEs in and out of Japan is in preparation. In order to develop a dialogue based on concrete experience, the Cyber Dialogue site has a section dedicated to good practices. All the RCEs are invited to give a brief report, including pictures and, eventually, audio of their good practices. The dialogue will thus not be too abstract and will instead be a forum for the RCEs and other participants to discuss concrete examples of how specific problems of ecologically, economically and socially unsustainable realities can become the object of mutual learning, common understanding and joint action. It is RCE Chubu's hope that interested members of different RCEs will join the international dialogue, after sharing their good practice examples with all the other participants from different regions of the world.

The dialogue among RCEs will become the priority activity of the third stage of the Cyber Dialogue, during which it will become important for RCEs to prepare their joint contribution to the 2014 concluding evaluation of the UN

Decade on ESD. A comparison of their respective activities will be a key topic in the third stage of the Cyber Dialogue, focusing on the 2014 and the end for the UN Decade on ESD.

The catastrophic events of the March 11 East Japan earthquake, tsunami and subsequent nuclear explosion at the Fukushima Daiichi nuclear plant will also be a focus of the second stage of the Cyber Dialogue. The spread of radioactive materials in the aftermath of the nuclear explosion provides a globally relevant focus for the discussion that involves the issue of nuclear electric plants as well as the mass production, consumption and disposal lifestyle that is based on a high energy consumption approach. Re-evaluating traditional knowledge of indigenous communities and other local communities as stressed in the CBD will also be a focus of the second stage. One concrete target of the second stage cyber dialogue is the preparation of reports for distribution during the Hyderabad COP 11. The active participation of activists and intellectuals from indigenous communities will provide a rare occasion for an international dialogue between those victims of the March 11 catastrophe in Japan who are trying to revive traditional knowledge and those within communities where such knowledge is already playing an important role in supporting sustainable community development.

In its second phase (2011-2012), the Cyber Dialogue will use the SNS Facebook system where "friends" of participants in the Biodiversity Cyber Dialogue are invited to participate in themes that might concern them, such as keeping traditional wisdom in indigenous communities and other communities. It will also involve those exchanging information about the Fukushima Daiichi nuclear explosion, providing them an occasion to expand the Cyber Dialogue to concerned citizens, in and out of Japan, who have had no previous access to ESD. It is hoped that the inclusion of a special section on good practices will help all participants – especially the RCEs – to join the discussion by sharing their concrete experience as an entry-point. The Cyber Dialogue will be enriched by these additions and others; the Japanese experience on and after March 11 alone could become the focus of an ESD dialogue on how to overcome unsustainability based on wrong attitudes and values, which led to the collision between humans and Mother Nature.

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RCE Espoo: NatureGate – Promoting Species Identification for Conservation and Sustainable use of Biodiversity

Mauri Ahlberg

RCE Espoo

RCE Espoo is the first Finnish RCE in the global RCE network. Its members include: the City of Espoo, Laurea University of Applied Sciences, Aalto University, University of Helsinki, Omnia, the Joint Authority of Education in Espoo Region, as well as many other companies and organisations that promote sustainable development. One of those organisations is NatureGate Ltd, in which the University of Helsinki is a partner. RCE Espoo was founded to promote sustainable living for citizens of Espoo. Participants in RCE Espoo are experts and professionals from those fields that promote sustainable development and mitigate climate change, such as researchers, teachers, entrepreneurs, and journalists. The RCE Espoo network integrates ecologically, economically and socially sustainable development, in formal, informal and non-formal education, to promote a sustainable future. This concept includes a number of ideas, including increasing awareness and capabilities of sustainable development, learning how to act sustainably, protecting and using biodiversity sustainably, social responsibility, participation, production of services and products that promote well-being, sustainable consumption, transport, recycling and saving energy.

NatureGate is an online service for biodiversity education, promoting sustainable use of biodiversity, including all aspects of sustainability.

Project Introduction

NatureGate is an online service for biodiversity education, promoting sustainable use of biodiversity, including all aspects of sustainability. NatureGate is a product of NatureGate Ltd. University of Helsinki is a partner in this company for sustainable development. The quality of the NatureGate online service is monitored and promoted by NatureGate Research and Development (R&D) Group in the Department of Teacher Education, at University of Helsinki.

The results of the collaboration between UNU-IAS, RCE Espoo and NatureGate have been very promising. However, a lack of resources for systematic empirical research makes it possible only to present qualitative research observations. Those observations and results will be detailed throughout the course of this chapter.

Project Background

In RCE Espoo, the starting point is that humans are part of the biosphere and part of its biodiversity. Biologically, humans are an animal species and are totally dependent on the rest of the biosphere for food, oxygen, clean water, air, renewable raw materials, medicines, and recreation, among others. In each region of the world biodiversity is at least partly different. During evolution life has diversified all over the earth: species are at least partly different, ecosystems differ from each other. The UN has declared the years 2011 – 2020 as the UN Decade on Biodiversity. RCE Espoo takes this decade seriously, concentrating on making local species and ecosystem identification easy and rapid for conservation and sustainable use of biodiversity. Towards this end, it investigates, monitors and promotes local biodiversity and ecosystem services.

The author, Dr. Mauri Ahlberg, is Professor of Biology and Sustainability Education in Department of Teacher Education, University of Helsinki. Based on his research in 2006, he concluded that the core element of sustainability education is learning to identify local species and to use them sustainably. Accordingly, in the beginning of 2006, he founded NatureGate R&D Group with Eija and Jouko Lehmuskallio. When RCE Espoo was established, he was asked to be part of the governing body of RCE Espoo. There were many meetings of the NatureGate R&D Group and the key actors of RCE Espoo, including its coordinator Ms. Mari Nuutinen and Mr. Aulis Pitkälä, currently Director General of the Finnish National Board of Education and Innovative Teachers of Espoo. The point is to educate, increase awareness, promote skills to identify local species and use local biodiversity sustainably in Espoo and in the whole Finland, and later on in the whole world.

Loftas (1995) and Subramanian and Pisupati (Eds.) (2010) estimate that there are 50,000 edible plants in the world, yet currently only 15 species contribute to total food energy. According to Johns and Stapith (2004) this has increased human vulnerability to natural and economic shocks. Many wildflowers and weeds are edible, many are toxic. In order to use biodiversity safely and sustainably, species have to be identified easily and rapidly. In California Academy of Sciences, Fisher (2012) had tested the best available identification tools for identification of San Francisco Bay Area ants, and he came to the conclusion that for laymen the best way to identify 170 local ant species is the NatureGate approach.



Fisher came to the same conclusion as Kaasinen and Ahlberg (2010) and IUCN CEC (2009), which were focused on all organism groups.

Compared to many other countries, Finland is sparsely populated. In Finland, there are so-called everyman's rights: all citizens are allowed to walk on woods, and pick berries, leaves of wild herbs and mushrooms, regardless of who is the owner of the forest. There are hundreds of years of traditions of picking and using berries and mushrooms from nature. In the 19th century, the first thorough Finnish Flora (Lönnrot 1860) contained information on how to use wild plants for food. At that time Finland was a poor agricultural country, in which famine was common. Some wild herbs have been used commonly, others have been used more rarely. In Finland, knowledge and interest on the use of native wild herbs has been increasing since the Second World War, originally because of lack of healthy food during war time (Rautavaara 1942 and 1977). Nowadays, in USA, the UK and in many other developed countries, use of wild herbs is a healthy fashion that promotes sustainable development, sustainable use of biodiversity.

In Finland local species and ecosystems have been researched from the 17th century and intensively over 200 years. The region of RCE Espoo is no exception. Traditional knowledge and use of species like wild plants, trees etc. has been collected long before this field of research was called ethnobiology. According to modern science, some folk knowledge around this issue are sound, while some are dangerous. From the viewpoint of modern science, traditional knowledge ought to be taken as hypotheses. Some of the claims, at least part of them, may be correct according to modern science, but some may be damaging for human health. For example, in Japan traditional knowledge supports the consumption of young stems of *Pteridium aquilinum* (bracken or common bracken). *Pteridium* is a species of fern occurring throughout the northern hemisphere. The plant contains the carcinogenic compound ptaquiloside and Japan, where the young stems are used as a vegetable, now has one of the highest stomach cancer rates in the world (Evans & al. 1971 and Gomes & al. 2011)

In the Finnish National Core Curricula (2004), for grades 1 to 6, implemented also in Espoo, one of the main educational objectives in biology is to investigate local

species and local ecosystems and to learn about them. NatureGate online is widely used in Finland for species identification. NatureGate is in Finnish and is translated at least partly in seven other languages, English included. In Figures 1 and 2, there are two photos of how NatureGate is used at schools.



Figure 1 Pupils of Mahnala Environmental School using NatureGate to identify a wild flower. (Photo, Courtesy of Ms. Annukka Alppi)



Figure 2 A screen shot showing an example of type of self-instructional views and icons that NatureGate uses to promote easy, rapid, and interactive use of its patented system and method for species identification.

Project Activities

Local species identification, conservation and sustainable use of biodiversity and ecosystem services is part of the lifelong learning and teaching vision of RCE Espoo. There are plenty of immigrants in Espoo and it is important to explicate the traditional knowledge of both natives and immigrants. There have been lethal misunderstandings around which mushrooms are edible in Finland and which are not because some inedible mushrooms look similar to those which are edible in South Asia. In the future, NatureGate will publish an interactive, online identification tool for Northern European mushrooms, both edible and toxic. In June 2012 a mobile Apps versions for iPhone and Android phones were launched officially. NatureGate will

also be integrated in school curricula and teaching packets will be tested, customised and localised to promote the integration of ecologically, economically and socially sustainable development. All interventions are planned as a series of design experiments, which will be documented and analysed for continual quality improvement.

Outcomes and Achievements

The initial collaboration between NatureGate and RCE Espoo is already an important outcome. Before NatureGate, people learned to identify species from field guides or from older people. NatureGate is an innovation based on more than two decades of accurate nature photography by Eija and Jouko Lehmuskallio, and their patented system and method for interactive species identification. NatureGate R&D Group of University of Helsinki, Department of Teacher Education, provides university level expertise and university level links to teachers and schools. All pre-service classroom teachers and biology subject teachers, as well as RCE Espoo affiliated teachers, have been taught how to use NatureGate online services for the identification of local species and to get knowledge about their sustainable use. to the teachers spread the message and encourage testing of the service. NatureGate has been presented to the most important persons of municipal and school administration. Not all of them are deeply interested in biodiversity, its sustainable use, species identification and the central role of them in promoting sustainable development. However, there is enough interest on the national and international level to spread this useful innovation.

A part of this collaboration is the implementation of design experiments and testing of digital herbaria created at schools, linking the photographed species to NatureGate as much as possible to certify and to make checking of identification of photographed species easier. Collaborative learning is applied as often as possible. Traditionally people think that they are outside of nature. NatureGate teaches from viewpoint of biological sciences that humans are a part of nature, in particular a part of biosphere covering the Earth. It is aimed at social change in which people of all ages, from children to elderly people are united by their interest in local biodiversity, enjoying it and its sustainable use. Curricula will be reoriented in many ways including through the integration of NatureGate. Sustainability principles have from the beginning been integrated into both RCE Espoo and NatureGate.

This means the continual integration of ecologically, economically and socially sustainable development. Both promote sustainable living, lifelong learning, systemic thinking and systems thinking, learning to understand the world as the biggest system and countless other systems as parts of it. On the Earth, most if not all systems are interacting. There is a special R&D Group for research on RCE Espoo and, as part of this research, critical reflections and evaluations are implemented. For all active participants of RCE Espoo and NatureGate, the basic principles of high quality learning and thinking are taught and continually implemented (Åhlberg 1997; 2005; Åhlberg, Äänismaa, and Dillon 2005).

Successes and Challenges

NatureGate is a highly successful and unique site for interactive, easy and rapid identification of species. A user does not need to know any organism names. The user just makes accurate observations of the organisms and clicks accordingly. Icons are mostly self-instructive. More information is linked to the key icons. Any selection can be reversed, the user may start from anywhere in the identification tool. NatureGate uses the patented system and method for interactive object (e.g. species) identification invented and patented by Eija and Jouko Lehmuskallio (Lehmuskallio & Lehmuskallio 2008a and 2008b). The core of NatureGate's photos and descriptions are from more than two decades of professional nature photographs by Jouko Lehmuskallio. The photos of NatureGate have been taken in nature, in the natural habitats of each organism. The photos are both scientifically accurate and aesthetically enjoyed by nature lovers. It is often said that looking at NatureGate photos creates a calming and relaxing nature experience. The text is designed to promote lifelong learning. Experts of each field have checked the descriptive texts as well as the identification tool. There are plenty of photographs and expertise on different species in each area.

The challenge is to get enough political will and funding to create local NatureGate servers all around the world. For Finland, the patented and unique NatureGate online service is crucially important, as evidenced by the support of different ministries and organisations, such as the UNESCO Committee of Finland. Too few people know about NatureGate due to a lack of advertisement and publicity. Through teacher education, however, the message is spreading.

RCE Kyrgyzstan: Conservation of Traditional Knowledge on Medicinal Plants

Chinara Sadykova

RCE Kyrgyzstan

RCE Kyrgyzstan was officially acknowledged as an RCE in May 2007. In September of that year, RCE Kyrgyzstan began raising public awareness on education for sustainable development (ESD), presenting a sustainable development concept publicly, presenting mountain ecosystems conservation issues, and making speeches and lectures for diverse focus groups, such as employees of the Ministry of Education, the State Agency on Environmental Protection and Forestry, decision makers, educators, and youth, among others.

RCE Kyrgyzstan established a partnership with ESD stakeholders. The main partners of RCE Kyrgyzstan are the State Agency on Environmental Protection and Forestry, the National Ministry of Education, Soil-Biology Institute of National Academy of Science, Kyrgyz Academy of Education, Kyrgyz Medical Academy, Bishkek Humanitarian University, Institute of Physical Culture and Sports, Naryn State University and local communities around the country.

RCE Kyrgyzstan activities include:

- Developing partnerships between educators, scientific experts, pre-service teachers, in-service teachers, NGOs and with environmental and sustainable development focused projects and programmes currently working in Kyrgyzstan;
- Raising awareness of decision-makers, teachers, schools, universities and NGOs on the importance of mountain ecosystem conservation;
- Creation and support of informational networks through websites and the State Agency on Environmental Protection and Forestry;
- Assisting RCE Kyrgyzstan members to gain experience and best practices from other RCEs and international organisations that are working in the field of ESD; and
- Creation of permanent fundraising activities for developing projects and programmes in Kyrgyzstan on ESD and mountain ecosystems conservation, sharing best practices from local communities and partners from Central Asia and around the world

Overall, RCE Kyrgyzstan's goal is to enhance understanding of the importance of mountain ecosystems conservation among diverse groups of stakeholders through the promotion of sustainable development (SD), ESD and the UN Decade on ESD in Kyrgyzstan and by strengthening the participation of civil society and educators.

Project Activities

In achieving its main goal, RCE Kyrgyzstan implemented several projects to share experience and research on traditional knowledge of the Kyrgyz on medicinal plant use. RCE Kyrgyzstan projects are focusing on recovery of traditional knowledge on medicinal plant use, the importance of biodiversity and mountain ecosystems, the sustainable nature use in the context of a healthy environment, and human well-being.

The main focus of its projects is to establish collaboration with local communities, traditional knowledge (TK) holders and youth. Within the framework of these projects, RCE Kyrgyzstan: established partnership relations with the rural population in the Naryn region; raised awareness of the importance of biodiversity conservation; collected information on TK medicinal plant use; developed a database of TK and medicinal plants; and created linkages between health, environment and traditional knowledge.

Healthy ecosystems and biodiversity are sources of various services that nurture life and enhance human well-being. Of these services, a cross-cutting one is the contribution that biodiversity makes to secure the health of people and life forms in all its manifestations – physical, mental and spiritual (Unnikrishnan and Suneetha 2012).

Biological resources of Kyrgyzstan play an important role in the economy and medicine of the country. Various species are used as whole food, for medicinal purposes and other commercial use. In total about 600 species of plant are used by people. Kyrgyzstan is a centre of origin for domesticated fruit crops and up to now progenitors of these crops vegetates in the country. Examples include walnut, some species of apple, wild apricot and pistachio. On 7% to 8% of the territory, the local population collects wild berries of sea-buckthorn, mountain ash, barberry, currant, raspberry, hawthorn, and other medicinal plants. (NBSAP, 1998).



RCE Kyrgyzstan projects are focusing on recovery of traditional knowledge on medicinal plant use, the importance of biodiversity and mountain ecosystems, the sustainable nature use in the context of a healthy environment, and human well-being.

The traditions and culture of the Kyrgyz are closely linked to the use of medicinal plants in daily life. Medicinal plants can be found all over the country in different climatic zones and on different altitude levels from foothills to alpine pastures. It is well known that plants which grow in the mountains have a pre-potent drug-induced effect. (Rogova N.A., Soodonbekov I.S. 2009). The diversity of the flora is seen in nectarous, feeding, aethereus oil-bearing, tinctorial, tannic and other useful characteristics.

Medicinal plants of Kyrgyzstan are widely used in traditional and academic medicine for the production of a variety of phytogenic medications and various drugs. Most of the plants are used in traditional medicine however many are not registered in official sources and have not been properly studied or researched. Ethnomedicine contains inexhaustible information about medicinal plants and humanity successfully used this knowledge for centuries for treatment of various diseases. (Kengebaeva N.V. Ganybaeva M.A. 2009).

RCE Kyrgyzstan realises the necessity of recovering traditional knowledge. Kyrgyz people were historically nomads and in order to survive in difficult mountain conditions they use traditions and knowledge that has been passed from generation to generation.

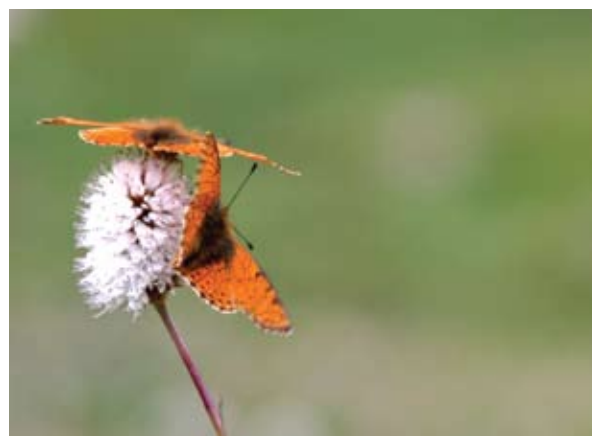
From the Soviet era up to present time botanical researchers from National Academy of Science, Biological-soil Institute Flora Laboratory, Center of Innovative Phyto-technologies, and the E. Gareev Botanic Garden have conducted academic research of the medicinal plants. There are also commercial structures that are involved in growing and gathering medicinal plants for future sale at market.

In Kyrgyz traditional medicine there are many examples where medicinal plants are used for anaesthetisation and treatment of sickness as well as for body and hair care, as cosmetics. Likewise Kyrgyz have used plants in daily life as a natural dye for wool and other materials. For instance,

currant and beet-root has a deep red color, onion aril can vary from light yellow to light brown, rhubarb has a green color, walnut cortex could be from green to brown, and poplar cortex has deep black and brown color. As such Kyrgyz used red clay (josh) as a dye for house walls and cheegrass. As a result of this study, RCE Kyrgyzstan extracted a list of medicinal plants as well as a number of diseases that could be treated with particular plants. This chapter presents only a few medical plants that are commonly used in the Kyrgyz Republic. (Box 1).

Chinese traditional medicine is very popular around the world, it uses phyto and animal-based biological resources. Since Kyrgyzstan opened borders with the rest of the world, Chinese business entrepreneurs have established businesses in the country. Currently Chinese entrepreneurs are procuring medicinal plants from the local population who are gathering biological resources of flora and fauna and selling it at a low price. This uncontrolled collection of medical plants, excavation of the plants roots, and cutting of bushes is leading to depletion of the unique botanical stocks of the country.

In the framework of the project on the study of traditional knowledge of the Kyrgyz on medicinal plant use, RCE Kyrgyzstan conducted sociological research among the local population of Naryn Oblast in 2010. In order to implement the study quantitative analyses were undertaken, including public opinion polls and individual interviews. In total 100 interviews took place with respondents age 45 to 86. The confidentiality level



Melitean butterfly on the flower in the mountains of Kyrgyzstan

was 90%, with a sampling error of plus or minus 10%. Interviews were conducted in Kyrgyz and Russian from June to October 2010. All respondents were very open to the process and shared their knowledge freely. However, not many people knew about traditional medicinal plant use and many of them didn't have experience in using it. Traditional knowledge's holders are mainly of age 50 to 80 and, if they have followers, in most cases it was their family members.

Analysis of the responses showed that the local population:

- Uses medicinal plants for the treatment of different diseases;
- Passes along traditional knowledge from generation to generation;
- Uses recipes of their ancestors for treatment of sickness and for health support; and
- Seek out healers in the region who cure the local population with medicinal plants, which they collect and prepare extracts from.

Research showed that there is a necessity to collect TK on medicinal plants since there not many TK holders in the country and many of those who exist are very old. It is very important to learn how to use medicinal plants, to preserve them and to cultivate these plants. Local TK holders are open to collaboration as they are concerned that TK knowledge is missing and new generation should keep TK and pass it on to future generations.

Conclusion

RCE Kyrgyzstan realises the necessity of recovering traditional knowledge. Kyrgyz people were historically nomads and in order to survive in difficult mountain conditions they used traditions and knowledge that had been passed from generation to generation.

RCE Kyrgyzstan is continuously conducting research to achieve the goal of sustainable biodiversity use and helping rural people understand the importance of mountain ecosystems conservation by linking it with the traditional knowledge of Kyrgyz. In partnership with its main stakeholders, RCE Kyrgyzstan has taken steps in the country to preserve biological resources in the framework of activities of the State Agency of Environment and Forestry Protection under the Kyrgyzstan Government.

Scientific research is carried out by scientists from the Biological-Soul Institute of National Academy and experts. However, those actions are insufficient to preserve fauna and flora and a need for more purposeful and systematic activities with various stakeholders has emerged. RCE Kyrgyzstan projects are related to sustainability (e.g. improvements in livelihood, ecosystems, etc.) as well as learning (e.g. developed curricula, pedagogical approaches, etc.).

There is a major need to enhance awareness of the local population on: 1. Sustainable use of biodiversity; 2. Mountain ecosystems conservation as a main condition that would enable access to good health and a safe environment; 3. Recovery of traditional knowledge of medicinal plant use; and 4. A transition to a green economy and sustainable society.

It is crucial to carry out widespread information campaigns on the importance of preservation and the sustainable use of biological resources. It is also necessary to link biological resources with life quality, human health and traditional knowledge. Restoration and the application of traditional knowledge in the context of a modern society should assist local communities in becoming major actors in conservation and the sustainable use of biodiversity. Traditionally, Kyrgyz were careful in using natural resources and that knowledge needs to be restored and disseminated.

Kyrgyzstan is in transition and a market economy dictates its own terms. Standard medical care and services are expensive and lack professional staff. Medicines are not available to many poor residents of rural areas. At present, villagers increasingly use the services of traditional healers and refer to traditional treatment with the use of medicinal plants. Traditional medicine is becoming increasingly popular and the Medical Academy has established a new department of traditional medicine. RCE Kyrgyzstan has identified further actions to be taken together with partners and the local community. These include:

- Creating linkages among well-being, health and quality of life with environment;
- Recovering traditional knowledge on biodiversity use in context of modern conditions;
- Raising awareness on the sustainable and safe use of ecosystems;

- Creating programmes in the frame of a green and sustainable society;
- Creating a common database of traditional knowledge of the Kyrgyz people – and other ethnicities represented in Kyrgyzstan – on the use of medical plants, use of biological resources and restoration approaches;
- Applying world knowledge on establishing mechanisms of natural resources and traditional knowledge conservation; and
- Carrying out scientific research and training courses on ethnobotany for college students and stakeholders.

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Box 1

Medical plant (*Kokomeren*) – *Thymus marschallianus* Wild. Is a plurannual subshrub 20–40 cm high. Medications based on thymus (infusion, liquid extract) have bacillicidal, expectorant and analgesic characteristics. It is used for cases of stomatosis, throat diseases, chronic bronchitis and gastrointestinal tract diseases. Kyrgyz widely used this plant for lowering blood pressure.

Medical Plant (*Jer Chai*) – *Tussilago farfara* L. Compositae. In Kyrgyzstan *Tussilago farfara* L. is widespread in foothills and valleys, it starts to blossom at the end of March. The leaves of foalfoot are prepared in early April to the middle of June. Leaves of the plant are used to cure diseases of upper air passages, chronic bronchitis, bronchial allergies, enhance expectorating, suppress cough. Brewed leaves are used as medicinal tea. The plant is also used to heal kidney disease, gastrointestinal tract diseases and headaches.

Medical Plant (*Coburgon*) – *Rheum reticulatum* A. Los. Polygonaceae Juss. Plurannual herbaceous plant 1.5 to 2 metres high. It grows in alpine areas, river valleys, rocky hills of Central Tian-Shan, basin of Issyk-Kul lake, Kyrgyz, Talas, Alay mountain ranges. Roots of the plant contain tanning substances. Leaves and roots are used for medical purposes, herbal infusion is used for digestion improvement and intestinal diseases. Roots infusion is used against parasitic worms.

Plantágo (*Baka jalbyrak*) – Perennial grass. *Plantago* grows in valleys, near households and in agricultural zones throughout Kyrgyzstan. *Plantago* leaves have resolvent, analgetic action and stimulate gastric secretion: in cases of respiratory organs diseases they have expectorant action, in chronic gastritis, gastric ulcers – ambient action. *Plantago* juice, dried leaves infusion is used as stupe in cases of concussion, phlogotic eyesore and insect bites. Thoroughly washed fresh leaves could be used as application in case of septic wound and furunculosis. Based on respondents responses *plantago* was used to stop bleeding of skin wounds, in cases of stomach ache *plantago* leaves were chewed and swallowed with saliva

Rhodiolarosea L. (*Altyntamyr*) Perennial grass, CAM plant, 10–70 sm high. *Rhodiolarosea* L. based medication stimulates task performance, improves memory and attention and also improves function of liver, adrenal glands, thyroid body, genital glands, promotes normalisation of metabolism, decreases blood sugar level. In traditional medicine *Rhodiolarosea* L. is applied as tea.

Aconitum leucostomum Worosch (*Akkodol*). Ranunculaceae Juss. Perennial plant. Grows in heavy beds in spruce forest and repent juniper, prevalent in western part of Kyrgyz crest and in KungeiAla-Too. Contains alkaloids. *Aconitum leucostomum* is applied when treating cardio-vascular diseases and joints.

Medical plants. *Artemisia absinthium* (*Ermen*) of Asteraceae family, 50 – 125sm high, frequently grows as subshrub. The plant is used as remedy improving digestion and tempting appetite. *Artemisia absinthium* medication is applied in treatment of liver, gall bladder diseases, hyposomnia, flu, dolor of upper airway. *Artemisia absinthium* was used in disordered stomach (the plant was chewed and then swallowed with saliva). *Ermen* was used for preparation of traditional soap “Shakar”, this soap had medical characteristics, helped to heal skin diseases, allergy, dandruff, skin and hair became healthy and silky. At present RCE Kyrgyzstan is taking steps to recover traditional knowledge on technology of production of “Shakar” soap.

Hypericum (*Sary chop*). Hypericaceae family. Perennial plant. Solitary or numerous blooms in cyme, united in jubate raceme, blooms are golden or yellow. Blooms are infused and drunk as tea to treat flu, joint diseases are treated by root infusion and soaking therapy.

Origanum vulgare L. (*Kok chop*). Perennial plant of Labitae family. Plants are 50 – 70 sm high. Blooms are small, numerous, united in corymbose-jubate raceme. Blooms in July–August. The plant grows in grassy clearings, bottomland meadows in foothills. *Origanum vulgare* is used in treatment of joint diseases, liver, stomach and intestinal canal. Tincture has resolvent, painkiller and antiseptic effect, anciently the grass was chewed to ease tooth pain.

Paeonia-anomalia (*Kymyzdak*), Paeoniaceae family, perennial grass plant of *Paeonia* family is known for its roots. The plant grows up to 1 metre. The root is 20–25 cm long, chestnut brown with intensive odor and sweetish taste. Is widely prevalent in Kyrgyzstan and Central Asia. In traditional medicine is used to treat idiopathic hypertension, stomach and intestinal canal diseases (gastric and duodenum ulcer, gastritis, diarrhea), toothache.

Rheum reticulatum A. Los. Polygonaceae Juss family. Perennial grass. Grows in Alpine belt on pebble beds, in river valleys, on rocky hills. Prevalent in Central Tian-Shian, bolson of Issyk-Kul lake, pools of Big and Small Kemin rivers, Kyrgyz, Talas and Alai crests. Roots contain hardening agents. The plant is used in traditional medicine to treat stomach and intestinal canal diseases. Live plants are imported from Sonkul lake area. Plant roots are large and hard to dig up entirely, so the establishment is quite low. Sprigs develop slowly.

Ephedra equisetina Bge (*Kyrk muundai chekende*). Ephedraceae Dum family. Much-branched bush. Green branches contain alkaloids, ephedrine at most applied to treat bronchial asthma. Spring regrowth of green branches starts in the end of March – beginning of April. Blossoming is periodical – in 2–3 years (end of May–beginning of June). Fruiting is rich.

RCE Espoo: The Encounters Project

Anna Maaria Nuutinen

RCE Espoo

Espoo was the first Finnish city to join the RCE network when RCE Espoo was established in January 2011. With the slogan *"Sustainable future is an active choice and we will reach it together!"*, RCE Espoo engages a diverse array of people in Espoo in education for sustainable development (ESD) through lifelong learning towards sustainable ways of acting, being, living, caring, working, affecting and enjoying. RCE Espoo works with diverse partners for a more sustainable future, including: City of Espoo (Educational and Cultural Services, Social and Health Services; Technical and Environment Services, Public Utilities Services); Omnia (Joint Authority of Education in Espoo); Laurea University of Applied Sciences; Metropolia University of Applied Sciences; Aalto University; University of Helsinki; The Regional Chamber of Commerce; Finnish National Board of Education (FNBE); SITRA; Finnish National Fund for Research and Development; UNESCO; Active Life Village Ltd; HSY (Helsinki Region Environmental Services Authority); Kuluttajavirasto (The Finnish Consumer Agency); Kierrätyskeskus (Helsinki Metropolitan Area Reuse Centre Ltd); Marefort Ltd; Metsähallitus (Natural Heritage Services) Southern Finland; Motiva Ltd, Helsinki; NatureGate Ltd; The OKKA Foundation for Teaching, Education and Personal Development; Sampo Group; Stories Ltd Paula Salmela; SYKE (Finnish Environment Institute); SYKSE (The Finnish Association for Environmental Education); TOY (Association for Science Education); Espyy (Environmental Association Espoo); Finnish Red Cross, and the Youth Emergency Shelter Espoo.

Introduction

The Environment and Schools Initiative (ENSI) is an international network that has supported educational development, environmental understanding, a global exchange of experiences and active approaches to teaching and learning through research since 1986. ENSI activities eventually led to the Encounters Learning Environment project (2008-2010). These projects and programmes were in line with the ethos of ESD whereby a school is developed based on the unique needs and nature of the school and the community. Keinumäki, Hospital School and Sorrila School from Valkeakoski are two key partners in the Encounters project.

In 2007, the Finnish National Board of Education (FNBE) offered grants for Learning Environment projects.


The purpose of the Encounters Project was to find ways in which sustainable development and its methods could become rooted in a school's daily activities

Colleagues from schools such as Keinumäki and Sorrila proposed a Learning Environment idea in order to bring a sustainable lifestyle to school culture. Riitta Paasivirta came up with the title, Encounters, while Anna Maaria Nuutinen and Paula Salmela added the sustainable lifestyle perspective to it. The two schools have begun implementation of the project in their own unique ways.

The Encounters project is fully aligned with the UN Decade on Education for Sustainable Development (DESD) and ENSI. Indeed, the two coordinators of the Encounters project belong to the ENSI group, which is led by FNBE. The association aims at supporting educational and pedagogical developments that promote insight into learning for sustainable development, environmental studies, active forms of learning and teaching, as well as education for citizenship, all via research and the international exchange of experiences.

In Espoo, the Encounters project evolved in a unique direction. There are about 100 schools in the region, from primary to upper secondary. Some of these schools are Learning Centres, such as Keinumäki School, which since spring 2009 has been responsible for ESD, particularly in-service teacher training and development of municipal/ local curricula and ESD materials.

The RCE Espoo network was created based on the network of the Keinumäki's school project: Encounters for a Sustainable Lifestyle. The purpose of the Encounters Project was to find ways in which sustainable development and its methods could become rooted in a school's daily activities, through networking with local stakeholders, authorities, researchers and experts and by choosing pedagogical methods that support social interaction and participation, and enrich the working methods within a school's learning environment. There were more than 40 organisations working together on the project. As such,



The core learning aims were commitment, participation and learning about sustainable lifestyles both in schools and at home among families. As such, parents' organisations are an important link between the school and the community.

the idea at the heart of RCE Espoo already existed inside the school project on a smaller scale.

The school acts in close cooperation with society and recognises that the internalisation of sustainable habits can only be carried out with the help of a wide range of society's members. Such an act demands courage, vision and skills from citizens to change critical activities and educational institutions in society.

"It is the role of education and training to ensure that citizens of all ages have the knowledge, skills, readiness and vision that will enable them to build a sustainable and equitable future and commit to a sustainable way of life. It is a demanding role that will require that firm support be given to teachers, trainers and educators." (Strategy for Education and Training for Sustainable development and Implementation Plan 2006-2014, National Commission on Sustainable Development, Sub-committee for Education, 2006)

The project led by Keinumäki School resulted in: ESD networking; collaboration with established networks; partnerships and co-operation with real life actors; participation and influence manifested in schools each day; the use of diverse pedagogical approaches on ESD; versatile learning environments for ESD; and measures of sustainable consumerism.

21st Century Learning Challenges

In the Encounters project, learning was seen in a socio-cultural framework, as a process of transformations that change both the learner and the environment. It is transformative learning that concerns the whole school community and challenges it to use each one's strengths and abilities. Learners are looking for optional learning opportunities and flexible and transactional spaces in the environment. The project responds to 21st century learning challenges by training students and teachers to face learning opportunities with an open mind. The local community offers a rich variety of professionals that schools can cooperate with, if they are ready for it. Local, national and international networking brings learning opportunities and project funding supports those efforts by giving necessary resources. The objectives of the project were broad enough and flexible enough so as to ensure multiple avenues of implementation. Each stakeholder

could feel fully committed in their participation. The objectives of the DESD formed the basis of the project. ENSI and European Union projects, like SUPPORT, gave guidelines for development. Sustainability was the 'guiding star' and its socio-cultural aspect was considered most important, though ecological and economic sustainability were intertwined in it. According to socio-cultural learning theories, students were subjects of their own learning and learning was based on social interaction, emotions and real life situations. Students could also take part in the planning of their learning environments, suitable both for them personally and as a group.

Project Activities

The project had a number of different aims, including:

- Varying learner-centred teaching and learning methods to allow students to use and further develop their learning environments, in cooperation with stakeholders, authorities and scientists, and by using information and communications technology as a tool;
- Widening the learning environments outside the school towards cooperation with professional stakeholders in the local community; and
- Enhancing participation via school councils in order to increase commitment and peer-learning among students, including taking the students' opinions and suggestions into consideration in planning and developing the learning environments.

The core learning aims were commitment, participation and learning about sustainable lifestyles both in schools and at home among families. As such, parents' organisations are an important link between the school and the community.

The project explored five different aspects of the learning environment:

1. The local aspect: families, local authorities and companies.
2. The physical aspect: developing learning environments by making changes in school buildings and developing learning in non-formal environments like museums, art centres, local companies, municipal departments, and in other schools and institutions.
3. The social aspect: the social interaction among students, researchers, family members,

citizens, authorities, universities and other ENSI-network schools.

4. The technical aspect: a diversity of information and communication technology (ICT) related tools to enhance learning and interaction (i.e. Smart Board, emails, videos, photos, web pages).
5. The didactic-pedagogical aspect: the most important environment was the 'attitude of open mindedness', as well as collaborative knowledge building and quality education.

Learning Packages

The goal of the Encounters project was to ensure that development and ESD take place as part of a school's daily life. To reach the objective, five learning packages were created taking into account all dimensions of sustainable development, including:

- The ecological dimension: biodiversity, ecosystem function and interaction, environmental exploration, human responsibility and influence, environment-friendly practices in everyday life, and the relationship with the nature.
- The economic dimension: energy and water saving, sorting and recycling, consumption, equity, and procurement.
- The social dimension: well-being, relationships, respect, safety, equality, participation and influence, finding the joy of learning, empowerment, discovery, and systemic, critical and innovative thinking.
- The cultural dimension: traditions, roots, multiculturalism, justice, tolerance, science and art.

The learning packages help children develop their perception of the socio-cultural history of the area. They learn to perceive the relationship between man and nature; to see how the activities of various age groups affect nature; how people learn differently; and how to approach differences. Finally they learn to understand how sustainable ways of life make a difference in building the future.

In the Encounters project, learning was seen in a sociocultural framework, as a process of transformations

Box 1 Learning Packages:

Ancient Espoo helps to build empathy with nature, its moods and seasonal changes. In ancient time, nature was respected and appreciated. This package combines art, music and history (mythical stories) into a fascinating entity. It allows students to become familiar with their own roots, and cultural history. Also, in other cultural areas, students can identify with the history of their native country. The units cover the cultural sustainability of the region and consist of six workshops. The package is carried out in collaboration with the Espoo City Museum and Art Center Pikku Aurora.

Medieval Espoo helps build an understanding of how human beings are dependent on nature, including soil, water and forest areas. The package familiarises students with medieval times, both ordinary life in those times and special occasions. Medieval people were strongly linked to their environments, their land and the forest. Students learn about medieval occupations in different workshops and also come to understand how life changes over time and how one might deal with those changes. They also learn the history of the region and how Espoo came to be what it is today. The package is carried out in collaboration with the Espoo City Museum and the Museum of Finnish Theatre. Espoo's 550th anniversary, in the spring of 2008, was part of the learning.

Nuukio National Park helps build a relationship with nature. It is important for individuals to have their own experiences in nature, thereby creating the basis for a future relationship. This package includes a comprehensive experience of Nuukio nature during different seasons. The aim is to confirm a participant's relationship to nature through their own experiences and help them to understand how man is dependent on nature: soil, air, water and energy. The package includes instructions on how to learn about Nuukio through stories, art and history. Nuukio's natural surroundings also provide an ideal setting for nature photography during different seasons. The package gives instructions for observation, exploration and even for nature tour organisations. The package is implemented in cooperation with the National Board of Forestry/Nuukio team and deals with ecological sustainability.

Mapping One's Environment demonstrates how experimental, inquiry based learning supports the understanding of interactions and the functioning of ecosystems. The package contains instructions for both teachers and students for experimental learning. It also includes instructions for air, soil, water testing and for the exploration of organisms. The basics of ecosystem functions and interactional relations are also explained in the package. The goal is for students to obtain information through their own investigations in the local environment, to learn how to ask questions related to the natural environment, and to learn how humans change their environments and impact organisms and their presence in the region. Systemic, critical and innovative thinking is an important part of the learning. The package is implemented in cooperation with WWF, the Nature House Villa Elfvik, Technical and Environment Department of the City of Espoo. An online tool, Nature Gate, was used for natural species identification.

The Keinumäki school as a Learning Environment covers everyday practices in school and supports sustainable lifestyles. The learning package aims to support students' well-being, participation, influence and activities in their own school, at home and in society. The project draws attention to sustainable development in all dimensions of life in order to help individuals adopt a sustainable lifestyle. Other goals of the package are: to promote the social sustainability of a safe, equal and friendly relationship between the formation of interactions and information searches, and the discovery and joy of learning; and to encourage economic and ecological sustainability in everyday life including energy and water reduction, sorting and recycling, reduction of consumption, and secure biodiversity and protection of our natural environment. Cultural sustainability includes human cultural history, traditions and multicultural aspects and issues of fairness and tolerance. The package is implemented in cooperation with energy companies, water departments, environmental and recycling centers, as well as individual households.

Conclusion

A holistic understanding of well-being and sustainable development creates the foundation for a new sustainable model of society. This project has helped to ensure that:

- Sustainable development is incorporated in the plans for early childhood education and care of all of Espoo's operative units of early childhood education as well as the curricula of schools, educational establishments and units of higher education.
- Sustainable ways of action are an integral part of everyday life and operational culture of all educational organisations in Espoo. The target is to establish high quality learning that provides learners knowledge, skills, preparedness, values and attitudes needed for understanding and realising sustainable lifestyle.
- All daycare centres, schools, educational establishments and units of higher education elaborate their own sustainable development programmes. Construction of the programmes is implemented in cooperation with Espoo's internal support service providers (catering, management and maintenance of premises). The programme work will be supported by training and guidance. Additional training is organised and supporting material prepared for teachers, trainers, educators and employees working in communication and customer service to increase their capabilities to influence people's knowledge, skills, values and attitudes related to sustainable development.

Overall, awareness of Espoo inhabitants about the different areas of sustainable development (environment, well-being, economy and culture) as well as of the possibilities of promoting sustainable development in everyday life, work and leisure-time activities, has increased over time. Production of environmentally-friendly services and products that increase the well-being of inhabitants has also been promoted.

Currently, the well-being of people and the environment and respect of cultural values are taken into account in the city planning of Espoo. The target of planning is to achieve safe and socially functional solutions that respect the cultural heritage and safeguard the vitality of local ecosystems.

The target of planning is to achieve safe and socially functional solutions that respect the cultural heritage and safeguard the vitality of local ecosystems.

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RCE Guatemala: Culture as a Central Point of Education for Sustainable Development

Eduardo Sacayón

RCE Guatemala

One of the fundamental principles shared by the partners of RCE Guatemala is the recognition of the richness of the indigenous culture that is key in the strengthening of the national identity, particularly because the culture of the indigenous peoples is closely associated with the country's biodiversity. It is also recognised that both culture and biodiversity are almost in complete abandonment and marginalised. Moreover, education policies do not consistently address the need for a culturally appropriate education. For this reason, RCE Guatemala is committed to the educational reforms that address the challenge at all levels: primary, secondary and university. The best way for children to learn is to receive their education in their mother tongue, so the RCE supports programmes for the training of intercultural bilingual education teachers. For example, at the university level, the RCE is engaged with the projects that promote indigenous knowledge and wisdoms to be incorporated in the educational mainstream. The RCE is committed to the training of university teachers and the support of indigenous students to strengthen their identity and learn to appreciate their culture. The vision of RCE Guatemala is the recognition of culture as a central point for sustainable development, as well as environmental protection and economical growth without exclusion and discrimination.

Introduction

It is widely recognised that cultural diversity, environmental conservation, economic and social development of individuals and societies are the fundamental principles of sustainable development.

Coincidentally, in RCE Guatemala's region, biodiversity is closely related to cultural richness, which gives societies enormous potential for economic and social development. Unfortunately, that potential has been put behind and is in constant risk of destruction by the capitalist development model, based on social exclusion and marginalisation of large groups, especially indigenous peoples.

All around the world, Central America is the region that invests the least in education. For example, in Guatemala, where more than 42% of the population is indigenous, the state spends only \$48 on average per year, per inhabitant, compared with \$2,714 Norway invests in education for each of its citizens, or the average of \$1,500 invested in OECD countries (Organisation for Economic Co-operation and Development).

To the lack of investment in education there is the added problem of a predominantly Western model of education which ignores the wisdom of indigenous people. The UN Special Rapporteur on the Right to Education, Vernor Muñoz Villalobos, who visited Guatemala in the year 2008, stated that the opportunities to education for indigenous people are very limited. According to him "there appears to be no space to promote cultures, cosmic visions, arts or ancestral traditions of the first people living in this country... However, to build the scientific, technological and cultural capabilities of a developing country it is necessary to guarantee middle and university education. In this sense, plans for the expansion and strengthening of secondary education and state universities must be supported" (UNHCHR 2008).

Besides extending the opportunities of access to education for the indigenous people, it is necessary to insist on the necessity that the educative systems may use culturally appropriate resources. In this sense, it is important to consider that cultural contents are closely related to the strengthening of the identity of peoples and to the construction of the nationality of different States. Cultural contents such as history, collective memory of peoples, their heroes, their customs and traditions are part of the educational systems that reinforce the sense of identity and nationality. Otherwise, societies become fragmented, imitating others' identities, devaluing their self-esteem, facilitating neo-colonisation processes that affect autonomous development of national states.

... in RCE Guatemala's region, biodiversity is closely related to cultural richness, which gives societies enormous potential for economic and social development. Unfortunately, that potential has been put behind and is in constant risk of destruction by the capitalist development model, based on social exclusion and marginalisation of large groups, especially indigenous peoples.



The teaching of cultural greatness of Mayan culture in Guatemala, gives an enormous value to its identity, which must go hand in hand with the teaching of modern knowledge and other discoveries in the Western world, as well as a right to education and use of modern technologies that every citizen must have.

One of the challenges of RCE Guatemala is promoting changes throughout the educational system, so as to introduce a culturally relevant education, where cultural and linguistic diversity of indigenous peoples can be recognised. By this way, culture should be seen as a central point of education for sustainable development and crucial for future generations in order to preserve their identity.

Among the country's vast cultural heritage are more than 5,000 archaeological sites associated with the Mayan culture, 24 different existing languages, and three places that have been recognised as "Cultural Heritage of Humanity" by UNESCO. A variety of regional women dresses, whose characteristics express the natural wealth of its flora and fauna. A worldview full of Mayan principles favorable to sustainability.

Several of the RCE Guatemala stakeholders work for changes in primary and secondary education, as well as in higher education under this principle. For example:

Programa de Apoyo Académico a Estudiantes Indígenas (PAAEI) is a programme which is intended to strengthen identity, leadership, political participation and academic training of indigenous students at San Carlos University.

Rigoberta Menchu Tum Foundation has several programmes of education and training of teachers and education advocates in rural areas to strengthen leadership, social and community roles and close relationships with the community.

Programa de Desarrollo Santiago (PRODESSA) promotes compliance with the human right to education by supporting educational reform, compliance with national and international commitments on education and policy advocacy. In its actions the organisation favors the indigenous regions of the country.

Escuela de Formación de Profesores de Enseñanza Media (EFPEM) is responsible for teacher training and basic education for educational reform.

Facultad Latinoamericana de Ciencias Sociales (FLACSO) trains outreach workers for the conservation of community forests.

Museo Odontológico (MUSEODONT) has a botanical garden, where it owns several local plants used by indigenous peoples of Guatemala for oral health. The Museum is opened to high school students and students of the career of Dentistry.

Radio USAC, TV USAC and Maya TV are media that broadcast news, interviews and the activities of network members, related to the promotion of the rights of indigenous peoples.



Faculty of Agronomy. Nagoya Protocol, biodiversity and traditional knowledge

Traditional Knowledge and Biodiversity: A University Experience Towards Curricular Innovation

Biodiversity and Traditional Knowledge in the Mesoamerican Context

Besides having an enormous cultural legacy of contributions to humanity from the Mayan culture, Guatemala also has an enormous biological richness. Today, Guatemala is part of the Group of Like-Minded Megadiverse Countries (LMMC), composed of a group of countries that harbour the majority of the Earth's species and are therefore considered extremely biodiverse and home to associated traditional knowledge. Other neighbouring countries such as Mexico, are also part of the 20 Megadiverse countries in the world. The southern part of Mexico, along with Guatemala, covers the largest area

of the Mesoamerican region, where millions of persons belonging to indigenous groups and communities still maintain their traditions and knowledge inherited from Mayan civilisation.

In Guatemalan territory, there are more than 600 species of flora and fauna, unique in the world (mammals, birds, reptiles, amphibians, freshwater fish, beetles and flowering plants).



Professional College of Veterinary, Zootechnics and Aquiculturist

It is widely recognised that cultural diversity is closely associated with the main concentrations of biodiversity in the world. Languages, which are an expression of cultural richness, are associated with biological richness, as can be seen on some maps globally. Worldwide, there are 6,700 languages, 15% of which are located in Latin America, including Mesoamerica. In Guatemala alone there are 24 language groups.

Indigenous peoples live and have rights over vast areas of land with high levels of biodiversity. Land and nature have a sacred quality that is part of indigenous values and beliefs. The Mayan peoples of Guatemala have a comprehensive view of the world, where all elements of the universe have life and are closely interrelated, including the earth, sky, air, water, forests and animals. Therefore the Mayan has a non-materialistic attitude and custody to land and natural resources, very different from Western consumer society.

In fact, the Maya worldview has life principles linked to sustainability, which does not mean that all descendants

of the Maya meet these principles 100%. Nor does it mean that these practices are isolated from modern life and the use of new technologies. In actual life, the principles of the Maya worldview are transmitted from generation to generation within each of their families in each of the different rituals, where harmony between humans and nature is practiced. This is seen in the ceremonies of marriage, sowings, harvests and religious festivals. However, the models of development that the country has promoted over hundreds of years, excluding indigenous peoples from the benefits of the wealth the country produces, depriving them of basic services like education, and exploiting their labour force in national production, have led to most indigenous people living in extreme poverty.

In addition, these models of development have needed an ideology that denies the relationship between the ancient Mayan civilisation and current indigenous culture. Extreme poverty and the denial of its past, among other elements, forces many natives to use cultural practices alien to the principles of the Maya worldview that are considered closely related to sustainability. It should be noted that in all models of human behaviour, whether political, religious or philosophical, such as democracy, there are always people and social groups that are not 100% consistent in their everyday practice with the principles and values they adhere to.

The close relationship with nature and their practice of deep observation led to the great contributions of the Mayas to human civilisation in all disciplines of knowledge, such as health, mathematics, law, astronomy, literature and architecture. Two major architectural monuments built by the Maya, Tikal and Quirigua have been recognised by UNESCO as the cultural heritage of humanity. Despite these acknowledgments, the Mayan world today and their wisdoms related to biodiversity are at risk for discrimination by the dominant socio-cultural context.

Indeed, this condition causes dominance in the educational system and the experiences of indigenous peoples are not valued. A predominantly teaching-learning system based on a Western view leaves no room for the knowledge and wisdom of original peoples at the university level. This means a continued loss of the cultural richness of the country, affecting the sustainability of society as a whole. There is also a lack

of awareness of society around the conservation and preservation of biodiversity.

In order to find mechanisms to recover the traditional knowledge and wisdom as well as conservation and preservation of biological diversity, the Network of Education for Sustainable Development in Guatemala has sought the creation of alliances with various institutions to develop an academic intervention for curriculum innovation.

RCE Guatemala: Wisdom Dialogues

A good practice to incorporate the Mayan perspective into the University curriculum has been the project “Wisdom Dialogues”.

Under the leadership of IDEI, the project has the cooperation of three other stakeholders from RCE Guatemala:

- Programa de Apoyo Académico a Estudiantes Indígenas
- Facultad Latinoamericana de Ciencias Sociales
- Museo Odontológico.

Cooperation and consensus have been the distinction of this association amongst the members of RCE Guatemala. Some of the tasks in which they have been cooperating are:

- Selection and contact of University teachers
- Organisation and administration of activities
- Conducting and participation in dialogues

In this project academic discussions on indigenous and universal knowledge are encouraged in order to enrich the university curricula and to explore the possibility of introducing indigenous knowledge into the current academic programme.

These dialogues are conducted by a specialist who presents a short essay, based on empirical research or analysis of documents and personal reflection, which serves as a basis for defining a joint strategy for integrating indigenous knowledge and universal knowledge. The aims of the talks have been to start a debate within all academic units of the university on the hegemonic articulation of knowledge with indigenous knowledge in the various programmes, disciplines and curricula, and to define strategies to operationalise

agreements, rules and declarations related to cultural pluralism and multiculturalism in the San Carlos University Strategic Plan 2022.

For instance, international debates like the Nagoya Protocol become opportunities to evidence the importance of the relationship between genetic resources, biodiversity and traditional knowledge. Strategically this convention is a good way to discuss with teachers of faculties of law, agriculture, veterinary, international relations, and politics about the rights of indigenous peoples regarding their intellectual property, biodiversity, wisdom, etc. and the significance of these topics in teaching programmes. It is also an excellent approach to discuss the relationship between Western knowledge and traditional knowledge, as there is interest in articulating these two types of knowledge into the university curriculum.

Some Outcomes

1. **More than 300 professors from different disciplines have been involved in these “Wisdom Dialogues”.**
One of the great achievements has been to bind professors from sciences with social and cultural issues, to which they are not related. Amongst them agronomists, zootechnicians, architects, veterinarians and dentists.
2. **Creation of a teacher network interested in promoting these debates, innovation and educational change.**
One of the highlights of this network is its multidisciplinary character, allowing for common problems to be addressed from different points of view.
3. **Strengthening an indigenous student network with about 300 students of different disciplines and faculties at the university.**
The opportunity to be together in common spaces and discussions has enabled increased participation in broader objectives such as those related to a reform process that drives the university as an institution.
4. **A good level of teacher motivation for educational innovation, reflected in various demands for similar activities in other faculties.**
During 2012 new dialogues were prepared about Intellectual Property and Indigenous Rights with the support of the Ministry of Economy.

5. Incorporation of the ethnic variable in the student enrollment at university level.

As a result of this it has been possible to show segregation processes of indigenous students to careers in social sciences and barriers to the enrollment of indigenous to careers of natural sciences, which is important information for the development of policies and programmes.

Principal Challenges

- Curriculum changes: The main challenge is to maintain a successful strategy of dialogue with teachers and authorities to continue with a process of awareness, allowing for an opening for the introduction of indigenous culture within the content of the dominant curriculum.
- Involvement of all faculties and disciplines at university: Expand the dialogue to all academic units of the university under the principle that all disciplines and careers can be enriched with modern knowledge together with indigenous knowledge.

Relevance for Programmes and Policies

The university is currently developing a process of educational reform. This project can offer valuable lessons and inputs to the definition of policies and university programmes such as:

- University curriculum culturally appropriate to the multicultural, multiethnic, multilingual characteristics of our country.
- Teaching sensitive to interculturalism, base to build a plural and inclusive university that meets the demands of higher education of indigenous peoples, the right to access to modern, scientific and technological knowledge, as well as to the strengthening the national identity with full recognition of the values and principles of the Mayan culture.

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RCE Kodagu: Sacred Groves of Kodagu – A Tradition to Conserve

Shyamala Mani

RCE Kodagu

Kodagu District in the state of Karnataka in southern India covers an area of 4106 sq. km. and has a population of 5,45,000. A large part of the district lies in the Western Ghats, one of the most complex and fragile ecosystems in the world. A third of the district is reserved and protected forest controlled by the government, and an almost equal area has private forests, coffee and other plantations. The population of Kodagu includes local indigenous communities, permanent migrants and floating population from other areas.

RCE Kodagu consists of several core organisations with the Centre for Environment Education (CEE) playing the coordinating role and Samvrudhi Trust's and Nirmala Kodagu assisting CEE in the coordination work. The active members of RCE Kodagu include Nirmala Kodagu, Samvrudhi Trust and the Kodagu Model Forest Trust (KMFT), which comprises Forestry College, Centre for Environment Education (CEE), Coorg Wildlife Society (CWS), Coorg Foundation, Coffee Board, Skanda Coffee, Tata Coffee and more. Among the other members of RCE Kodagu are, EMBARK, Coorg Public School, District Administration, Deputy Director of Public Instruction, All India Radio Madikeri. In the Kodagu Heritage Interpretation Programme (KHIP) the specific activities relating to high school and college teachers' training are coordinated by Forestry College; the coordination of eco-clubs and teacher training in primary and middle schools is done by CEE; Nirmala Kodagu along with the DDPI, handles conservation education; establishment of rain centre and training Ecodevelopment Committees (EDCs) is CWS's responsibility; Eco-tourism-related actions are coordinated by CEE along with CWS and the Eco-tourism committee of KMFT; Samvrudhi coordinates health education and the women's self-help group programmes; and besides EMBARK coordinates all youth activities.

The sacred groves revival process – initiated by stakeholders like the Kodagu Model Forest Trust, Forest Department, temple committees, research institutions and NGOs through various public awareness programmes, seminars, training and interaction programmes involving students, stakeholders and media – has helped revive the value of these important biodiversity hotspots in the district. The College of Forestry and Kodagu Model Forest Trust have been actively involved in the revival

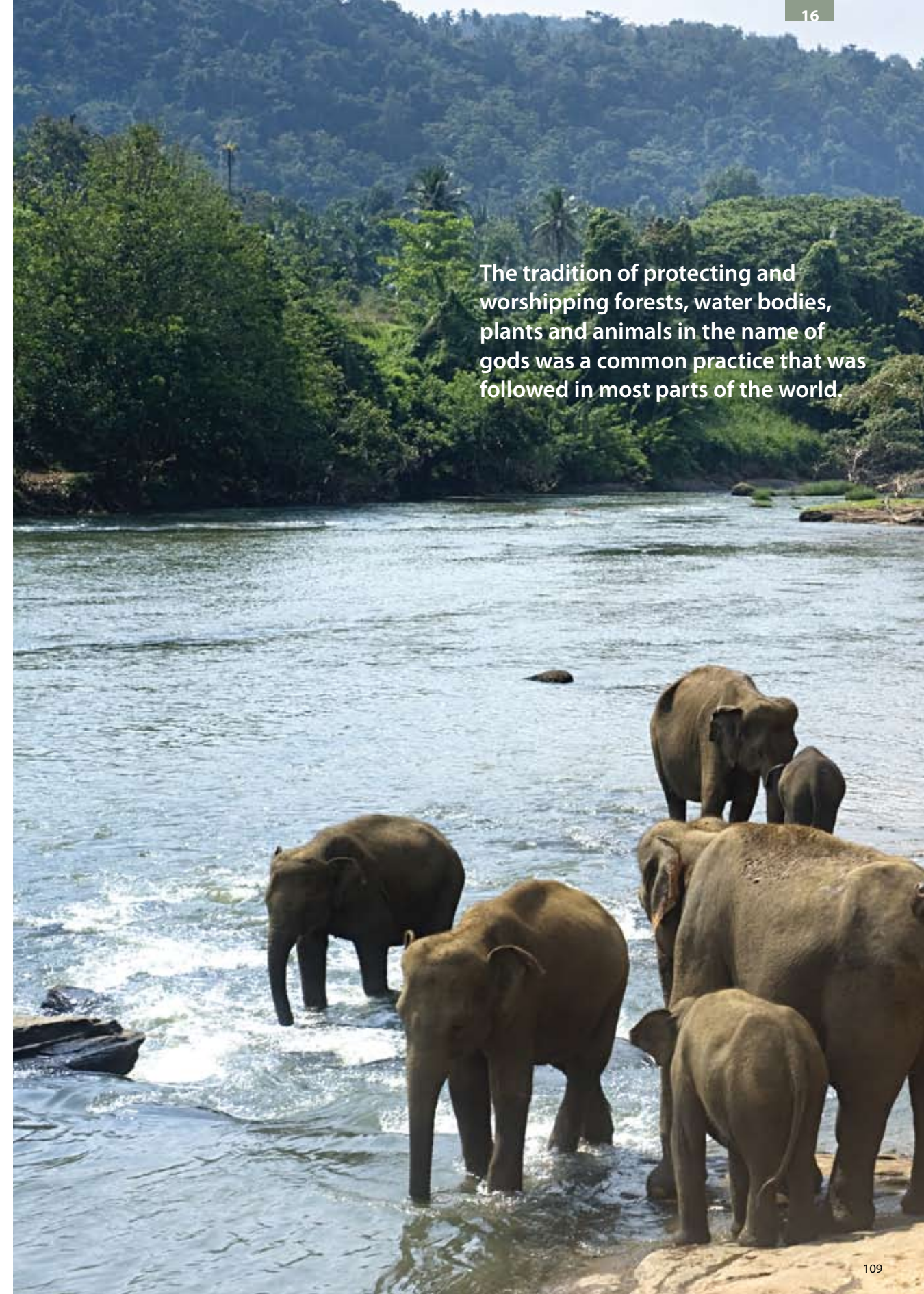
programme. RCE Kodagu has played an important part in emphasising the role of sacred groves in biodiversity conservation through education programmes in schools and educational institutions. It is now felt that the landscape that was under threat due to invasive tourism, changing land use patterns, excessive exploitation of natural resources, loss of biodiversity in coffee plantations, encroachment of village level common property resources and loss of traditional values can be protected through sustained and innovative education programmes. Education in educational institutions combined with sacred groves festivals and media campaigns throughout the district would help revive a disappearing tradition while protecting and conserving biodiversity.

Background

The tradition of protecting and worshipping forests, water bodies, plants and animals in the name of gods was a common practice that was followed in most parts of the world. What began as nature worship underwent several transformations and has either been totally lost or is in the process of destruction. This practice is still prevalent among a few ethnic groups in the world today. India is one such country where this tradition is still alive but is in the process of diminution. In India the sacred groves tradition is common in most of the states except Andaman and Nicobar Islands, Jammu and Kashmir, Lakshadweep, Nagaland, Punjab, and Tripura. Within the states there are certain micro sites where this tradition has been sustained over the years thanks to the support of native communities. One such area where this concept of sacred groves is still surviving in fairly good condition is Kodagu district in Karnataka state of Southern India.

Kodagu is the second smallest district of Karnataka and a land of fascinating geographical diversity with forests and hills, rivers and streams cascading through the valleys, pastures and plantations, wildlife sanctuaries and historical monuments. The mountains of Kodagu give rise to rivers such as Cauvery, Kabini, Laxmanathirtha, Ramathirtha and Hemavathi. The physical features vary from the highlands that stretch from the north-west to the south and down the slopes that gradually descend to the plains bordering the districts of Hassan and Mandya in the north-east and east, respectively. Coffee is the major cash crop, with pepper and oranges as intercrop. Agriculture consists of mainly paddy and a few horticultural crops such as

The tradition of protecting and worshipping forests, water bodies, plants and animals in the name of gods was a common practice that was followed in most parts of the world.



sapota, banana and guavas. The forest and vegetation mix is a combination of evergreen forests with sholas, semi-evergreen, moist deciduous and scrub forests.

Kodagu and its people have many unique traditions and one such tradition is the concept of “Devakad” or the sacred groves (SGs). There are SGs all over the world but what is unique in Kodagu is the very large number, with 1214 listed SGs covering an area of 2550.45 hectares in the district; this is the highest in the world. There is one SG for every 300 hectares of land. Every village has one, or more than one, grove. There are 14 villages with more than 10 groves and Thakeri village in Somwarpet taluk has the largest number, with 17 groves. Though the district has a large number of groves most of them are very small islands. Out of 1214 groves in Kodagu, 80% are less than 2 ha in area and there are only 123 groves that cover more than 4 ha (Kushalappa and Kushalappa 1996).

What began as nature worship underwent several transformations and has either been totally lost or is in the process of destruction.

These groves have been protected in the names of 165 different deities. The most common deities are Iyappa, Bhagavathi, Bhadrakali, Mahadeva, Basaweshwara. All the 18 native communities, including Muslim communities called Jammamapilas, are part of this unique tradition. Most of the sacred groves have a village level committee consisting of representatives from all the major communities of the village with Devathakka the person assigned as head of the committee to look after the functioning of the temple. There are others, like Bhandara Thakka (treasurer or keeper of money and jewels) and Uruthakka (head of village) and Nadthakka (head of a group of villages), who assist the temple committees. These responsibilities, along with the performing of various rituals such as offerings, music, dance and other religious rituals during the annual festivity, are given to members of certain communities within the village. RCE Kodagu and especially KMFT have been strengthening this aspect of conservation through festivals, community engagement, anthropologists and conservationists to highlight the significance of the tradition of maintaining sacred groves by communities and the benefits of them.

The sacred groves have undergone changes in their legal status, physical extent and worship tradition. The extent of the groves has reduced from 6277 ha in 1905 to 2550 ha in 1985. But their numbers increased from 873 to 1214 during the same period, indicating a reduction in area resultant of their fragmentation (Kalam 1996ⁱⁱ and Uthappa 2004ⁱⁱⁱ). This reduction in area was mainly due to encroachments for cultivation and habitation. The most important cause for the change in their physical area was due to the confusion regarding their legal ownership, which was presumed to be with the revenue department from 1905 until 1985. KMFT examined the issue and published a book in 2004 that clarified that these sacred groves were declared as protected forest in 1873 and such status continues today. However, when government orders were issued for their transfer from the forest department to the revenue department in 1905 and later back to the forest department in 1985 this resulted in dual ownership and hence both departments did not take the steps to protect the forests. RCE Kodagu wrote letters to the concerned department in the Ministry of Environment and Forests, made presentations, provided evidence and organised visits by the concerned officials from Delhi and Bangalore and finally had SGs declared as special forests.

The Concept of Worship

The loss in the physical extent of the SGs and their conversion into coffee estates and habitation during the period 1905 to 1985 brought in remarkable changes in social customs and practices. The tradition of restrained resource utilisation practice along with the natural enrichment of soil had given way to rapid and indiscriminate resource utilisation resulting in a shift of focus from grove to deity and the temple. The original concept of a sacred grove followed by a sacred pond and then paddy cultivation has gradually disappeared due to increasing pressure of population and changing cropping patterns leading to more and more area being brought under commercial crops, such as coffee and ginger. These changes have also influenced the worship concept. The worship concept, which originated as nature worship, gradually transformed to installation of deities and finally into construction of huge structures or temples forgoing the grove and its inherent ecological importance. The construction of temples and installation of deities resulted in regular worship over an annual or seasonal worship concept. This process of transformation and the

temple attaining prominence over the grove has resulted in the temple committee looking after the management of temples rather than the groves. The worship, which started with a grove associated with a local deity, such as Badrakali, Iyappa, Vishnu, or Shiva, has passed through several stages and has finally given way to huge temples where daily worship is held. Small platforms with symbolic stones have given way to temple structures with various types of architecture, which has the influence of neighbouring districts of Kerala and Karnataka.

Ecological Value of Sacred Groves

Access to and interference with sacred groves was restricted and hence the natural resources mostly remained unexploited, permitting the complex ecological processes to continue uninterrupted over a longer period. This made sacred groves a micro hotspot of biodiversity. The sacred groves are richer in native species and are diverse in species of trees, climbers, plants, birds, butterflies, fungi and other insects (Box 1).

Box 1 Diversity of Sacred Groves

Tree diversity: Sacred groves are repositories of certain red-listed and endemic tree species of western ghats. Trees such as *Dysoxylum malabaricum* (devadhara or white cedar), *Vateria indica* (doopa), *Artocarpus fraxinifolius* (balanji), *Artocarpus hirsuta* (hebbalsu), *Garcinia gummi-gutta* (panapuli) are a few to name.

Fungi diversity: Studies (Kushalappa & Bhagwat, 2001) suggest that a network of micro-reserves such as sacred groves may shelter a diversity of species belonging to habitat-specific groups of organisms such as macro-fungi. The species turnover of macro-fungi in sacred groves was found to be higher than that in reserved forests. Fungi species such as *Xylaria* and wood rotting macro-fungus such as *Ganoderma* were found in sacred groves of Kodagu.

Animal diversity: Sacred groves are home for many birds such Malabar whistling thrush, small green barbet, Malabar grey hornbills, spot billed duck etc. They also support a large number of amphibians, reptiles, small animals, boars and micro-organisms.

Medicinal plant diversity: *Justicia wynaadensis* (Maddu thoppu), *Asparagus racemosus* (Takki), *Cynodon dactylon* (Garike pillu), *Solanum xanthocarpum* (chunde, Kudane), *Rauwolfia serpentina* (sarpaganda), *Vateria indica* (Bili doopa), *Garcinia gummi-gutta* (panapuli), *Ventilago madraspatana* (Maithal), *Smilax china* (Munnrothballi) are a few to name. A documentation programme on medicinal plants conducted at five sacred groves showed that the number of medicinal plants varied from 16 in Kumboor sacred grove in Somwarpet taluk to 65 species in Vanabhadrakali sacred grove in Virajpet taluk.

Some of the important ecological services provided by sacred groves are related to their function in recharging aquifers as well as soil conservation and maintaining of the nutrient cycling. Recharging of aquifers is related to the function of the vegetative mass of the grove itself to retain water, soak it up like a sponge during wet periods and release it slowly in periods of drought. Accumulation of forest litter, its decomposition, the organic material built in the soil and its return to the biomass of the standing forests secures a continued nutrient cycle, ensuring the maintenance of biodiversity, continuity of the evolutionary process and the comprehensive health of the enclosed landscape (Bhagwat et al 2005a).

RCE Kodagu published an educational package, consisting of a poster, booklet, and a cassette of songs, for middle school teachers and students so that they can understand the background, issues, and importance of conserving the SGs and the methods to be adopted for conservation. More than 55 schools across Kodagu used the package to conduct surveys and document the medicinal plants. They put up an exhibition for the benefit of other schools, students and community members in 2007.

Conservation of Sacred Groves

The local communities are the protectors of sacred groves and conserved them as part of their culture and traditions. The people of the village where the sacred grove is situated took on the moral responsibility of preserving nature's gift in its untouched form. The only exception to the rule of non-interference was during the special festivals at the deity's abode in the sacred grove for which the produce from the sacred grove was utilised to a very minimal extent. All native communities in Kodagu have a

role in maintaining their sacred grove and have a unique tradition of worship, dance and music, which are part of their tradition and culture (Bhagwat et al 2005b).

Sacred groves have also served as areas where members of the communities who are the original inhabitants of Kodagu – namely, Kodava, Ammakodava, Airi, Heggade, Koyava, Kumbaara, Kudiya, Maleya, Golla, Kaniya, Panika, Banna, Kapaala, Kembati, Hajaama, Madivaala, Maeda, Adiya, Jamma Mapilla, Koleya, Vokkaliga Gowda, Jammada Gowda, Lingayatha, Kuruba, Yerava, Brahmin, Aadhi Karnataka and Haalumatha – got together during festivals promoting communal harmony. Each family in a village has a definite responsibility to the sacred grove and the deity and a member of one specific family in the village is recognised as the Thakka. Families who owe allegiance to the deity and grove follow this tradition religiously. The custom, culture and traditions with regard to the sacred grove and the deities are identical throughout Kodagu and are a part of the tradition of Kodagu from time immemorial.

In most Kodagu communities, women are the traditional healers who perform their duties without any expectation of remuneration. They conserve, preserve and teach their daughters to likewise be traditional healers. Many home remedies and even complex treatment of humans and livestock is carried on by their tradition. However, loss of habitats and lack of interest for traditional healing is responsible for the diminution of this tradition.

Today many other formal institutions like the Forest Department, research institutions and NGOs have joined hands with local communities in conservation of sacred groves through various programmes, such as public awareness campaigns at various sacred groves festivals, exhibitions, street plays, and video shows to educate the local community regarding the relevance and relative importance of the existence of sacred groves in the larger landscape. Involving college students and school children in documenting and creating awareness regarding the rich medicinal plant diversity in sacred groves, organising seminars, training programmes and interactive programmes for students, officials, temple committee members and the general public on various aspects of sacred groves are some of the ways sacred groves can be conserved and safeguarded.

In a project involving 300 middle schools, about 20 eco-volunteers from colleges were trained along with 1,000 teachers during July to December 2005. An educational package on sacred groves, which gave background and data sheets explaining both methodology and the information to be gathered, was given to the teachers to orient students. These teachers and students had earlier analysed their syllabi and textbooks and had developed a lesson plan manual for themselves, with chapters on water, soil, air, flora, fauna and energy and with local examples and activities. This led to transformative learning.

Applying this learning element, the children collected and analysed data on the status of sacred groves using standard but abridged methods. They then exhibited their findings through charts, posters, photographs, skits and radio programmes to a wider audience, including their parents and other communities. A children's festival in April 2006 made the authorities and the general public aware of the status of the sacred groves and the need for conservation of these sacred groves

Conclusion

The work of RCE Kodagu has demonstrated that while there are many folk healers and plenty of medicinal material in the region, a systematic study or database on healers, traditional knowledge and medicines are lacking. The partners also observed several systems of traditional medicine and healing but noted that the response from communities to these is unknown. At the same time there is a lack of access to good raw drugs from plants because of multifarious laws and the absence of a single window system. Improper regulation or implementation of laws on procurement, safeguards, cultivation, sustainable harvesting and conservation are responsible for poor access.

Informal non-standard preparation of drugs is widely prevalent, which confuses people and leads to severe health disorders and failures in some cases. Non-disclosure of drug contents and lack of sharing on processes is leading to skepticism and fear among communities.

There is no mechanism to ensure policy on conservation, preservation and propagation of medicinal plants, wildlife conservation and other material required in drug

preparation. This is aggravated by the lack of state support and protection of traditional knowledge experts, healers and practitioners.

In order to address these critical challenges, there is a need to identify and provide healers with legitimate space to work naturally and comfortably. RCE Kodagu members like CEE, KMFT, Forestry College, Nirmala Kodagu and Samvruddi Trust also need to provide them with capacity building and training wherever and whenever required.

The RCE, being well positioned to facilitate co-engaged learning, would need to further ensure stakeholder participation in the revival of interest in traditional medicine and healing among the general communities. By doing so it could provide a platform for intra- and inter-generational sharing of traditional knowledge, conservation practices and sustainable use of resources.

Further engagement with local, regional and global networks of traditional knowledge experts, healers, medicinal plant experts, institutions like FRIHT or UNU-IAS, companies, governmental departments, and others toward the creation of understanding and sharing of traditional medicine and healing practices is required. Further networking with Asia-Pacific RCEs, African, Latin American, indigenous communities in the United States, Canada, Australia, New Zealand, Europe and others will help build understanding and solidarity in matters of conservation of traditional healing practices and sustainable use of natural resources. This kind of networking also helps in exchanging knowledge, methodologies and sustainable practices. Organisations such as UNU, UNESCO, WHO, UNDP, IUCN, UNEP are involved in providing the platform, expertise, and opportunities for meeting and exchanging issues, experiences and providing technical as well as financial support for conservation. Therefore, collaborative projects and collective efforts involving different stakeholders, funding agencies and policymakers will go a long way in devising and executing sustainable conservation policies and facilitating efforts in this very important area of human endeavour.

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RCE Makana and Rural Eastern Cape: Recovering and Expanding Bio-cultural Diversity

Rob O'Donoghue

The Makana and Rural Eastern Cape RCE

The secretariat of the Makana and Rural Eastern Cape RCE is hosted in the Education Faculty of Rhodes University. It operates out of the Environmental Learning Research Centre (ELRC) that was established as a community-engaged partnership with Makana Municipality. The centre has a sustainability commons that embodies the isiXhosa metaphorical ideal of *idlelo lencubeko lesendalo nabantu*, which most closely translates into commonage where people share right of access and benefit. The RCE commons is beginning to operate as a small-scale 'incubator' where diverse community-engaged 'learning to change' programmes have been initiated.

Achievements

Two of the RCE's small-scale initiatives – agriculture and biodiversity – that draw on indigenous knowledge are reflected in this chapter. These involve the recovery of traditional knowledge practices as valued doings, beings and knowings, for learning that juxtaposes the re-valued heritage with what is now known and the issues of the day.

The RCE sustainability commons incubator is primarily centred on local water, energy, health, agriculture and biodiversity, which can be initiated without external funding.

Background

A legacy of colonial conquest and apartheid exclusion has represented the indigenous peoples of South Africa as inferior. Modern scientific knowledge has thus predominated as the basis for reorientation through education for sustainable development (ESD). A continuing pattern of exclusion is found in ESD programmes without adequate care being taken to note what knowledge practices, both indigenous and institutional, have high levels of congruence with reality. One finds, for example, that:

- Kitchen gardening is being taught as a modern process of organic compost gardening (permaculture) without reference to *ethuthwini*, the traditional practice of composting homestead organic waste; and

- Restoring biodiversity is being approached as a conservation science reintroduction of indigenous trees without noting the indigenous practice of including a portion of forest leaf litter.

Given these continuing anomalies and a failure of most indigenous knowledge discourses to transcend oppositional posturing over probing for reality congruence in bio-cultural practices, RCE Makana set out to focus on congruence in critical processes of emancipatory learning to change. This chapter gives an account of the emerging process and some of the tools used to probe for synergies across histories of alienating exclusion.

A 'Growing from Within' Approach in RCE Activities

Although reference is commonly made to Indigenous Knowledge Systems today, the intellectual narratives are developing as narrowing appropriations that most often represent indigenous as a heritage of wisdom that is seen as opposing and having been oppressed and excluded by the Western Knowledge of the colonial regimes. Intellectual dialectic and systems narratives in response to historical exclusions seldom work with the reality congruence of indigenous heritage practices as an endogenous capital in the language (mother tongue) and practices¹ of local people. This limits the practical recovery of indigenous knowledge as an often forgotten lineage of sustainable practices that have benefitted people and the environment over many generations. Much of the discourse on indigenous knowledge thus exemplifies spiritual dimensions of identity over a recovery of common sense intergenerational practices that are more congruent with natural systems than many of the practices of late modernity.

A congruence-seeking approach has found synergies towards better practices in urban food production, the restoration of plants of bio-cultural significance, health producing ways of preparing food and the provision of an improved water supply to households in Makana. The congruence-seeking approach draws on an endogenous (growing from within) view of knowledge as a symbolic capital steering sustaining practices that have been shown to be sustainable prior to the ways of the modern day.

If the symbols of a language were not to some extent congruent with reality, with the data they represent, humans could not survive. Their orientation would be flawed, their communication full of misunderstandings. (Elias 1991: 96)



¹ Here 'indigenous knowledge practices' is used over indigenous knowledge and indigenous knowledge systems. A primacy of practice situates the indigenous narrative signifying a real world activity that allows a post colonial juxtaposing of indigenous and modern in the production of new mediating knowledge that is reality congruent in a changing world.

Cultural ways of doing and seeing things can differ widely but all refer to or are done in a real world of physical objects and processes that are shared by all. A tree, for example, can be seen as a good source of firewood because it burns well to boil water with residual coals that will slowly cook the meal without burning. Elsewhere, the same species of tree might be seen as a precious shady spot for a family picnic. The first case is most common in rural areas where wood is still used for cooking and the second in urban areas where trees may not be cut down as firewood. It is also conceivable that many indigenous peoples may hold both perspectives, these having grown from within and into use without an oppositional narrative or a social discourse of exclusivity. This is particularly apparent in urban areas where new patterns of more wasteful practice have developed into the modern age.

The RCE cases of working and learning together with and from indigenous knowledge practice are centred on an endogenous (learning from within) perspective. This sets out to juxtapose the heritage practices alongside modern institutional knowledge to better address the sustainability challenges of our globalising risk society, now beset with real fears of global climate change. In the RCE programme, indigenous² and scientific/institutional knowledge are brought together in a real world referenced, boundary-crossing journey where the critical nexus of events in indigenous and institutional perspectives are worked within the context of current risk to re-imagine better ways of doing things together in the world. Here the meaning-making interplay of indigenous heritage practices and explanatory scientific narratives, open the way to an explanatory grasp to enable change to more sustainable ways of living together with dignity and respect. In this way, each indigenous knowledge informed story of learning-to-change in the Makana context of increasing risk, draws upon both heritage and what is now known in modern institutions for a journey of practical engagement to learn from within together. The three sides of being in the world and experiencing increasing concerns, and a recovery of intergenerational heritage practices are felt within and read with and against modern science and institutional conventions.

The interplay of these three dimensions of mediated social learning is represented in Figure 1.

RCE change practices across emergent risk, heritage practices and what is now known



Figure 1: An interplay of situated risk, heritage practices and modern science in expansive environmental learning to change.

In each case that follows, the story was developed in a mother tongue recovery of the reality congruent wisdom in indigenous knowledge practices. The practices were process-mapped to differentiate the relevant nexus of events that enable participants to develop more sustainable practices and a better explanatory grasp. Both of the cases examined are education and development interventions to mitigate climate change. These had, up until the advent of an endogenous approach, been awareness creation interventions commonly 'parachuted in' or 'facilitated' to change community behaviour. The focus areas for an inclusion of indigenous heritage practices were:

1. Compost gardening for local food production; and
2. Planting indigenous trees to restore biodiversity.

Below both practices are represented in a brief summary of the salient points of the emergent story of heritage practices. The stories are used as start-up for a learning

process that juxtaposes heritage practices, how we do things today and what is now known (Figure 1).

Ethuthwini, a Compost Gardening Knowledge Practice

In the early 20th Century the communities moved from the harbour area to Red Location were told to stop dumping their waste next to their homes because of outbreaks of plague. Before this the *ethuthwini* dumping practices of the Xhosa and the *izaleni* of the Zulu were such that food waste was allocated to a specified space near the homestead. The practice did not produce a smelly dump but a watered place that was high in organic matter so that the seeds removed from foods and dumped grew wild and could be harvested for food. Children could also be taught what foods to collect in the veld so *ethuthwini* was also a place for the Gogo (grandmother) to teach the next generation what wild foods to harvest, where and when.

Insights into *ethuthwini* practices³ developed from accounts given to RCE members by old women allowed the RCE to replicate an organic dump at the Environmental Learning Research Centre. In late December 2011, the *ethuthwini* process happened spontaneously and RCE members arrived back after the New Year to find 12 large pumpkins, along with tomatoes, squash, potatoes and



Ethuthwini flip composter

The intersecting knowledge landscape for recovering *ethuthwini* for restoring the knowledge practices using a low-cost aerobic composter.

a variety of wild edible plants. In this way the heritage practice has been re-mapped onto the landscape in story outline as indigenous mirror data for examining what is currently being done and what is more widely known in modern disciplinary knowledge.

Throughout this work no opposing perspective between indigenous knowledge practices and institutional propositions was found. This is not to say that differences might not be evident in other spheres. What is of note is that these do not appear to be manifest at the level of practice where there was congruence between the wisdom of ages and what is now known, with the process providing insights into modern waste management practices that currently impact on community health and environment.

Planting Indigenous Trees to Restore Biodiversity

When forests were abundant they were both a refuge for cattle and people in unsettled times and were places where people could collect the plants they needed for community health. Over the years, however, as forests receded farther away from homesteads there was a need for people to take some of the plants home so that they had health-promoting plants at hand or could build and repair the living fences of plants used to make cattle *kraals*. To successfully transfer forest plants to the homestead, the elders would teach that, "You must bring the forest with the plant."

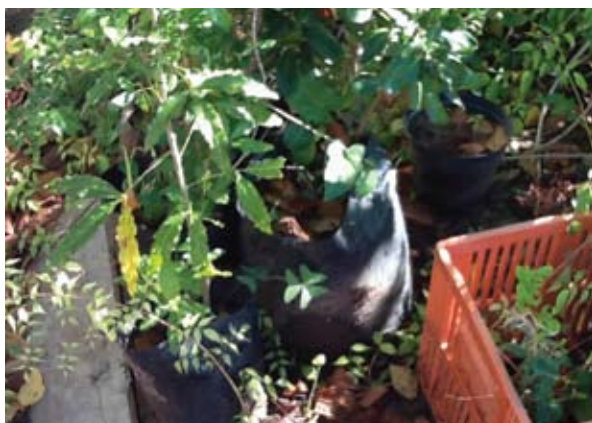
In the 1960s when indigenous trees had similarly receded in Makana, people began to plant indigenous trees to make Grahamstown a harbour city. People did not transfer trees from the then distant forests but bought them from the local nursery. Soon they began to say that indigenous trees are very difficult to grow. The trees would start well but then die a year or two later, often during a period of drought. By the 1970s and 80s scientists had discovered that the heat-sterilised potting soils lacked the ecology of bacteria and fungi that was necessary for the growth of indigenous trees with strong root systems that can resist drought. The mycorrhiza found in forest leaf litter and soil was shown to have a hormone that stimulates root growth. They scientifically described this as a mutual relationship

² Indigenous participants do not make the claim that their knowledge practices are scientifically constituted so these are not referred to as scientific here, although in intellectual debates on the nature of Indigenous and Western Knowledge the claim to both having the character of science is now fairly commonly advanced by intellectuals (See Shava, 2008, for example).

³ The dump combined village organic waste and wood ash was usually near the cattle kraal so that one had three inputs that produce a rich organic mix for gardening.

where the wild plant and the soil micro-organism mutually benefitted.

With this knowledge on the moving of indigenous trees and the story on the recovery of *ethuthwini* composting practices, the Makana youth cooperative developed a cleaning and greening strategy for Ward 7.



Micro-nursery of indigenous trees

An ancient planting practice that was overlooked can be read with the science of mycorrhiza to produce healthy trees in a micro-nursery

The locally initiated Makana RCE project has recently been supported as a Grahamstown 200 initiative by Makana Municipality. Previously unemployed youth were assisted in developing a proposal by Deepka Joon of RCE Delhi whilst she was on an internship at the Environmental Learning Centre. In this initiative, each weekend five youth activists would clean a household stand and set up a composter to decompose biotic waste. This should reduce the waste stream to the landfill and provide future greening and kitchen garden food production. With the winter cooling, the participants in the programme will add biotic waste and water weekly until the spring when trees will be planted and summer gardens started.

Tools for a Realist Analysis across Indigenous Knowledge Practices and Modern Scientific Propositions in Contexts of Risk

Much of the indigenous knowledge discourse has been constituted as dialectic (opposing Indigenous and Western), spawning counter hegemonies that have sought to take up the moral high ground and engage the

unsustainable excesses of modernisation. Much of the struggle for ascendancy here has become detached from indigenous peoples and their environmental practices. The Makana RCE's work has found that surface narratives commonly slip into an assumption that difference is the focus to attend to. To support a process that might circumvent surface readings to provide 'explanatory depth with emancipatory critique' that is more reality congruent, the RCE has been exploring Critical Realist tools after the work of Roy Bhaskar that is now being taken up around the emerging issue of climate change (See Bhaskar, 2010). Here all representations are treated with respect as real and, where there are apparent differences, as plural perspectives borne of differing practices in relation to a real phenomenon, as in the earlier example with the multiple ways in which people see and use trees.

What has been interesting is how the concern with purposeful knowledge practice and the ways in which these enable a reflexive grasp at the boundaries between 'knowledge systems' is restoring dignity along with better and more practical ways of doing things together in a world at risk.

Conclusion

The narrative recovery of indigenous knowledge practices was a slow but rewarding process of retroductive endogeny, looking back to recover and learn with the heritage wisdom within. This process restored dignity to practices that had been vilified or lost in the tyrannies of oppressive marginalisation within both the colonial and modernising periods of the state appropriation of daily life. The mother tongue narratives, with translation, produced stories of indigenous knowledge practice that were developed for urban children to explore with parents and elders and to take into learning in schools and communities.

The Makana RCE project has thus been built around the interface between heritage practices and modern scientific propositions. The assumed differences of intellectual discourses on indigenous and Western has not materialised and the outcome appears to be a recovery/rediscovery process where change practices have a latent endogeny and reality congruence that is encouraging for shaping better ways of doing things together in a changing world.

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Bokmakierie bird calling

Mainstreaming and Upscaling Traditional Knowledge and Biodiversity Practices

Zinaida Fadeeva

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Contextualised Learning for Bio-cultural Diversity

Bio-cultural diversity has emerged as an important component of education for sustainable development (ESD). ESD principles like value orientation, transformative education, cooperation, problem solving, participatory action, holistic perspective, and self-organisation are integral for conserving, revitalising and sustainably using related resources. At the same time, working with biodiversity issues makes ESD “come alive” in the most profound way. Looking into bio-cultural diversity through the prism of learning offers a perspective that mutually reinforces strategies of both areas.

The learning reflected by this book is that of cross-sectoral multistakeholder partnerships – initiatives that often face many barriers. Good practices and pilot models that successfully engage communities in sustainable use or conservation of local bio-cultural diversity have often had to deal with policies that are not always amenable to local development ambitions. Rectifying such order of things is challenging as it is routed in the succession of practices that value different forms of knowledge and define development as a rather limited notion of “growth”. Post-Johannesburg sustainable development discourses called for radically different approaches that encourage learning and knowledge development by various stakeholders, including non-experts. Though well recognised, they are still challenging undertakings.

Multiplicity of contextualised development strategies through educational interventions make the RCE network a unique place for showcasing how local multi-stakeholders valuing bio-cultural diversity can synergise actions under a common umbrella for collective action. They also portray the relevance of a global space for concerted action and understanding of bio-cultural diversity beyond localised geographical boundaries. Many of the case studies presented in this book are still in the early stages of their implementation. However, upscaling successful models needs immediate attention. Upscaling here does not mean simplistic replication of practices. Moreover, due to the contextual nature of such experiences they may not be amenable to abstraction,

though the process learning elements can be promoted far and wide. A comprehensive strategy is needed to understand these models of local and regional networking and collective learning, to support them and enable them to make deeper impact through engagement in relevant partnerships and policy processes.

RCE projects demonstrate the interlinkages between the topics of biodiversity and local development. RCEs emphasise the impact of various personal behaviours, policies, guiding concepts and development approaches on biodiversity and complexity associated with a comprehensive approach to the challenge. They have highlighted that cohesive development approaches grounded in an understanding of ecosystem-based development has to face new forms of collective education and learning in all sectors. It must include multiple stakeholders and processes such as formal and informal education and research, professional trainings, engagement with families, communities, enterprises, and markets, among others.

Learning in Challenging Circumstances

Often narrowly interpreted, biodiversity is a neglected area in development. Attention to it could be further complicated as its relevance to some significant groups might not be immediately evident. For example, it often remains invisible for the urban population or becomes a perceived long-term luxury for rural communities facing needs of immediate survival.

Among the RCEs who have reflected on their projects in this publication, we see urban (e.g. RCE Greater Dhaka), rural (e.g. RCE Kodagu) and mixed (e.g. RCE Makana and Rural Eastern Cape) communities. With their experience of addressing issues of bio-cultural diversity in various settings through participatory problem-oriented learning, the RCEs could provide models of co-engaged, cooperative learning in settings where alienation of the stakeholders from the issue is perpetuated by lack of knowledge and/or resources or lack of immediate experience with the problem.

Learning across Boundaries

Being often critical components of the majority of supply chains providing humanity with food, water, fuel, medicine, clothing, shelter or hospitality, biological resources are being affected by a vast number of stakeholders. As supply chains run across countries and regions with, potentially, different perceptions and approaches towards bio-cultural resources, rights and justice, use or protection, coordinated discussions about impacts of various practices at the stages of material sources, production, packaging or consumption would have to take place. It is necessary to identify decisions that balance actions and their local/global implications. The variations of interests in bio-cultural resources have implications not only at the level of global or national supply chains but also within local communities. For example, the RCEs’ regional stakeholders whose livelihoods directly depend on biodiversity and those whose relations with ecosystems are not directly experienced often coexist. For both types of stakeholders (global and local), sustainable use of bioresources closely relate to critical aspects of learning and knowing, in particular *development of systems conducive for sustainable resource use* (including growth and investment strategies that do not explicitly value biodiversity) and *change of culture of production and use*:

Preference towards more sustainable practices that are based on the knowledge and appreciation of bio-cultural diversity along the supply chain would require significant system innovations across countries and production sectors. Such, more sustainable, consumption-production systems seek new forms of incentives that secure fair and just distribution of benefits for resource use among the local and global stakeholders.

New culture of using and consuming in the professional or personal domain is necessary to create preferences that lead to sustenance and revitalisation of ecosystems. Such, often radical, changes in priorities are a challenging task as implications for different choices have to be understood and negotiated for different groups, including marginalised and disadvantaged.

RCEs present promising opportunities in the ambition to balance sustainable development priorities in the communities and along the supply chain. Relations that have already been established among the RCEs constitute a possibility to develop learning and research consortia that are required to address the biodiversity issues along the supply chain and across the regions.

Learning for an Intercultural Context

As mentioned in the editorial, a lack of sufficient theoretical approaches for understanding cultural practices is a key element for decision-making. From the indigenous worldview there are certain unique features of traditional knowledge such as non-dualistic, dynamic, informal, secret and sacred, spiritual, time-related and nonlinear nature. Methods are also intuitive and meditative, with an emphasis on reciprocity. While applying modern frameworks, these elements may not be well recognised. This poses certain issues in learning of such elements in a formal, institutional framework, wherein several inter-related bio-cultural complexities might not be secured. RCEs, however, appear to begin addressing this. For example, RCE Guatemala showcases a unique model of integration of traditional wisdom of Mayan heritage in higher education programmes. RCEs could offer a promising setting for preserving and growing the diversity of contemporarily relevant traditional knowledge that currently, in many communities, is limited to a few traditional knowledge holders and is at risk of disappearing. Through growing trust and community links at the levels of values, knowledge and practices, such learning could be strengthened.

Mainstreaming and Upscaling Bio-cultural Diversity-oriented Practices

To be more effective, the actions of the RCE community have to align more effectively with the development processes working with questions of bio-cultural diversity. In the area of biodiversity, this strategy is supported by global attention to the Aichi Targets that, among other things, highlight the importance of the awareness of biodiversity values, needs for their integration into development strategies, and the request of attention and actions from all stakeholders. One of the five strategic goals is explicitly dealing with the “implementation through participatory planning, knowledge management and capacity building”. Benefiting from aligning, together with other networks, their actions to the Aichi Targets, the RCEs could in turn demonstrate the strategies of going beyond awareness-raising by engaging NGOs, businesses, governments, universities, schools and communities in addressing biodiversity concerns. Going further, it would require more systematic and practical engagement with like-minded networks and initiatives, including those initiated under the auspices of the Convention on

Biological Diversity (CBD). While such engagement could be guided by the similarities in goals, they would benefit from more holistic and multi-perspective approaches offered by the RCEs (while addressing specific goals of development in a particular context, the RCEs projects cut across various sectors in addressing these goals.) For example, RCEs working in the urban areas could benefit from (and, in turn, enrich) the Global Partnership on Local and Sub-national Action for Biodiversity, established under the auspices of CBD, which facilitates the sustainable management of biodiversity in urban areas through planning, strategising and learning from the ongoing practices.

Several synergies on bio-cultural diversity can be identified with various existing networks and programmes at multilateral, regional or national levels. To name a few examples, the Satoyama Initiative, whose goal is to sustain socio-ecological production landscapes with their ability to promote biodiversity and sustain human livelihood, could be an attractive partner for the RCE community as it also engages with a variety of stakeholders concerned with knowledge and learning about the issue. (Duraiappah et al. 2012). Individual RCE partners, such as businesses, could contribute to the Global Platform on Business and Biodiversity under CBD that included initiatives at the regional and national levels. Similarly, youth of the RCEs might give significant input into the Global Youth Coalition to Halt the Loss of Biodiversity – a new initiative to develop a global platform that empowers young people to act locally and enable their voices to be heard during international processes such as CBD. Outcomes of the RCEs' work could benefit various processes aimed at developing knowledge repositories on biodiversity or related use. The Group on Earth Observations Biodiversity Observation Network (GEO BON) that provides biodiversity data to decision-makers could be an example of such initiative. Community Knowledge Service promoted by the Equator initiative could be a potential linkage to strengthening collective learning especially among marginalised communities. Defining and building a consortium amidst agencies that address bio-cultural diversity and education could enable strengthening of related region-specific, sub-national processes.

This book has underscored the role of learning in collective efforts of regional partners to advance biodiversity agenda. Cases from Asia, Latin and North America, Australia, Africa and Europe demonstrate the importance of ESD for the RCE projects to reach bigger potential by broader and deeper engagement with the partners and across the fields of knowledge and action. Further, it helped to realise that characteristics of communities such as RCEs, which combine local development capacity and global capability for engagement, might hold potential for contributing to institutions that strive to balance management of bio-cultural diversity. For example, it could assist in finding a more appropriate outlook at education for global governing bodies such as CBD CEPA shifting its current emphasis of awareness and information towards transformative learning and by aligning global and local approaches.

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This book has underscored the role of learning in collective efforts of regional partners to advance biodiversity agenda. Cases from Asia, Latin and North America, Australia, Africa and Europe demonstrate the importance of ESD for the RCE projects to reach bigger potential by broader and deeper engagement with the partners and across the fields of knowledge and action.

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Moving Forward: Mainstreaming and Upscaling Traditional Knowledge and Biodiversity Practices

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List of Abbreviations

ABS	Access and Benefit Sharing	LBSAP	Local Biodiversity Strategy Action Plan
ACB	ASEAN Centre for Biodiversity	LMMC	Like-Minded Megadiverse Countries
AERD	Association of Environmental and Rural Development	MA	Millennium Assessment
APEX	Accelerated Programme for Excellence	MAFF	Ministry of Agriculture, Forestry and Fisheries
CBD	Convention on Biological Diversity	MAPs	Medicinal and Aromatic Plants
CBR	Community Biodiversity Register	MEA	Millennium Ecosystem Assessment
CCDR-N	Regional Office of the Ministry of the Environment	MEWS	Meghalaya Environment and Wildlife Society
CCPL	Central Cebu Protected Landscape	MoE	Ministry of Environment
CEE	Centre for Environment Education	MoEF	Ministry of Environment & Forests
CEPA	Communication, Education and Public Awareness	MoEYS	Ministry of Education, Youth and Sports
CGEC	Centre for Global Environmental Culture	MPCAs	Medicinal Plant Conservation Areas
COCs	Chemicals of Concern	MPDAs	Medicinal Plant Development Areas
COP	Conference of the Parties	MRD	Ministry of Rural Development
CREPN	Chubu RCE-ESD Promotion Network	MUSEODONT	Museo Odontológico
CSR	Corporate Social Responsibility	NBSAP	National Biodiversity Strategy and Action Plan
CWS	Coorg Wildlife Society	NEAC	National Environment Awareness Campaign
DDPI	Deputy Director of Public Instruction	NGC	National Green Corps
DEQP	Department of Environmental Quality Promotion	OECD	Organisation for Economic Co-operation and Development
DERU	Disaster Management and Rehabilitation	PAAEI	Programa de Apoyo Académico a Estudiantes Indígenas
DESD	Decade on Education for Sustainable Development	PMA	Porto Metropolitan Area
DREN	Regional Office of the Ministry of Education	PMA-ESP	Porto Metropolitan Area – Environmental Strategic Plan
EA	Ecosystem Approach	PRODESSA	Programa de Desarrollo Santiago
EFPEM	Escuela de Formación de Profesores de Enseñanza Media	PSCST	Punjab State Council for Science & Technology
Efs	Education for Sustainability	RCE	Regional Centre of Expertise
ELRC	Environmental Learning Research Centre	REPORMA	Regional Resource, Poverty, and Poverty Response Mapping
ENSI	Environment and Schools Initiative	RUA	Royal University of Agriculture
ERA	Ecological Risk Assessment	SCS-CEL	Student Community Service-Community Empowerment Learning
ERECON CaM	Institute of Environment Rehabilitation and Conservation, Cambodia Branch	SD	Sustainable Development
ESD	Education for Sustainable Development	SGs	Sacred Groves
ESDC	Education for Sustainable Development Center	SIDA	Swedish International Development Cooperation Agency
FEPPCAR	Forestry, Environment, Plantation Crops and Permaculture Consultancy and Research	SIEP	Sirindhorn International Environmental Park
FGD	Focus Group Discussion	SNS	Social Networking Service
FGPE	Foundation for Global Peace and Environment	TEEB	The Economics of Ecosystems and Biodiversity
FLACSO	Facultad Latinoamericana de Ciencias Sociales	TK	Traditional Knowledge
FNBE	Finnish National Board of Education	TMT	Toyota Motor Thailand
GDP	Gross Domestic Product	ToT	Training of Trainers
GEA	Grupo de Estudios Ambientais	TUA	Tokyo University of Agriculture
GEF	Global Environment Fund	UNDP	United Nations Development Programme
GEO BON	The Group on Earth Observations Biodiversity Observation Network	UNEP	United Nations Environment Program
GoI	Government of India	UNESCO	United Nations Educational, Scientific and Cultural Organisation
ICT	Information and Communications Technology	UNICEF	The United Nations Children's Fund
IDEI	Instituto de Estudios Interétnicos	UNIDO	United Nations Industrial Development Organisation
IUCN	The International Union for Conservation of Nature	UNU-IAS	United Nations University – Institute of Advanced Studies
I-WARM	Integrated Water and Resource Management	USM	Universiti Sains Malaysia
JCN-CBD	Japan Civil Network for the Convention on Biological Diversity	WHO	World Health Organisation
KHIP	Kodagu Heritage Interpretation Programme	WII	Wildlife Institute of India
KMFT	Kodagu Model Forest Trust	WWF	World Wildlife Fund
KNOWNET	Knowledge Network	WWOOF	World Wide Opportunities on Organic Farms