ICT AND ENVIRONMENTAL SUSTAINABILITY

The environment is a large complex system. Managing and protecting it contributes to improving human health conditions, sustaining agricultural and other primary production, and reducing risks of disastrous floods as well as wildfires, mudslides and other natural disasters. The effects of ICT on sustaining the environment are multidimensional. The most fundamental effects involve the following areas.

Raising Awareness and Sharing Knowledge

ICT can improve people's understanding of environmental issues and their policy implications. It can ensure that environmental knowledge is communicated to a broader audience, especially by using electronic media to educate a new generation that does not believe that declining environmental quality has to be sacrificed for economic growth. This generation is more sensitive and willing to be involved in formulating policies that affect their communities, countries and the world in the medium and long term.

Environmental Monitoring and Associated Resource Management and Risk Mitigation

ICT improves the ability to obtain, store and integrate large volumes of environmental data and to conduct simulation and analysis in real time. It permits monitoring (See Table 2) of environmental quality, accuracy in detecting sources of pollution and projecting environmental problems. Geographic Information Systems (GIS), linking satellite imaging with computer analysis, are increasingly powerful tools in designing management plans and forecasting environmental threats.

Environmental Progress in the ICT Sector

The ICT sector has made substantial advances in improving the internal environmental performance. By developing more efficient systems and equipment, the ICT sector uses fewer materials and has eliminated ozone-depleting chemicals. For example, between 1997 and 1999, signatories to the Environment Charter of the European Telecommunications Network Operators Association (ETNO) improved energy use by 21 percent and fuel consumption by 26 percent (UNEP 2002).

Enabling Greater Environmental Sustainability in Other Sectors

By intelligently using ICT products and services, other industrial, commercial and agricultural sectors can reduce resource use and save energy. For instance, microchips can create more efficient car engines. Electronic controls can improve energy efficiency and reduce pollution in many industrial processes. Email and online applications can reduce paper consumption. Amazon.com, the online bookstore, is an example of a new business model that sprung from the ICT revolution. The potential for its positive environmental impacts is demonstrated in Table 3. Substituting a service for a product is an example of dematerialization. A virtual network answering service requires about four percent of the energy for production and operation and generates approximately 1.5 percent of the waste, compared with a physical answering machine (Tuppen 2002). In 2000, it is estimated that tele- and video-conferences enabled by telecommunications services prevented 540,000 tons of carbon dioxide emissions from being released in North America (UNEP 2002)

Communication in Developing and Enforcing Policies Affecting the Environment

Communication among governments, business, scientific experts and concerned citizens is vital if environmental remediation programs intend to meet their objectives efficiently and equitably. ICT can promote the public's participation and incorporate its ideas. This leads to more inclusive and accountable policies and more environmentally sustainable outcomes. In Indonesia, for ex-

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ample, government officials tackled weak enforcement of water pollution standards by developing a public-access information database. It rated how well firms complied with pollution-discharge requirements. Even before the information became public, firms rushed to improve their ratings. Regulators, meanwhile, could focus limited enforcement resources on the worst offenders. In the program's first 15 months, roughly one-third of the poorly performing firms came into compliance with regulations (World Bank 1998).

Table 2: Selected Initiatives Using ICT in Environmental Monitoring

Initiative and Application Model	Impact
Environmental Information Network (EIN) Project of Ghana. Launched in 1999, **EIN** uses ICT to link the databases of two national environmental agencies – the Environmental Protection Agency and the Forestry Research Institute of Ghana. By sharing databases, local and international researchers, government agencies and other environmental groups can use the information to support decision-making, intervention strategies, and awareness campaigns about environmental protection. The database is publicly available for free use. http://www.bridges.org/iicd_casestudies/ein/index.html	• EIN is now pivotal in preventing the destruction of Ghana's natural resources and developing them in a sustainable way. • By sharing project details with other African countries with a similar historical and developmental background, EIN helps them avoid reinventing the wheel of pest management practices. • EIN provides access to international sources and facilitates collaboration between researchers and agencies.
SIDSNet, the Small Island Developing States Network, is a communication medium to discuss and share information on biodiversity, climate change, coastal and marine management, energy sources and trade. It promotes sharing experiences and developing a global SIDS agenda. http://www.sidsnet.org/	• The web site receives an average of 300,000 hits per month from over 100 countries including donors and SIDS. • The site heightens awareness among SIDS decision-makers about the link between the environment and human development
Global Forest Watch (GFW) is an international data and mapping network. It combines on-the-ground knowledge with digital technology to provide accurate information about the world's forests. Since 1997, GFW has worked with Cameroon, Canada, Gabon, Indonesia, Chile, Russia, Venezuela, the Democratic Republic of Congo and the US. By the end of 2005, GFW is expected to have its forest-monitoring network operational in 21 countries, covering three-fourths of the world's remaining frontier forests. www.globalforestwatch.org	• Scrutinizing the practices of forest product companies and ensuring they honor pledges to harvest only from sustainably-managed forests. • Providing information on what is happening to the forests, helping promote and establish successful forest management practices.
Weather/Pest Information Network provides weather data to forecast pest problems. This reduces pesticide use and its subsequent impact on environmental quality and farming sustainability. The network benefits farmers in developing countries such as Zimbabwe, Armenia, Israel and Jordan by helping them improve their pest management. http://ppathw3.cals.cornell.edu/iipmweb/veg_fruit_IPM.htm	• Seven existing pest models have saved the fruit and vegetable industry an estimated US$7.1 million by using improved forecast data to guide pest management practices.

ICT and Environmental Sustainability:
Selected World Bank Group Funded Projects

World Bank
Lake Victoria Environmental Management Project (LVEMP)
Kenya, Tanzania, and Uganda,
1997-2002
US$70 million, co-funded with Global Environment Facility (GEF)

LVEMP is a comprehensive program aimed at maximizing the benefits to riparian[11] communities by:

- using resources within the basin to supply safe water and ensure a disease-free environment;
- conserving biodiversity and genetic resources; and
- integrating national and regional management programs to reverse –to the maximum extent possible– environmental degradation of Lake Victoria.

To reach these goals, LVEMP uses ICT extensively in managing its environmental resources. The project has used ICT to create and update scientific and socio-economic baseline data on the current status of Lake Victoria's forest growth, land-use practices, wetlands, industrial and municipal waste management, fishing factors, satellite lakes, water quality and quantity, sedimentation, limnology and hydraulic conditions. GIS is the main tool used to investigate changes in the wetland habitats around Lake Victoria. The satellite imaging helps to quickly assess Lake Victoria's wetlands, identify and quantify threats, propose solutions and formulate guidelines for its wetland management.

LVEMP made it easier for riparian governments to embark on a long-term resource management and environmental improvement program. For instance, surface coverage of the water hyacinth[12] in Lake Victoria, which in the late 1990's spread across 12,000 hectares, has been reduced by 80 percent and fish exports to the European Union have resumed. The project's training programs have enhanced the awareness and capacities of local people and government institutions.

*info*Dev
Data Fusion for Flood Analysis and Decision Support (ANFAS)
China, Slovakia and France
2000 – 2003
*US$4.2 million, co-funded with the European Commission (*info*Dev contributed US$250,000)*

The ANFAS project's objective is to create an information system that will provide solutions for flood prevention and protection. The new simulation system will help make decisions that could reduce flood damage. The final product will be a Decision Support System –as opposed to an early warning system– with near real-time prediction capabilities.

During the pilot flood data analysis period (2000 – 2002), applications were tried on the Vah river in Slovakia, the Loire river in France and the Jing Jiang Reach in China. Partners from Europe and China shared expertise –in remote sensing, scien-

Table 3: Energy Saving – Traditional Bookshop vs. Amazon.com (US$)

	Traditional Bookshop	Amazon.com
Sales per square foot	250	2000
Energy cost per square foot	1.1	0.56
Energy cost per 100 sales	0.44	0.03

Source: Sawhney and Contreras

[11] Communities that are located on the bank of a river, lake or tidewater.

[12] A pervasive floating aquatic plant notorious for clogging waterways.

tific computing, computer vision, Internet technology, GIS, knowledge-based systems and soil sciences– to make the most appropriate decisions when there is a flood risk.

The ANFAS system performs flood simulation of water flow based on likely scenarios and can assess flood damage by using either simulated results or remote-sensed images of a real flood event. At a prospective level, the system can analyze flood-plain morphology including changes in the riverbed and subsurface properties that follow repeated flooding.

IFC

Natural Disaster Risk Management Project

Honduras, 2004 – 2014

US$50 million, to be co-funded with Inter-American Development Bank and major international re-insurers

This project involves designing a private sector-driven, comprehensive natural disaster risk-management scheme. The project combines financial, technical (early warning systems, watershed management and emergency planning), regulatory and educational infrastructures into a mutually supportive system that creates a secure and sound foundation for development.

In order to effectively implement this scheme, the project utilizes a GIS, which is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information (data identified according to location). Sources of data for GIS include aerial photographs, satellite data, and digital maps. GIS technology can be used for scientific investigations and environmental management. For example, GIS can enable emergency planners to easily calculate emergency response times in the event of a natural disaster or scientists to find wetlands that are threatened by pollution.

In 1998, Honduras was devastated by Hurricane Mitch. As a result, Honduras has been selected as the first country to implement this natural disaster risk-management scheme. Both the public and private sectors are very receptive to the project. After Honduras, project developers are interested in extending the natural disaster risk-management scheme to all of Central America and South America, beginning with Nicaragua, the Dominican Republic and Colombia.