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Assessing and Monitoring Sustainable Development in Colombia

by Rhoda Metcalfe

What methods can best assess sustainability in the Sierra Nevada? (Photo: Rhoda Metcalfe)

For 10 years, the Fundación Pro-Sierra Nevada (FPSN) de Santa Marta has worked on small environmental and development projects in the Sierra Nevada mountain range of Colombia's Caribbean coast. The Sierra Nevada is considered an ecological treasure: containing tropical forests, snow-capped mountains, dozens of rivers, and many unique species of plants and animals. It is also home to a major archaeological site, called the "Lost City" of the ancient Tayrona Indians.

But the Sierra Nevada is also rife with violence. Conflicts between guerrillas, paramilitary groups, and the Colombian army occur on a daily basis. And over the past 25 years, it has been significantly deforested, with just 15% of its original forest left standing today. This began with an influx of peasant farmers fleeing the violence in other parts of Colombia and looking for land to clear for farming. The deforestation continued during the marijuana "bonanza" of the 1970s and 80s, during which more than 100,000 hectares of forest were cleared for marijuana fields.

Despite these setbacks, staff at the Fundación felt they were making some inroads into sustaining a unique ecosystem under pressure. Since 1994, however, the Fundación has assumed the role of "guinea pig" in a groundbreaking initiative that is forcing its researchers and policymakers to rethink their whole approach to sustainable development.

New assessment tool

With IDRC-funding, a Colombian research team in partnership with IUCN (World Conservation Union) experts is field testing and expanding a new assessment tool known as PRAM — Participatory and Reflective Analytical Mapping. The PRAM project is part of a larger initiative launched by IDRC and IUCN to develop, test, adapt, and refine various methods and tools for assessing sustainability in Asia, Africa, and Latin America.

The PRAM approach is based on a software program, called Map Maker, that was designed by development consultant Eric Dudley in collaboration with IUCN and other agencies. Map Maker allows users to create simple maps using complex environmental and social information on any geographic area from the farm level to the planet. These maps can then be used by researchers and policymakers to assess the degree of sustainable development throughout the target area.

Alejandro Imbach, a member of the PRAM team, says this assessment tool was long overdue in the field of international development research. "We have failed a great deal in development aid in the past 50 years, so we need to rethink how we're carrying out this work. Most projects that fail [do so] because no one is trying to assess what they're doing," he says.

Effective use of information

According to Natalia Ortiz, one of the team members, PRAM allows development groups to make rapid and informed decisions. "Most organizations that work with the environment have filing cabinets full of information, but don't know how to use it effectively. You have to read through all the documents to make a decision but the reality changes all the time [and you don't have] time to stop and read all the material," she explains.

The PRAM methodology is based on the idea that sustainable development depends on both environmental and social factors. In other words, explains Imbach, if either the environment or the social situation is poor or not improving, then the system is unsustainable.

In Colombia, the PRAM team focused on the six social and environmental indicators they felt would have the greatest impact on sustainability. The team gleaned most of the environmental data it needed from the Fundación's files. To gather the social data, the team invited municipal and community leaders, agricultural representatives, and other experts from around the Sierra Nevada to provide input.

Rating the municipalities

At this point, the team rated each of the 11 municipalities in the Sierra using the environmental and social criteria and fed these numbers into Map Maker to generate a series of colour-coded maps. According to Ortiz, although the system is still at an early stage, the analysis proved useful. It found that the three eastern municipalities — in the isolated Guajira department — have the highest level of social despair and some of the weakest economies. This situation is partly due to political violence as well as to very low levels of government assistance.

Up until now, the Fundación has also largely ignored this region. "A lot of surprises came out of this analysis," says Ortiz. "We started to understand that we don't have homogeneous information about the entire Sierra Nevada region. The areas we don't have any information about are the municipalities in the worst conditions, both environmentally and socially."

For many municipalities, the Fundación had environmental data, but little idea of the social conditions. "We started to understand that sustainability is a process that links the two sides: environmental and social. And if the Fundación cannot work on all these issues itself, it needs to start making links with other

institutions or government departments so the issues are addressed. Because if not, the process of sustainable development is going to be unbalanced and very slow. And we won't generate the changes we're looking for," concludes Ortiz.

Rhoda Metcalfe is a Canadian writer living in Colombia.

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"Map Maker" Simplifies Cartography in the Field

by Curt Labond

Colombian researchers are using Map Maker to monitor sustainable development indicators (Photo: Rhoda Metcalfe)

Good maps are often required for the successful planning and execution of research and development projects. But creating a useful map can be a time-consuming and difficult chore. A new software program, called Map Maker, can help those without cartographic experience produce basic electronic maps with a minimum of fuss. Map Maker is handy for mapping fields, forest paths, urban developments — even objects on an archaeological site.

The program — a simple geographic information system or GIS — is designed to create and manipulate maps on IBM-compatible computers that run Microsoft Windows. The results can then be saved and shared electronically, printed, or used in other GIS programs. Map Maker was designed by Eric Dudley, an independent consultant on community-based development aid based in Cambridge, England. Version 1.5, released in July 1996, is freely available over the Internet, or by mail for a fee. To promote its widespread use in developing countries, Dudley encourages people to copy and distribute the program, which fits on a standard 1.4 Megabyte (Mb) computer diskette.

Roots

Map Maker was developed in collaboration with several institutions, particularly the World Conservation Union (IUCN), the Centro Agronómico Tropical del Investigación y Enseñanza (CATIE), and the Asia desk of the United Nations Centre for Human Settlements (UNCHS). In addition, IDRC is contributing to the production and distribution costs of a Map Maker manual. The GIS program is currently being used by more than 1200 people in over 80 countries. In one IDRC-funded project, Map Maker is being assessed as

a tool for reporting progress toward sustainable development.

According to Dudley, Map Maker suits a variety of tasks. In addition to applications involving the management of natural resources, the software has been used for urban mapping in Afghanistan by organizations working on post-war reconstruction. Instructor Alejandro Imbach has also used Map Maker to teach elementary school students in Costa Rica how to create simple maps for school projects.

Features

Map Maker runs on a 486 IBM-compatible computer equipped with 4 Mb of RAM, although a 386 with 2 Mb of RAM can be used in a pinch. The program offers numerous features for creating and manipulating images and data. To begin, users can draw a map with the help of a computer mouse, electronically scan an existing map into the system, download a digitized map from the Internet, or import one from another GIS program. Alternatively, Map Maker can accept information from a field survey or a GPS (Global Positioning System). Users can then add, move, or edit text and graphics. For example, artwork such as polygons, lines, and symbols — representing roads, population centres, and other features — can be selected from templates, generated by the program, or drawn freehand. The program can produce maps in different scales, measure areas and distances on-screen, and display them in either metric or Imperial units.

Map Maker files can be shared via e-mail and on diskette. The files can also be read by a variety of standard GIS formats or used as images in commercial word processors. Maps created by the program can be printed in either black and white or colour and in different sizes, including wall-size maps which are made by combining the images from up to 100 sheets of paper.

Curt Labond is an Ottawa writer.

For more information about Map Maker products and services, contact:

Eric Dudley, 64 Tenison Road, Cambridge, CB1 2DW, UK; Tel: 44-1223-367854; Fax: 44-1223-350349; e-mail: eric@dudley.win-uk.net;

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- GIS for health and the environment: Proceedings of an international workshop held in Colombo, Sri Lanka, 5-10 September 1994 (Full text on-line)
- Making a difference: Measuring the impact of information on development: Proceedings of a workshop held in Ottawa, Canada, 10-12 July 1995 (Full text on-line)
- Assessing and Monitoring Sustainable Development in Colombia
- Information: A global resource *Addressing equity gaps in information and communication requires work at the intersection of technology and society.*
- Hi-Tech Software Used to Control Malaria in Brazil (April 1993)

Additional resources:

The University of Edinburgh Department of Geography: What is GIS?

Map Maker: Demystifying GIS

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Integrated Pest Management for Colombian Small Farmers

by David Mowbray

Integrated Pest Management (IPM) test plot in Colombia

Gerardo Sota farms on some of the most difficult terrain on earth -- the precipitous slopes of the Andes mountains in Colombia. No farm machine can negotiate the steep hillsides and narrow furrows. Every carefully terraced row must be plowed by hand. Every bean pod, ear of corn, or potato that grows is picked or dug by hand. He, his sons, and now his grandsons work year-round to keep their hectare-and-a-half farm productive.

Despite the demanding conditions for farming, Sota loves his land. To him, every square metre is precious and, if treated well, will give something back. "Agriculture is my profession," Sota explains. "My father taught me how to farm the land. Farming is what I most like doing."

Staple Food

Sota grows potatoes, carrots, corn, and -- most importantly -- beans. Beans are a vital food crop in the Andean region of South America. In Colombia, Ecuador, and Peru, beans provide both calories and protein in the diets of the rural poor. Many Andean families eat beans three times a day. By the turn of the century, demand is expected to exceed supply by 30%. Beans have been grown in rotation with corn on the mountain slopes for thousands of years. The stalks left from the harvested corn form climbing poles for the beans. The nodules on the bean roots take nitrogen from the air to fertilize the soil for the next corn crop.

Gerardo Sota had always farmed without using chemical pesticides. More than 20 years ago, his father had warned him of their dangers. For years, he saw no need for them. But 15 years ago, the situation changed. "I started to use them ever since I lost a bean crop," he recalls. "The crop was attacked by a pest. The

beans had already developed pods and suddenly that pest attacked. The pods turned black."

Vicious Cycle

Sota lost his crop and any chance of making ends meet that year. He determined never to let it happen again, deciding that the risk of sickness from the insect spray was worth it. Now Sota and the other bean farmers of the Andean region are caught in a vicious cycle of ever increasing pesticide use.

The indiscriminate use of the sprays killed not only the pests but beneficial insects too. As a result, what had been insignificant pests, such as the leafminer, were left with no natural enemies and began devastating bean crops. So farmers had to spray more. Today, in some bean-growing areas of the Andes farmers spray every week.

> "We farmers have a fault," explains Sota. "If we see that a tablespoonful works to kill the insects, then we say, 'Well let's add another tablespoonful so it will be even more effective!'"

Cause for Alarm

Practices such as these were alarming Dr Cesar Cardona, an entomologist at CIAT, the International Centre for Tropical Agriculture based in Cali, Colombia. "We detected a very serious situation of insecticide abuse among small bean farmers in the Andes of Colombia, Ecuador, and Peru. We found that the levels are extremely high, that the crop is becoming uneconomic because of the excessive use of chemicals," Cardona says.

In the past, Cardona himself had advocated the use of pesticides to improve crop yields. "I was trained to use pesticides 20 or 25 years ago. I did it for a while but I have been convinced that we can produce safer products at lower cost without using so many chemicals."

Participatory Research

Cardona determined that a program of integrated pest management, a strategy that had worked with many other crops to reduce the need for spraying, could work on the tiny mountainside plots if enough farmers could be convinced to use it. The key to his idea was to involve farmers in the research itself.

With funding from IDRC and the cooperation of the national agricultural research systems of Colombia, Ecuador, and Peru, Dr Cardona initiated a program of farmer participatory research to find out which insect management strategies would work.

Implementing IPM

The whole goal of integrated pest management (IPM) is to reduce pesticide use to the minimum necessary by introducing practices such as destroying crop residues that harbour the eggs of next season's pests. The crops are regularly inspected and then sprayed using only the chemical that is appropriate for the particular pest. The various components of the IPM approach had worked well in other situations but this was the first time anyone had tried to use them with small farmers in such difficult terrain and with a crop like beans.

Cardona's research team selected farmers willing to set aside some of their fields for the tests. Each farmer had two similar plots -- one which he or she maintained in the usual way, spraying whenever it was considered necessary. In the adjacent plot, the scientific teams used the more environmentally sound, integrated approach.

If IPM techniques worked, the scientists thought the farmers participating in the tests would see the results

right away. For the most part that was true. But the researchers also learned from the farmers. Not all the ideas tested at the research stations were acceptable to the farmers. For example, the scientists thought that sticky yellow traps coated with fuel oil would reduce the insect population. To trained scientific eyes they did kill millions of bugs. But the scientists had not considered the extra work involved in maintaining the traps on the steep mountain slopes. The extra trips down the mountain to town to get new oil, and the cleaning of the traps demanded too much labour to be worthwhile. Moreover, although the traps were full of dead bugs, the farmers still saw thousands of live insects on their bean plants.

Simple Monitoring Techniques

Another part of the IPM strategy is to monitor the bean plants for signs of insect infestation. But many of the farmers have little formal education. The careful record keeping and arithmetic that served well at the research stations could not succeed with the farmers. So the researchers who were working with farmers on the test plots in Ecuador came up with a straightforward monitoring and counting technique that every farmer could understand and use. It required just a glass jam jar and a pocketful of beans. For every damaged bean pod the farmer spots, a bean goes into the jar. If the jar fills slowly, there is no need to spray.

Cesar Cardona says the results on the test farms throughout the region are impressive. Crop quality has been maintained, pesticide use dramatically reduced and the profitability of the bean crop increased because the farmers spend less on pesticides.

> "If most of them start implementing IPM, insect population levels will gradually decrease in the area," Cardona says. "Now they do see the better economic returns and lower cost. There is no need to use so many chemicals. They can produce the same with at least 60 or 70% less insecticides without losing a penny -- or even make more money."

Everybody Wins

In the towns and on the farms of the Andes, it is an approach by which everybody wins. Consumers get a healthier product, farmers expose themselves and their families to far fewer potentially damaging chemicals, and the land carries a lower toxic burden into the future. Eventually, it appears possible to restore the equilibrium that existed thousands of years ago when the indigenous people of the region first understood the close relationship between beans and corn and never used a drop of insect spray.

The next phase of the project will develop methods of getting the technology from the test farms to everybody's farm. Gerardo Sota does not think this technology transfer will be especially difficult. "It favours farmers and it's less risky for us not to use toxic chemicals. Consumers are in less danger of being harmed by these products. I would recommend it because it gives such good results."

David Mowbray is an Ottawa-based film-maker and writer, reporting from Colombia.

Resource Person:

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The CIAT-Canada Connection

Canada has had strong links with CIAT, the International Centre for Tropical Agriculture based in Cali, Colombia for a quarter of a century. CIAT is one of 16 international research centres in the developing world devoted to improving food security for the world's most impoverished people. It was founded in 1967 and since 1971 both the Canadian International Development Agency and IDRC have been major donors to the operations and the research programs of the renowned Centre.

Robbin Ruggles, a Canadian recently on CIAT's professional staff, points out that Canada was instrumental right from the beginning in getting CIAT's renowned cassava improvement program off the ground. Cassava, a root crop that originated in South America, now serves as a food staple for half a billion people, primarily in South America and Africa.

Canadians Benefit

Canadians farmers have also benefitted directly from work done at CIAT. In addition to its research work to improve beans, cassava and other crops, CIAT holds one of the world's major germplasm collections in its gene bank. A navy bean variety called ExRico 23 was developed by the national research program of Colombia. CIAT introduced it to North American farmers. It is resistant to white mould disease and its use has saved Canadian farmers millions of dollars. Other CIAT bean lines with resistance to potato leaf hoppers will soon find their way onto Canadian farms.

As for the future Ruggles feels there are areas for cooperation between Canada and CIAT that remain to be tapped. He would like to see CIAT linked with more agriculture and environment departments at Canadian universities. "CIAT can act as a bridge for Canadian universities to partner with national organizations in developing countries."

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> In the Tangerine Grove: Pesticide Use in Thailand, by Daniel Girard. *A multidisciplinary research team examines the high incidence of pesticide poisoning and damage to humans and the environment in Thailand.*
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> Return to Resistance: Breeding Crops to Reduce Pesticide Dependence *Raoul Robinson describes how to use a long-neglected plant breeding technique to create hardy new plant varieties that are naturally resistant to pests and disease.*
>
> Women and Integrated Pest Management, by Margarita T. Logarta. *Reseachers in the Phillipines have been introducing a new system of integrated pest management to rural women.*

Additional resources:

> Cooperative Research Centre for Tropical Pest Management Internet site
>
> IPM Net Internet site *Information for international agricultural interests from the Consortium for International Crop Protection.*
>
> Selected references on pesticides and pest management

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Sustainable Hillside Agriculture in Colombia

by Ronnie Vernooy

Colombian hillside farmer participates in conservation research (Photo: Ronnie Vernooy)

On hillsides across Latin America, small-scale farmers face severe problems of land degradation and decreasing yields as a result of deforestation, overgrazing, and overexploitation of the available land base. Experience has shown that a concerted effort is required to deal with the different problems of unsustainable land-use, which range from soil depletion and soil erosion to dwindling water and tree resources.

Several soil-conservation methods have been developed, including planting hedgerows, alley cropping, plowing contour lines and terraces, the use of covercrops, and the tilling of crop residues into the soil. However, the successful adoption of such solutions by hillside farmers ultimately depends on the creation of suitable incentives and a favourable policy environment. Meaningful involvement of the people who are directly or indirectly affected by the degradation of natural resources is essential to any initiative that aims to improve their lives.

These key insights are the basis for the Hillsides Program, an action-oriented initiative coordinated by the International Centre for Tropical Agriculture (CIAT) in Cali, Colombia. Sponsored by IDRC, the program aims to improve the livelihood of poor hillside farmers and the sustainability of the natural resource base upon which they rely.

These twin goals are being pursued through community-based, participatory research and development at research sites in Colombia, Honduras, and Nicaragua. According to Douglas Pachico, CIAT's Director of Strategic Planning, the program's multistakeholder approach and focus on community organization

represents a step beyond both "traditional" crops research and farming systems research.

The Hillsides Program involves a variety of watersheds, including the Ovejas River-Cabuyal Basin, located about 75 kilometres southeast of Cali. This watershed covers some 7,000 hectares of land at altitudes ranging from 1,100 to 2,200 metres above sea-level. Most of the watershed's 6,500 inhabitants tend small farms on steep, degraded slopes. In addition to environmental problems, they face economic hardship, a lack of services such as education, health, and credit, and a lack of agricultural infrastructure.

Ecologically sound technologies

One of the program's objectives is to identify ecologically sound technologies that use resources more efficiently. The program also attempts to design effective strategies for implementing technological solutions that will improve resource management and the livelihoods of local farmers.

Under the program, researchers are examining watersheds from several perspectives including their biophysical, geographical, and socioeconomic characteristics. Most watersheds include a mix of commonly owned and privately owned natural resources that are used by people living both inside and outside the watershed. Case studies are under way in areas that represent a range of watershed types. The analytical methods being developed should, therefore, be relevant over a large geographical level, says Jacqueline Ashby, a rural sociologist and coleader of the Hillsides Program.

Ashby and her colleagues are combining biophysical and socioeconomic research at the field, farm, community, and watershed levels. The Hillsides Program has developed a community resource mapping tool — a three-dimensional physical model of the Cabuyal Watershed — for analytical, awareness-raising, and training purposes. This tool helps community members understand both what a watershed is and how it functions, and can be used to map land-use patterns and problems. It is also useful for setting resource management priorities. Local farmers played a key role in developing the model, which illustrates significant patterns of soil use and degradation resulting from erosion and deforestation.

Basket of technologies

In the village of Pescador, Colombia, researchers are offering local farmers a variety of land-improvement and production-boosting options, which they can adapt to local conditions — for example, different altitudes, soils, and nutrient levels. This "basket of technologies" includes improved varieties of cassava, maize, legumes, fruits, forage crops, and covercrops, as well as upland rice varieties imported from Madagascar by CIAT.

So far, the new plant varieties have been offered to farmers on an informal basis, although a more systematic approach of technology transfer is being planned. The aim is to foster a decentralized, demand-driven approach to research and development activities. To achieve this, the team is scheduling regular meetings with farmers to increase their involvement in designing, monitoring, and evaluating the experiments under way, and is encouraging more visits and interaction with resource-poor farmers, including women.

For its part, the farming community has set up agricultural research committees to select and test the available technologies, and adapt them to their own circumstances. The ultimate goal is to get farmers more involved in setting the agendas of agricultural research and extension agencies. Greater community involvement may ultimately lead to a larger selection of technologies to choose from, increased adoption rates, and higher farming incomes.

Participation and consensus building

To develop a common agenda for the sustainable management of the watershed's natural resource base, the

Hillsides Program is bringing together key stakeholders through CIPASLA, a consortium of 14 government and nongovernment organizations. So far, CIPASLA has financed more than a dozen projects on reforestation, the use of organic fertilizers, biological disease control methods, the establishment of rural agroindustries, and the documentation of local values and culture concerning natural resources.

CIPASLA members strongly believe that the best way to achieve their goals is through the sharing of ideas and resources. To ensure that community members have a stake in the success of CIPASLA projects, local communities are required to match the financial and labour contributions made by the consortium and other institutions. This approach has caught the attention of the Government of Colombia, which has contributed US$50,000 to CIPASLA.

Next Steps

Since its launch in 1993, the Hillsides Program has made considerable progress. "A lot has changed already. We are making some profits right now. Corn and cassava yields have been good," notes one farmer in the Cabuyal Watershed.

The priorities now are to increase the level of face-to-face interaction and information sharing among those involved in research and development activities, outside researchers, policymakers, and community members. For example, the establishment of improved links with government would strengthen the research and agriculture extension base, improve local farmers' access to tools and resources, and create stronger R&D-policy linkages. Similarly, stronger links with Latin American universities would help broaden and diversify the research base and strengthen the national research capacity. This may eventually allow CIAT to withdraw from its role in designing and executing the research agenda.

Once CIPASLA has matured as an organization, the consortium may take on the role of screening, approving or rejecting development projects proposed by government and nongovernment organizations. The ultimate aim is to avoid duplication of efforts and the implementation of conflicting agendas and scenarios.

Ronnie Vernooy is a senior program officer at IDRC.

Resource Persons

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Latin America: alternatives to poverty-driven resource degradation

Breeding a better bean: the horizontal resistance approach *Using horizontal resistance breeding techniques to develop higher-yielding black bean varieties in Mexico*

Integrated pest management for Colombian small farmers *Colombian farmers conduct successful experiments to reduce pesticide use on their bean crops.*

Andean farming for present and future *A farming systems approach and working closely with small farmers in Peru's Andean Highlands offers alternatives for sustainable production and higher family*

incomes

Additional Resources:

"Institutionalizing farmer participation in adaptive technology testing with the "Local Agricultural Research Committees" (CIALs)" Jacqueline Ashby, Teresa Garcia, Maria del Pilar Guerrero, Carlos Arturo Quiroz, José Ignacio Roa and Jorge Alonso Beltran. Cali, Colombia: CIAT, 1995

"Institutionalizing participatory, client-driven research and technology development in agriculture" Jacqueline Ashby and Louise Sperling. Development and Change, Vol. 26, 1995: pp. 753-770

Hillsides Program Annual Report 1993-1994. Cali, Colombia: CIAT, 1995.

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Grassroots Indicators for Sustainable Development

by Helen Hambly

A Kenyan farmer pulls a plant from the dry, cracked soil. Shaking away the soil, she examines the roots and predicts that the short rains will come soon, perhaps by month's end. In Bhutan, pastoralists alternate herds of yak and cattle between northern and southern pastures according to the seasonal flowering of a local shrub, a crucial practice for the regeneration of pasture and for the prevention of disease transmission between the two species. In northern Canada, aboriginal men and women discuss changes in the concentration of effluent in local rivers from pulp and paper processing. Their assessment of water quality is based on variations in the taste of fish.

All over the world, examples such as these can be found of local people using "grassroots indicators"; measures or signals of environmental quality and change formulated by individuals, households and communities, and derived from their local systems of observation, practice and indigenous knowledge. Since "the environment" is defined here in its widest sense to cross economic, social, cultural and ecological boundaries, grassroots indicators may be better gauges of well-being than traditional development indicators that are confined to sectors such as health, education or the economy. The central importance of grassroots indicators is as pieces of information that local people use to make decisions based on observed trends, or to judge how close they are to specific goals. They are instrumental in local monitoring of ecosystems, evaluating and predicting environmental change, as well as in decisions whether to work toward sustainable and equitable development.

First Nations Environmental Indicators

Canada's indigenous peoples, known as the First Nations, have a long, informal experience with grassroots indicators. Traditionally, they have depended upon renewable resources (agriculture, hunting and fishing) that they have managed sustainably for hundreds of years. Their livelihood and very existence has often been threatened by unsustainable development manifested in water pollution, deforestation, and declines in fish and wildlife. Now, First Nations suggest they are lacking structured, formal analysis of these environmental changes to enable communities to assess the damage done, identify their causes and slow down or reverse harmful trends.

Henry Lickers of the Mohawk Council of Akwesasne in Ontario is the lead investigator of the IDRC-supported project "First Nations Environmental Knowledge and Approaches to Natural Resources." He argues that environmental indicators can significantly improve a community's analysis and evaluation of local change. Environmental indicators can help preserve existing First Nations knowledge of sustainable resource use and, most importantly, strengthen traditional rights, including a decisive role for First Nations in formulating local resource management policies.

Interestingly, for First Nations people, indicators of environmental decline simultaneously uncover links to social violence and declining health standards. At an IDRC Grassroots Indicators Workshop, held in

Ottawa in late 1993, Henry Lickers provided a unique example of such a grassroots indicator: changes in the number of women who preserve food as a measure of domestic and social security. Women preserve fruits, vegetables, meat and fish when they feel assured of social and domestic stability. Lickers defined domestic stability in terms of lack of domestic violence and addictive behaviour as well as economic well-being.

Indigenous Knowledge and Innovations

The Society for Research and Initiatives for Sustainable Technologies (SRISTI), an IDRC-supported NGO in Ahmedabad, India, documents indigenous innovations and exchanges information through its network and newsletter known as "Honey Bee." This network draws its operating principles from the behaviour of the honey bee: just as the bee collects pollen without making the flower poorer, knowledge should be shared without depriving its owners. The network also encourages a cross-fertilization of ideas among innovators.

For SRISTI Chairperson Anil Gupta, environmental indicators are intrinsic to systems of indigenous knowledge and technological innovation. Local land users have rigorously explored and tested environmental indicators through generations of adaptation. The key for research in this subject area is, therefore, to compare and test Western scientific concepts against grassroots indicators to "add value" to local knowledge.

One example of how SRISTI is tackling this objective is to study the taxonomic basis of indigenous knowledge systems. Local ecological classification systems, from cloud formation to soil type, are compared to formal scientific taxonomies. This work is not only important in identifying and potentially using grassroots indicators, but also in restoring appreciation for the richness and values of local culture. Bringing this awareness to research agendas in universities, development programs, and extension services is SRISTI's next challenge.

Moving Grassroots Indicators into the Mainstream

Clearly, the challenge of integrating grassroots indicators into decision making is two-fold: how to make them more acceptable within current decision-making processes and how to make these processes more receptive to grassroots indicators. These twin challenges are the foundation of a special IDRC activity that supports research to evaluate the potential for identifying and utilizing grassroots indicators.

Currently, there exists little published material directly relevant to grassroots indicators. The most impressive material is "grey literature," consisting mainly of research proposals. Almost nothing exists on how grassroots indicators may actually feed into national environmental planning and policy design or reporting systems.

Given this information vacuum, two outcomes of IDRC's 1993 workshop on grassroots indicators are particularly important: the formation of the Grassroots Indicators Network (GRIN) and the drafting of a Protocol for Research and Networking Activities on Grassroots Indicators. In essence, the protocol states that research on grassroots indicators should be controlled by local communities, should address needs and priorities identified by communities themselves, and research results should first be shared with the source individual or community before any wider diffusion occurs.

In the follow-up to the workshop, two key subject areas were proposed for IDRC support: early signals of ecosystem stress or change; and community adaptation to environmental change. Already, relevant project activities have been identified. Some are specifically related to grassroots indicators, such as "Community Resource Mapping for Policy Analysis in the Central American Hillsides," a collaborative project between the *Escuela Agricola Panamericana de Zamorano* in Honduras and the International Food Policy Research Institute. Other projects have a sub-component on grassroots indicators, such as the Ugandan Fisheries Research Institute's "Lake Victoria and Nile Basin Management Research Project."

Beyond these two examples, IDRC, in cooperation with the Grassroots Indicators Network, is ready to support a range of activities in order to stimulate ideas and documentation on grassroots indicators as well as determine their usefulness for policy and decision making.

Linking Grassroots Indicators to National Reporting Systems

Certain initiatives are overcoming the obstacle of finding ways to incorporate grassroots indicators into environmental reporting systems. In Rijnmond, Netherlands, people telephone a central "hotline" number run by the Environmental Monitoring Centre to report noise and air pollution based on what they smell, see and hear. Periodic tallies of these reports are then passed on to public authorities. Data from the grassroots indicators of pollution can then be compared and synthesized with official data from the national environmental services.

Similarly, in Ontario, Canada, telephone hotlines are operated by provincial authorities, often with the participation of community groups, for monitoring invading plant species and sightings of endangered birds and animals. Use of local observations means that decision makers have an additional source of data, including an increase in sample size due to a larger number of direct observations.

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