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Cultural encounters: learning from cross-disciplinary science and development practice in ecosystem health

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Overcoming challenges to ecosystem health calls for breaking down disciplinary and professional barriers. Through reflection on a research and development project to address pesticide-related concerns in northern Ecuador, this article presents challenges encountered and accommodations made, ranging from staff recruitment, through baseline assessments and community education activities, to mobilising for policy change. In so doing, it exposes underlying problems of paradigm and process inherent in bringing researchers and development practitioners together, in addition to the problematic role of advocacy that is associated with joint research and development initiatives in the fields of agriculture and health.

KEY WORDS: Aid; Civil Society; Environment; Gender and Diversity; Labour and Livelihoods; Social Sector; Latin America/Caribbean; North America

Introduction

Throughout Latin America, human activity is increasing the pressure on ecosystems, which in turn affect livelihoods and well-being. Scientists, development agents, and the general public are increasingly aware of the multi-dimensional nature of the decline of the ecosystem, and hence of the need to co-operate across scientific disciplines and professional and practitioner cultures. Research methods are expanding in order to accommodate not only the biophysical aspects of agriculture and health, but also the cultural and socio-political systems in which practice operates, leading to an erosion of the boundaries among scientific disciplines as well as between science and rural development. Emergent approaches are steering rural development practice towards designs that emphasise social interaction and process management. While it is commonly agreed that such activity may contribute to more effective mediation between the interests of external projects and communities, we found the challenges of cross-disciplinary practice to be substantial.

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In this article, the authors – a rural development specialist, an occupational/environmental health specialist, and an agricultural economist – share their experience with a joint knowledge-generation and development intervention to improve ecosystem health in northern Ecuador. For each of us, established approaches to conducting work became uprooted, at times leading us to question the usefulness of the collaboration. Eventually, we found or built common ground, however imperfect. Here, we examine the conflicts encountered and the compromises made. We highlight challenges for the design and practice of interactive cross-disciplinary research and development.

Setting the scene: Eco*Salud*

> *Years ago, we did not need to apply pesticides, but people said that a man who lived close to this place started [to apply] first. It seems that the worms came from the products, because after that, the pests began to increase. As a result, it is no longer possible to produce without [pesticide] applications.* (A smallholder farmer from Carchi)[1]

Pesticide dependency is one unexpected and undesired outcome of science and development policy, with consequences for health on a global scale. Since the early 1990s, a number of national and international organisations have been working with communities in Carchi, Ecuador's northernmost province, to assess the role and effects of pesticide use in potato production, and to reduce its adverse impacts.[2] Carchi is famous for potato production, growing 40 per cent of the country's production on only 25 per cent of the land dedicated to the crop. Although potato has been an Andean staple for millennia, industrial technologies, such as tractors and agrochemicals, and market integration have driven unprecedented agricultural intensification. Fertilisers and pesticides have made it possible to increase potato production, but at great costs both to the ecosystem and to human health.

Researchers provided quantitative assessments of community-wide pesticide use and its adverse effects during a first phase of research in Carchi (Crissman *et al.* 1998). Most alarmingly, rates of pesticide poisoning reported among the rural population were among the highest in the world. Medical and psychometric testing revealed that two-thirds of the rural population suffered neuro-toxic effects from pesticide exposure. Among farmers, these effects were associated with measurable declines in farm productivity. Through system modelling, we demonstrated the potential of different strategies to reduce pesticide dependency and thereby improve ecosystem health.

Canada's International Development Research Centre (IDRC) established the Ecosystem Approaches to Human Health Program in the belief that ecosystem management affects human health in multiple ways, and that holistic, gender-sensitive, interactive approaches to the identification and remediation of problems are the most effective way to achieve improvements (Forget and Lebel 2001; www.idrc.ca/ecohealth). The ecosystem approach to human health considers two principal aspects: exploration of health determinants (be they environmental, social, cultural, or economic) and attention to associated socio-environmental interactions. In development terms, this line of research is intended to lead to critical assessments of how interventions may mediate change that is consistent with ecosystem health goals (see Figure 1).

The model mandates a mix of research and intervention while incorporating attention to social diversity and more deliberate interaction among scientists, community stakeholders, and policy makers in the construction of alternatives.

The authors led the implementation of one project funded by IDRC Ecosystem Health: Eco*Salud* (*salud* is Spanish for 'health') in three stages (Cole *et al.* 2002).

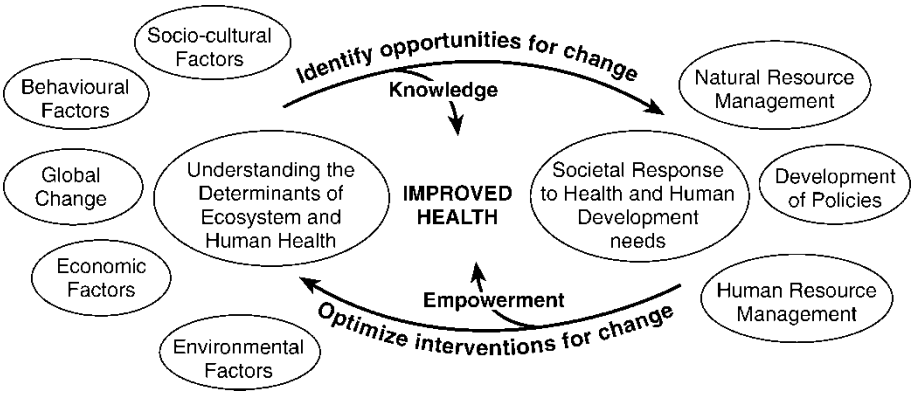

Figure 1: IDRC's Ecosystem Health group's iterative research strategy for improving human health (Forget and Lebel 2001)

Stage I: Start-up and engagement

This stage involved community selection, recruitment of families from those communities willing to participate in both the research and intervention activities, the commencement of data collection, and the initial participatory encounters with individuals, families, and the community. Once we had selected the three community locations, we proceeded to conduct baseline surveys, followed by preliminary data analysis to guide the overall project plan. For meetings with communities, we discussed past research and initial findings and encouraged individuals and families to enlist in learning activities, in particular Farmer Field Schools (FFS). Originally scheduled for six months, stage I lasted for nine months due to delays in staff training, development and testing of research tools, and data collection and preliminary analysis.

Stage II: Expansion of community activities

This stage involved completion of the neuro-behavioural measurements, ongoing research on specialised themes, and implementation of FFS in each community, educational campaigns, and other intervention activities. We planned to complete this stage in one year, but it lasted nearly two years, with certain activities continuing through to the end of the project.

Stage III: Reassessment, sustainability, and policy efforts

The final stage included the completion of post-intervention neuro-behavioural assessments and visits to each participating farm household to assess changes in pesticide practices. It included efforts to inform the public about preliminary research outcomes and advocate policy, both in Carchi and at the national level. The project ended before we had fully achieved our policy objectives, but fortunately new partner initiatives took up some of what Eco*Salud* left behind.

Throughout these stages, the implementation of the varied research and development tasks in Eco*Salud* involved continual negotiations among team members. Table 1 lists points of difference that emerged during the project and summarises outcomes and consequences. We go on to identify four decisive moments: staff recruitment, quantitative design and data collection, development intervention design, and advocacy and policy intervention.

Table 1: Outcomes and consequences of clashes between the Eco*Salud* research and development teams

Points/ moments of divergence	Researcher perspective	Development perspective	Outcomes and consequences
Staff recruitment	Technical expertise	Cultural background and facilitation skills	• Technical skills with investments in 'participatory' training
Preoccupation	Rigour; high-quality information and analysis	Relevance to community's interests; high-quality process	• Rigour over relevance
Project planning	Based on objectives; pre-established plan	Based on learning; interactive and iterative process	• Pre-established plans with milestones generally not met by staff
Baseline	Objective, reliant on high-quality information prior to project intervention	Subjective; should be based on methodologies such as a participatory rural appraisal	• Lengthy structured surveys; communities unmotivated by intrusive questions • Corruption of baseline
Project sample selection	Should be random and representative of the population	Self-selecting, based on interest	• Self-selected based on farmer field school (FFS) enlistment; complications with research design • Problems with quantitative design and statistical analysis
Sample maintenance	Minimise sample loss to protect investments in data collection and maintain observations for statistical analysis	Greater tolerance for participant drop-out from pesticide-education interventions	• Selected interventions designed to cover all participants without option of self-selection
Understanding of change	Better information; effective technologies	High-quality dialogue and social learning	• Technologies over process
Intervention design	Based on outcomes of research and technology transfer	Based on community priorities and capacity building	• Focus on project priority: pesticides • Difficulty with community participation, especially during financial crisis
Participatory approaches to training	Effective but slow and expensive	Necessary investment for lasting change	• FFS became the lead methodology
Community incentives	Financial incentives acceptable for inspiring change in practice	Financial incentives inappropriate and interfere with local initiative	• Use of interest-free loans for personal protective equipment
Political intervention	Conflict with researcher mandate of 'neutrality'	Appropriate and necessary for change	• At first limited to information, but later, as the industry became involved, advocacy

Moments of divergence

Staffing

Divergent ways of seeing, valuing, and doing first surfaced during staff recruitment. Crissman, a CIP Senior Scientist and agricultural economist, was the Eco*Salud* Project Leader. He recruited two Ecuadorian agricultural researchers: a farming systems specialist from the national agricultural research institute (INIAP) and an agricultural economist on CIP staff who took responsibility for quantitative objectives associated with before-and-after measurements. Cole, a medical doctor and occupational/environmental health specialist based in Canada, supported the health-research components of the project, in addition to providing input to health-related training activities. Sherwood, a rural development and Integrated Pest Management (IPM) specialist, was hired to lead the training and development component.

The Eco*Salud* leaders recruited field-level staff consisting of both research assistants and community facilitators based at the INIAP provincial office in Carchi. The first differences among the project leaders centred on the representation of women on the staff. Some leaders were more committed to hiring women, while others were more concerned with hiring people on whom they could count to complete tasks and act as confidants. Given the all-male presence in the INIAP field office and the Eco*Salud* leadership, and IDRC's demands for gender balance, we agreed to give preference to woman applicants. On the thematic side, the researchers were more preoccupied with the formal technical qualifications of staff. The national staff emphasised a notion of 'professionalism' which was based on formal degrees and the capacity to present oneself with 'authority'. Meanwhile, the lone development expert emphasised the need for field-oriented people with strong communication and process-management skills.

A limited pool of applicants responded to our announcements in provincial newspapers. We hired a man from the centre of the country who had been a former student of one of the researchers and was his trusted confidant. He had conducted BSc research in Carchi and was at least familiar with its rural history and social dynamics. The development leader was satisfied that this person came from a rural village and had practical farming knowledge. The remaining two applicants eventually hired were women: a nurse and a gender specialist who had worked on domestic violence. Box 1 provides summarises the staff and its experience.

Hence, Eco*Salud* was staffed by people from distinct research and development cultures, generations, academic backgrounds, and professional orientations. We found that differences in gender, nationality, and organisational cultures, combined with conflicting perspectives over roles and priorities, contributed to tensions at different moments of the project. Although the project was administratively a single unit, functionally it divided into separate research and development teams. Conflicts between the teams emerged during initial baseline work and ensuing project planning.

Research design

Eco*Salud* sought to combine rigorous quantitative research while simultaneously stimulating behavioural change through farmer- and community-led interventions, which we generally referred to as 'participatory development'. As a result of negotiations among team members, the research design included elements of mechanistic logic needed to accommodate the demands of quantitative research, as well as more open-ended and consultative learning processes that sought community involvement in on-going information processing and the construction of responses.

The principal research hypothesis was that participatory training and other community activities would enable individuals and communities to make more informed decisions about pesticide use

Box 1: Eco*Salud* team members

Researchers

- **Project Leader:** US-trained PhD-level economist. Experience in SE Asia and the Andes. Knowledgeable about production and productivity concerns of rice and potato systems. A talented communicator and well-liked leader, a convener and conflict manager.
- **Research-component co-ordinator:** Ecuador- and US-trained MSc-level economist, with expertise in potato and production economics. Traditional and pragmatic; good manager of activities, preoccupied with quantitative rigour.
- **Development-component co-ordinator:** US-trained MSc-level specialist in pest management and adult education, with 12 years' experience in discovery-based approaches to integrated pest management in Central America. A knowledgeable generalist; strong connection with rural poor and social-change interests.
- **National economist:** INIAP staff assigned to the project; Ecuador- and Chile-educated MSc-level economist, experienced in farming-system economics and linear programming; preoccupied with rigour and technology transfer.
- **Human-health specialist:** Canada-trained and based medical doctor and epidemiologist with occupational/environmental health expertise; experience in community-health programmes in Central and South America. Multi-faceted, familiar with quantitative and qualitative approaches.

Field staff

- **Gender specialist:** Ecuadorian BSc-level educator with expertise in women's development concerns. Talented facilitator, sensitive to gender issues, in particular domination of women.
- **Nurse:** Ecuadorian BSc-level nurse, with medical centre and farm-management experience. Sole Carchense of the group, pragmatic, and with no previous experience of community development or project implementation.
- **Agricultural extension agent:** Ecuadorian BSc-level agronomist with soil-conservation expertise. Rural background, pragmatic and hard working; preoccupied with farmer relevance.
- **Temporary enumerators and researchers:** numerous BSc- and MSc-level students who implemented project surveys and conducted extractive research on specialised topics, such as nutrition, farm economics, soil and water contamination by pesticides, and farming styles.

that would lead to reduced exposure. Quantitative data were collected about knowledge, attitudes, and practice (KAP), and the neurobehavioral functioning of individuals. The research team needed measurements of a representative sample of individuals before and after the interventions. The validity of the conclusions that it could draw from the measurements rested on respecting established statistical procedures for sample selection, as well as community consultations.

Meanwhile, the development team sought to implement change through participatory approaches that rested on individual willingness to enrol in the project. The development team foresaw starting with a small group of families that would grow and over time play an increasing role in project design and implementation. From their perspective, beginning with structured surveys would interfere with that process. As part of its community-entry strategy, the development team held open information sessions concerning the previous research on pesticide exposure and its impacts on health. The approach demanded an open-ended process, whereby communities could learn about opportunities and voluntarily enlist in activities. On the other hand, KAP surveys especially were susceptible to respondents who adjusted answers to what they thought interviewers wanted to hear, thereby biasing measures.

Agreeing on a sample was problematic. Lacking the freedom to construct a sampling frame and select from it, the researchers decided to over-sample. For the baseline survey, the

economic researchers included every household in each of the three communities, representing at least 100 families per community. This strategy guaranteed inclusion of anyone who decided to participate in the Farmer Field Schools. Meanwhile the health research team needed families willing to submit themselves to an adapted WHO battery of neuro-behavioural tests. The health assessments and associated tests took about half a day per individual, so it was realistic to conduct such studies with only about 20 families per community. The development team operated under the social concept of *critical mass* and was most interested in recruiting a much smaller population of 15–25 per cent – the most progressive families – as a means of constructing alternatives and eventually catalysing spontaneous change in pesticide use.[3] As a result, the development team needed to enlist only 20 to 30 families in each community.

Concurrently with the research baseline surveys and assessments, the development team began to hold sessions with communities to limit information on pesticides during these initial activities. The health professionals grew frustrated that it took so long to identify the population of innovators in each community, reducing the time between the before-and-after neuro-behavioural tests. In summary, from the early stages, the researchers felt that the development team's demands both slowed down the project and jeopardised the quality of its information. Meanwhile, the development workers found problems with the social effects of extractive research.

During the process of engaging communities, some farmers were quick to appreciate Eco*Salud*'s priorities and to lobby in their own interests. Some sought access to cheap credit, seed, and agrochemicals. As a farmer from Santa Martha de Cuba cleverly asked:

> Ingeniero*, I would like to ask you if it is possible to get some sacks of fertiliser as a gift from the institution [INIAP] for a new plot. I know you want to have a lot of FFS [Farmer Field Schools] everywhere, and we are the ones who will represent the results, and will tell the others that we have had a good experience. I think we can also say that the institution gave us good support. That is why we are asking for some help.*

The development team expressed concern that the intensive baseline would work against its objectives. Indeed, the research team's lengthy interviews on production, socio-economic assessments, and medical tests taxed people's time and motivation. As a woman from the community of San Francisco de Libertad confided:

> *The* licenciadas *[interviewers] came and asked many questions. We were getting tired, but we did not tell them, because they were nice people. We even became good friends with one of them, but a lot of people tried to hide from them each time they came [to conduct interviews]. People were scared of so many questions. They even asked us what we ate and the price of our electric appliances.*

The reliance of participatory methods on participants' continued interest and attendance created problems for the research team. Some FFS participants dropped out. The research team, who had spent considerable time and funds measuring the baseline neuro-behavioural status of FFS families, viewed this with concern. Due to the open-ended nature of FFS, they feared that too many of the original sample would not change their behaviour sufficiently to reduce pesticide exposure and thus measurably improve neuro-behavioural scores within the project timeframe.

Intervention design

The bulk of stage II – expansion of community activities – was supposed to shift from quantitative research towards enabling farmers and their families to effect change (Sherwood *et al.* 2005). At the end of the first year, the teams came together to re-design the intervention

strategies, in accordance with the initial project experience. During planning workshops, it became clear that the economic researchers favoured technology-transfer approaches, while the development practitioners favoured knowledge-based approaches. Differences could not always be reconciled. For example, some researchers felt that the best way to deal with pesticide exposure was to promote Personal Protective Equipment (PPE). The development team pointed out that PPE was the central strategy of Safe Use of Pesticides (SUP), which had been promoted by the Ministry of Agriculture and the pesticide industry for decades and led to questionable results (Murray and Taylor 2000). They argued that the problem was not a lack of information or technology, but rather a lack of *internalisation* of the problem by means of awareness-raising and knowledge-raising strategies. This concurred with the literature on occupational health, and so, with the support of the health expert, the development perspective won out. It was agreed that the second year of the project would centre on a series of in-depth, community-led activities, and that PPE would come in at the end.

The standard view of IPM centres on pesticide applications based on economic thresholds and the transfer of single-element technologies within a framework of continuing pesticide use. In contrast, FFS in IPM, as developed by the FAO in Southeast Asia, proposed group-level environmental learning on the principles of crop health and ecosystem management as an alternative to reliance on curative measures to control pests (Pontius *et al.* 2002). Since the standard approach to IPM had not delivered results in Carchi and the project aimed to test more participatory methodologies with farmers, we decided to go with the Farmer Field Schools.

During FFS sessions, the farmers, not the trainers, provide the technical expertise. What is most important for trainers is a base knowledge of pest biology and ecology and strong facilitation skills. To introduce FFS in Carchi, we decided to send staff to an intensive three-month training of trainers (ToT) in FFS methodology that was led by the FAO's Global IPM Facility. Selecting staff to participate in the ToT exemplified the multiple and complex biases faced on grounds of gender, professionalism, and project-based employment. The development expert had hoped to send both a male agronomist and a female sociologist to the ToT. Nevertheless, research-team members failed to see the relevance of sending a non-agronomist. Furthermore, one leader wanted to send only permanent staff, in part because 'soft' project money financed temporary staff, and it would be difficult to cover responsibilities for three months. As a result, only one trainee was sent: the permanent-hire male INIAP agronomist.

INIAP's staff had great difficulty appreciating the differences between vertical delivery of extension services and enabling farmers to find their own solutions to problems. Rather than facilitating experiential learning in the field, for example, extension agents were inclined to give classroom presentations. Rather than using questions to elicit group introspection about their concerns, extension agents gave answers. Nevertheless, with extensive training, supervision, and follow-up, a number of INIAP agronomists became high-quality FFS facilitators who went on to champion the methodology.

In an iterative fashion, FFS participants conducted learning experiments on comparative (conventional versus IPM) small plots, to fill knowledge gaps and to identify opportunities for reducing external inputs while improving production and overall productivity. After two seasons, results in three communities were impressive. Through improved management and use of alternative technologies, such as Andean weevil traps, late blight-resistant potato varieties, specific and low-toxicity pesticides, and careful monitoring before spraying, farmers were able to reduce the use of pesticide sprays by half, while maintaining or increasing production. In learning plots, the amount of active ingredient of fungicide applied decreased by 50 per cent, while the use of insecticides used for pests that had commonly received the highly toxic carbofuran and methamidophos decreased by 75 per cent and 40 per cent respectively. Through diverse tactics for reducing costs, farmers demonstrated ways to increase

productivity by 36 per cent. It became clear that lack of potential farming alternatives for markedly reducing the use of pesticides, in particular the highly toxics, was not the problem.

Advocacy and policy reform

While all agreed about the severe effects of pesticides, there was considerable debate among Eco*Salud* staff over acceptable degrees of advocacy on behalf of the communities. The research team initially felt that its only obligation was to inform communities and policy makers; the Ecuadorians in the team were more reluctant than the foreigners, probably because the national scientists expected to continue their professional careers in Ecuador and thus perhaps had more at stake. Meanwhile, the development team felt that ties between SESA, the government plant-health inspectorate with the mandate to regulate pesticide use, and the pesticide industry would prevent change, and so they argued for more aggressive action. Following a visit by pesticide-industry representatives who downplayed the severity of the situation in Carchi and placed the responsibility on farmers, the Project Leader concluded that it was time to re-evaluate the conventional, non-interventionist role of researchers.

After consulting with the project staff and the directors at CIP headquarters and INIAP, we decided that it was our responsibility to play a more vocal role in informing the public and advocating stronger regulation of pesticides. The development team developed a series of radio announcements and educational programmes that were broadcast throughout northern Ecuador. Eco*Salud* linked with strategic partners, such as a consortium of development organisations working in Carchi, and the local chapter of the Pesticide Action Network, to advance common concerns. Project staff held numerous private meetings and seminars with government officials and industry representatives.

In May 2001, Eco*Salud* organised a national conference in Quito to present results and policy recommendations. Following practices for hazard reduction recommended in the industrial-hygiene tradition, a top-priority policy recommendation was the elimination of an entire class of pesticides that were causing the neuro-behavioural damage in Carchi: WHO Class I, or highly dangerous products. The development team lined up statements of support from government and non-government agencies. Pesticide-industry representatives from the USA, Central America, Colombia, and the city of Guayaquil, where most Ecuadorian chemical companies are based, arrived in Quito days before the conference to meet with the organisers and relevant government officials. Instead of requesting to learn more about the studies and recommendations for improving the situation, they seemed to lobby against the veracity or relevance of the research findings. They expressed concern about the recommendation for eliminating WHO Class I pesticides and persuaded the Director of SESA and the President of the National Pesticide Technical Committee not to support that measure.

Regardless, representatives from diverse FFS in Carchi travelled to the capital to attend the forum and made convincing presentations on their tested alternatives for substantially reducing their dependency on the problematic products in question: carbofuran and methamidophos. They requested that government officials attend to the Carchi declaration and a National Pesticide Committee proposal. Officials from the Public Ministry of Health and the Pan American Health Organization (PAHO) committed themselves to playing a more active role of training, monitoring, and advocacy, similar to other projects in Central America. The Quito conference led to a television documentary on the pesticide crisis in Carchi which was broadcast throughout the country and subsequently presented to select audiences in other parts of Central and South America, as well as the USA and Europe. Despite receiving many letters from farmers' organisations, researchers, and development

professionals in Ecuador demanding that the government give attention to the situation in Carchi, the Director of SESA never responded.

By the end of project, the Eco*Salud* staff had overcome its most divisive professional differences and matured into a formidable research–intervention team. Unfortunately, as happens with many development initiatives, funding ran out and staff moved on to other employment. Complementary projects took over a number of the training activities in the project sites and grew into other regions. This included the training by INIAP of nearly 100 FFS facilitators in Carchi and nearby Imbabura, the transition of FFS to autonomous small-enterprise production groups, and an expansion of FFS in Ecuador and elsewhere (LEISA 2003). In July 2003, INIAP, CIP, and FAO published a Spanish-language book which summarised the research and intervention results. In a forum attended by public officials, industry representatives, and the media, the authors emphasised the need to reduce and eventually eliminate the use of highly toxic pesticides in Ecuador. SESA officials and pesticide-industry representatives responded with seeming lack of interest in the alarming health impacts and treated with disdain calls for the removal of the highly toxic insecticides from the market. As reported in a BBC World Service radio programme that included interviews with government officials (BBC World Service 2004), pesticide salespeople, farmers, and hospital personnel in Carchi, the official government position had become: 'We have established international standards of recommendation and we force the pesticide industry to obey those rules', and 'We cannot be held responsible for farmers' misuse of pesticides'. Despite the evidence of more than a decade of research that clearly showed the hazards of pesticide use in Carchi and feasible alternative practices, it became all too clear that effective change would depend on a protracted process of lobbying and local action that went beyond the constraints of Eco*Salud*.

Reflections

Complementarity: learning to work together

While personalities were always at play in conflicts, contrasts among our staff were most clearly distributed across disciplinary and professional lines. At a most basic level, the differences between social and natural scientists concerned subject: people or the environment. The contrasts between scientists and development practitioners generally concerned purpose: research or action. Eco*Salud* staff applied at least three distinct problem-solving logics, consistent with what Röling (2002) has labelled instrumental, economic, and interactive perspectives. Biophysical scientists and medical professionals most commonly apply the instrumental approach that centres on addressing causality through technology development. Economists and business people tend to use an economic approach that uses market opportunities and 'comparative advantage' as means of addressing problems. Development practitioners most often use the interactive approach, seeking to solve problems through actor participation and negotiated agreement. Table 2 summarises these approaches.

The Eco*Salud* project was to acknowledge that instrumental and economic approaches alone would not solve the ecosystem health crises in Carchi. The introduction of an interactive approach enabled the project to begin to address relevant social issues behind pesticide abuse, the reliance on highly toxic products, and the associated impact on human health and productivity. Eventually, Eco*Salud* found that all three approaches had important contributions to make in achieving healthier ecosystem management, but not without much struggle.

The reality of the pesticide problem struck home during visits to communities, where each of us came across personal accounts of pesticide poisonings. The tragic poisonings of children found at each location were particularly disturbing. Combined with the invisible quality of

Table 2: Three approaches to solving problems (adapted from Röling 2002)

Characteristic	**Instrumental**	**Economic**	**Interactive**
Who?	Biophysical scientists, pest-management specialists, medical professionals	Economists, business-oriented partners	Development practitioners, sociologists
Predicament	Lack of control over causal factors	Competition, scarcity	Anthropocentric destruction of habitat, lack of control over ourselves
Dynamics	Causation, self-organisation of systems	Rational choice, struggle for economic survival, market forces	Interdependence, agency, learning, reasons
Objective	Control or management of nature for human purposes	Win, gain advantage, optimise utility	Negotiated agreement, concerted action
Knowledge base	Natural and medical sciences	Economics	Social science, cognitive science
Effect based on	Technology (agrochemical inputs, biological controls, medicines)	Strategies for technology up-take, market integration	Conflict resolution, agreement, learning
Policy focus	Engineering, hard-systems design, regulation	Fiscal policy, market stimulation, technology transfer	Interactive policy making, social-process design, dialogues, process facilitation

toxic exposure, the severity of the pesticide problem created a sense of urgency among the staff. Nevertheless, while this may have brought us together at the beginning, common sympathy with communities was not enough for overcoming our differences. In hindsight, we found that a functional internal project environment was needed to mediate in the regular conflicts among staff. This was enabled through a handful of administrative mechanisms (see Box 2).

These administrative mechanisms, however, failed to reconcile certain differences. For example, the predominantly male leadership in Carchi frustrated the female staff, who had difficulty being heard and respected, despite the quality of their work. One conflict between a soft-spoken but rigid agronomist and a vocal feminist lasted for the duration of the project, despite endless mediation and efforts to help them to resolve their differences. Sometimes, this tension permeated upwards to the project leadership, playing out between the project's functional research–development divide. Nevertheless, by shifting their energies to the greater purposes of the project, each managed to stay with us through to the end of Eco*Salud*.

The combined factors of highly relevant research and a growing appreciation among the development staff of the purpose of the research were essential for overcoming biases against quantitative perspectives. For example, early on the development team realised that high-quality quantitative information could play an important role in calling attention to concerns about pesticides. Similarly, the researchers began to see the potential of gender-sensitive participatory approaches. For example, the women and children, who were brought into the project by the gender specialist, were the sectors quickest to respond to the health-related

Box 2: Administrative means to overcoming differences among EcoSalud staff

In retrospect, project staff identified a number of administrative mechanisms that facilitated interaction among diverse professional and other perspectives. These included the following:

- **Shared project responsibility:** from Day 1, the entire staff participated in project design and planning, including both research and development activities. During workshops, divergent perspectives were elicited and differences accommodated through discussion and negotiation. Research and development team leaders mediated discussions. When differences could not be reconciled, we commonly referred back to the original proposal or the donor's demands.
- **Limited financial resources and transparent administration of funds:** appreciating Eco*Salud*'s relatively small budget, the project leaders had to creatively pool resources from their organisations and ongoing projects. Knowing this, the staff pulled together to conserve resources and to lever funds with communities and other like-minded projects.
- **Open and regular communication:** with the exception of the Canada-based health expert, the remaining project leaders were based at a research station in Quito, where they regularly met during regular monthly meetings and informally over coffee to assess progress and to resolve differences. The Project Leader had won a reputation for 'keeping his door open' and being a good listener. All trusted him, including the field staff from Carchi. For difficult problems, such as personality issues, he was consulted privately. Similar meetings were held weekly in Carchi, although, due to the institutional culture of the national partner as well as the leadership style of director of the field office in San Gabriel, those were more structured and rigid. Often times, conflicts were not resolved in Carchi, and so demanded the attention of the research team and development team leaders. The leaders regularly discussed concerns and altered weekly visits to Carchi to interact with the field staff and help members to resolve differences before they became major conflicts.
- **Learning and re-design:** while the donor operated by pre-determined annual plans, it was open to revisions. As research results emerged and communities began to contribute ideas to the project, we inevitably discovered new opportunities.

information. During one meeting, after the men in the room had adamantly denied careless handling of pesticides, one mother pulled a member of our staff aside with a suggestion. She requested cameras be handed out secretly to the town's children, who would in turn take photographs of the men misusing products, for example, washing out backpack sprayers in the streams. We handed out disposable cameras and offered to pay for film development. Several weeks later we called together the community and the kids gave a surprise presentation of their photos, much to the embarrassment of the men. This spontaneous activity and others like it were repeated in the other communities and usually were quite successful in communicating the point about problems with pesticides.

Interdependence: engaging policy reform

While the development team was eager to take on advocacy roles on behalf of communities, the researchers at first hesitated. Earlier critiques of researcher inaction on pesticide-related policy more than a decade earlier in the Philippines pointed out why such risk, although problematic for science, was necessary for change (Loevensohn and Rola 1997:1):

> *. . . it was not until 1992 that policy decisions were taken commensurate with the scale of damage that research was projecting. These included a ban or severe restriction on a number of popular but highly toxic insecticides and, in 1993, the launch of a nationwide program of farmer training in Integrated Pest Management (IPM).*

The international community, in particular the International Rice Research Institute (IRRI), FAO, and international NGOs, missed numerous opportunities to intervene, largely due to organisational rigidity, obedience to standard operating procedures, and diverse forms of self-censorship. The majority of national and international researchers refused to share findings and take stands in public meetings and media programmes. Loevensohn and Rola (1997:24) argued that both international institutions and researchers shared a degree of responsibility for the delay in policy progress:

> *There was information that was not persuasively put forward to policy makers that, had it been, might well have advanced the decisions. This would have led to a reduced toll in death and illness, to lesser damage to the aquatic environment, and likely to increased rural incomes. Seizing these opportunities would, however, have required individuals to act in inhabitual ways, outside the mandates of their institutions, and possibly at some personal risk.*

Stepping out of their comfortable roles, Eco*Salud* researchers proactively engaged stakeholders in policy debate at both the provincial and national levels. As a result, an unknown source threatened a team member by telephone, and industry representatives questioned our research. Fortunately, such attacks were not as strong as those that have happened to other researchers when publicity about their research has threatened to affect the profits of industry or agendas of other special-interest groups (Deyo *et al.*1997). We found that such threats had the effect of uniting the research and development teams.

As others (Riggs and Waples 2003) and we ourselves have experienced, private industry often pays greater attention to short-term gains for shareholders than to the longer-term health of users of their products and the greater public good. The social-science research on pesticide use in Carchi (Mera-Orcés 2001; Paredes 2001) substantiates the need for knowledge-based and socially oriented interventions aimed at political changes.

Bugs in the system: encountering structural constraints

In analysing needed change for the management of complex issues such as those associated with social systems and the environment, Röling (2000) mapped out graphically the development of scientific paradigms. Here we have adapted his approach to emphasise source of change and levels of preoccupation. The source-of-change axis is built on extremes of exogeneity (externally generated) and endogeneity (internally generated). The level-of-preoccupation axis is built on extremes of mono-vision (the control of components or parts) to holo-vision (management of systems or synergies of parts). The interaction of these two axes provides a taxonomy of development (see Figure 2).

Different members of Eco*Salud* and stakeholders engaged in pest management in Carchi embodied particular perspectives and could be roughly assigned to different quadrants. Pesticide salespeople and 'modern' (i.e. external-input intensive) farmers generally fit into quadrant I. When considering pest problems, this 'techno-centric' perspective produced recommendations for 'single-bullet' solutions, such as the application of pesticides or spraying efficiency. Meanwhile, the researchers at INIAP and CIP, usually biological scientists or economists, tended to draw on perspectives combining exogenous and holo-vision designs when confronting pest-management problems (quadrant II). This perspective led to the application of hard science and systems thinking and produced externally designed research and intervention approaches, such as a call for Integrated Pest Management. Meanwhile, researchers with anthropological or sociological backgrounds, as well as development practitioners with a similar perspective, tended to value interactive endogenous-holo-vision design (quadrant III). While maintaining an emphasis on systems-level complexity, these actors tended to view

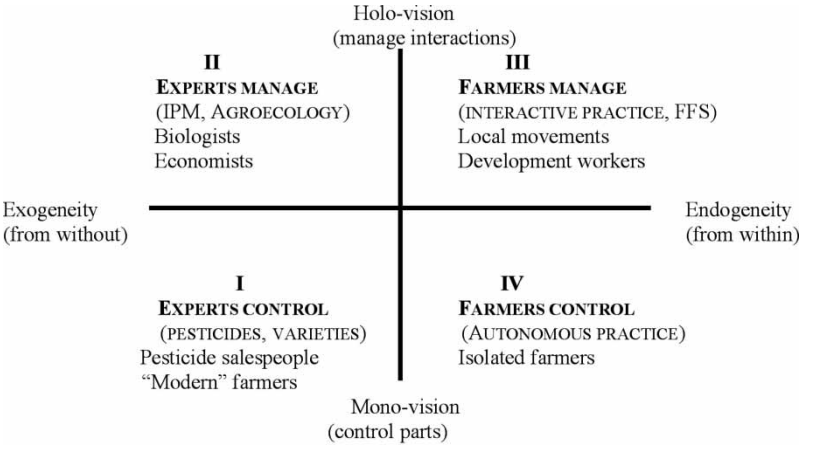

Figure 2: Development paradigms (adapted from Röling, 2002)

pest and pesticide dependency as human-caused phenomena. When conceiving interventions, they argued for culture-centred approaches, for example the local construction of IPM through participatory agro-ecosystem analysis, as practised in the Farmer Field Schools. The health researchers and professionals straddled all three quadrants. Farmers who were relatively isolated from external technologies as well as local communities tended to develop technologies autonomously and fell into quadrant IV.

From our experience, the logics of quadrants I, II, and III were all readily apparent across the staff and differences, such as those presented in Table 1, and commonly played out along the quadrants. Nevertheless, we found that present institutional and policy designs, shaped by the assumptions of exogenous designs, ultimately circumscribed our capacity to apply community-based participatory approaches. Sometimes differences were irreconcilable, such as disagreement about the degree of investment of project resources in either technology or process-oriented activities. Commonly a dominant actor, such as the project manager, provided a resolution of differences. At other times paradigmatic differences were mediated over the thematic 'middle ground' found in quadrant II, for example over the relatively neutral theme of IPM. This was where individuals articulated differences during weekly meetings in the form of proposed activities and logistical concerns, encountered divergent views, and made compromises for the good of the project. The success of Eco*Salud* arguably relied upon the leaders' ability to facilitate and negotiate interaction among these different perspectives.

We envisage the need for a new professional capable of negotiating solutions to cultural differences among research and development professionals and between external actors and communities (see Table 3). High-quality information will always be needed for measuring and understanding agricultural, health, and environmental concerns, but the way we go about defining and prioritising questions, conducting, interpreting, and using research for development is subject to change. We found that cross-disciplinary research and development practice called for professionals with generalist academic backgrounds, practical community-development experience, and strong facilitation skills.

The ecosystem-health approach calls for new ways of thinking, organising, and doing that challenge us to go beyond present institutional designs. While we emphasised cross-disciplinary science, it became clear that what was most needed was a framework that permitted trans-professional science and development practice that was oriented towards greater accountability to communities. Such a movement would require fundamental change towards more

Table 3: Towards more interactive community-based research and development (R&D) (adapted from Pretty 1995)

	Conventional R&D role: Producer of knowledge, technologies, and services	**Newer R&D role: Reflective facilitation of learning and action**
Assumptions on reality	Single tangible reality	Multiple realities that are socially constructed
Interaction with bodies of knowledge	Disciplinary-based, limited interaction with other perspectives	Transdisciplinary-based, ongoing interaction and transformation of perspectives
Scientific method	Reductionistist and positivist. Complexity can be best described through independent variables and cause-effect relationships. The perception of the researcher is central	Holistic and post-positivist. Local and global categories and perceptions mutually acknowledged. Differences between subject and object; methodology and data are little defined
Strategy and context of research	Researcher knows what he or she wants. Designs are pre-established. Information is extracted from controlled experiments. Context is controlled and independent	Researcher does not know where the research will go. Themes emerge from learning-action process. Focus and understanding emerge from interaction. The context is fundamental
Who sets priorities	Researchers and practitioners give priority to problems and activities.	Communities, practitioners, and researchers prioritise together.
Relationship with intended beneficiaries	Researchers and practitioners control and motivate clients from a distance. Tendency to distrust local people, who are principally research objects	Researchers and practitioners maintain close dialogue with constituents. Construct trust through joint-analysis negotiation
Modality	Project driven: time- and theme-bound	Driven by programmes and social movement: unbound, work in teams based on long-term commitment
Political intervention	Inappropriate: threatens objectivity	Appropriate and necessary: acknowledgement of social role of science

locally democratic and pluralistic science and development, which in turn would place new pressures on policy frameworks (see Table 3).

Conclusions

Differences between the institutions of research and development do much to divide practitioners and little to bring them together. Under the demands of project implementation, professionals from both camps involved in Eco*Salud* were forced to interact and negotiate perspectives. While this interaction sometimes led to unsatisfactory results for some, it also contributed to new skills and understanding of previously disparate perspectives.

Working cultures for staff members (for example, agricultural extension, participatory research, feminist social change, and health services) were built on different sets of assumptions,

methods of resolving conflicts, planning, and perceived roles in interacting with project participants. Through the sometimes difficult processes of negotiation and accommodation, the staff gained insight into their divergent perspectives. With new understanding, participants learned to work in complementary ways that contributed to successful project outcomes, such as more integrated use of research data and participatory methodologies for both science and development. When confronted by external obstacles, in this case over pesticide-policy matters, the staff joined forces and collaborated to advance a common agenda that became framed around the elimination of highly toxic pesticides.

Despite new cross-disciplinary learning and practice, we cannot hide from the fact that the vast majority of rural people in the three communities where Eco*Salud* operated, not to mention the rest of Carchi, continue to be chronically exposed to harmful pesticides and as a result continue to suffer neuro-toxic damage which affects their productivity and well-being. Regardless of high-quality research that has revealed dramatic health problems, the conception of effective farm-level alternatives, and extraordinary efforts to communicate those to policy makers and the public, to date very little has been achieved in improving local conditions. Moving towards greater accountability to communities takes us beyond present organisational and professional designs and demands a revision of policies, including fundamental changes in existing development and research institutions.

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Notes

1. Unless otherwise noted, the quotations presented in this article were documented during the field research of Myriam Paredes, a sociology student from Wageningen University. Many of them appear in her thesis (Paredes 2001).
2. Principal collaborators included INIAP (National Institute of Agricultural Research (Ecuador), CIP, Montana State University (USA), McMaster University and University of Toronto (Canada), Wageningen University (the Netherlands), and the FAO's Global IPM Facility.
3. In the 1960s, Rogers (1983) statistically tested the concept of critical mass to describe the dynamics of technology diffusion in rural communities. Bunch (1982) applied critical mass as a strategy for enabling people-centred agricultural development.

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