

**What Really Works
in
Watershed Management?:
Some lessons for Guatemala**

Report prepared for USAID/G-CAP

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October 2001

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ACKNOWLEDGMENT

I am grateful to the following persons for reviewing the draft of this document and making valuable suggestions: Manuel Basterrechea, Ronnie de Camino, María de los Angeles Castro, Ron Curtis, Paul Dulin, Pieter van Ginneken, John Nittler, Carlos Perez, Julie Rice

1. Context

Hurricane Mitch, in late October 1998, blew millions of dollars of assistance into Guatemala, part of which intended to mitigate the effect of future disasters of this type. As this assistance that has run for almost two years ends, USAID is asking: "What have we learned from this experience that might help in similar efforts in the future?" This paper is an attempt to summarize some answers. Watershed management embraces many social, political, economic, institutional and technical facets. This document concentrates primarily on the technical approaches and practices.

But USAID had already spent millions of dollars on watershed management projects in Guatemala even before Hurricane Mitch. The history of these projects goes back more than 30 years. USAID, other donors and national governments have spent many hundreds of millions of dollars on such projects in other countries of Central America where conditions are similar. Therefore, in trying to come up with some answers I will also look beyond Guatemala, beyond USAID and back before those catastrophic days in October 1998.

This paper is a summary. The references cited present examples, analyses and evaluations to substantiate the conclusions. For the sake of brevity, descriptions are kept to a minimum and I shall simply refer to these other documents. The full text of many is available and hyper-linked in the CD version of this paper.

2. The Mitch hurricane aftermath in Guatemala

2.1. Design in a hurry

USAID/Guatemala established a two-year assistance effort under the Special Objective for post-Mitch reconstruction, the funds for which were approved by Congress in June 1999. The Special Objective reads: "Rural Economy Recovers from Mitch and is Less Vulnerable to Disaster." This goal was to be attained through the following intermediate results (IR): 1) strengthened national- and community-level disaster preparedness; 2) sustainable recovery of agricultural productivity; and 3) improved disease prevention and control programs. This paper deals only with the second result. To address it, USAID/Guatemala approached seven private and governmental Guatemalan organizations and asked them to submit proposals for post-Mitch rehabilitation work in the watersheds of the Polochic and Motagua rivers. The organizations submitted their proposals between August and September 1999 and USAID/Guatemala signed the first cooperative agreement in September and the last in December 1999. This close timing inevitably made local participation in the design minimal.

2.2. Implementation

The following non-government organizations implemented natural resource and agricultural productivity projects, either through direct cooperative agreements (ANACAFE, CARE, CRS) or as subcontractors (FEDECOVERA, Defensores de la Naturaleza, Fundación Solar, Pastoral de las Verapaces, CARITAS/Zacapa and SHARE). Because funding terminates on 31 December 2001, no organization will have had more than 28 months of operation under this program, although most already had related ongoing activities in these or nearby watersheds.

2.3. Monitoring: What do all those numbers really mean?

All of the implementing organizations identified quantitative indicators, kept records of performance and delivered quarterly reports to USAID/Guatemala. The variety of

indicators and formats, combined with the sheer volume of the data make meaningful interpretations difficult. USAID contracted Chemonics International Inc. to periodically evaluate progress made by the NGO implementers and suggest improvements (see References). The prior commitments, momentum and short duration of the program allowed limited scope for adjustments once operations had begun.

3. The rationale for watershed management

3.1. The watershed problems of Guatemala

The number one watershed problem in most of Guatemala is excessive surface runoff caused by intense rain falling on land that is improperly used. This is what caused the flood and landslide damage during the Mitch catastrophe and innumerable less dramatic events before. This excessive runoff in turn leads to other less conspicuous damage – soil degradation and the consequent loss of soil productivity. We can do nothing about the rain, but we can change land use. Because improper land use covers very large areas, the solution to the problem must usually also be applied over a large proportion of the watershed.

One exception is the damage caused by runoff from roads or urban areas, which tend to cover only a small part of the watershed but can cause a great part of the landslide damage. In parts of Honduras perhaps 50% of the visible damage from the Mitch hurricane was caused by roads. Poorly designed, poorly built and poorly maintained roads with too few (and too small) culverts and waterbars, sliced through watersheds and concentrated water in critical breakout points.¹

This problem of runoff contrasts with the problems of chemical and biological contamination, which are usually caused by “point sources” and tend to be of secondary importance in the Guatemalan context, except in special situations such as in watersheds that supply drinking water. This paper emphasizes the problem of runoff as a function of land use, but does not cover the problems of chemical and biological contamination, nor those caused by runoff from roads and urban areas.

3.2. The rural development versus the watershed approach

Few doubt the critical importance of wise watershed management in a country as rugged, densely populated and dependent on natural resources as Guatemala. The disagreement tends to be on **how** to bring about proper management.

Historically most programs and projects² that have attempted to improve land use in Guatemala (and elsewhere in Central America) have focused on improving the welfare of *campesinos* by promoting better agricultural and forestry practices. This is the rural development approach. Projects have been primarily socially oriented, aimed at rural development for the benefit of the poor. Good environmental and watershed maintenance as well as the downstream impact have usually been secondary, in the belief they would automatically follow as *campesino* livelihoods improved. Although the greatest overall impact would probably be achieved by a healthy balance between the social and the watershed dimension, the former inevitably has predominated.

The two principal approaches, rural development and watershed management, while seldom in conflict, are not automatically complementary either. Success in improving *campesino* land use, for example, might not result in significant improvement in watershed conditions where *campesinos* occupy only a small area of the watershed, or

¹ Personal communication with Paul Dulin.

² As used in this paper, projects refers to those financed by international, national or private sources.

where others occupy the more critical areas of the watershed. If ranchers, for instance, mismanage most of the upper watershed with extensive grazing combined with frequent fires (as is common), then improving land use and welfare among *campesinos* occupying only a small proportion of the watershed will have little impact on runoff. Yet this focus on the *campesino* often seems to be the exclusive approach.

Since the hurricane, institutions, especially NGOs that for years have focused on rural development and improvement of the welfare of *campesinos* are suddenly packaging their customary proposals under the watershed label, while continuing business-as-usual. The projects of these organizations tend to cover only a tiny proportion of the watersheds and their inhabitants, and so while they may be “successful” from the development standpoint, significant effects on watershed cover are unlikely – unless the innovations spread without further project intervention.

4. The measure of success: Looking backward

4.1. How should we identify success in the watersheds?

All projects have hoped-for objectives and results. For watershed and land use projects, the results tend to be measured in land area treated, the number of farmers applying a practice, the number of people trained, or some similar measure. The question seldom asked is whether these promising accomplishments actually continue to spread after the project is gone. An objective review of this question would likely show that the answer has been very disappointing. I have observed that very few practices proliferate on a significant scale once the project has come to an end.

The meaningful proof of success is not established during the project or by its close, but rather after several years have passed. A truly successful watershed practice is one that initiates a process that continues to change the landscape, even long after the project itself or other assistance promoting the practice has ended. It must change land use and it should be visible. Standing on a hillside overlooking the watershed years after the project is over, unless one can actually see the effects of the practice, it is unlikely to have been successful.

A personal experience made this hard truth painfully clear to me. From 1976 to 1981, I directed a COHDEFOR watershed project, assisted by FAO, in the Sierra de Merendon of Honduras. The project soon became known as a model, a real star project that received numerous visitors and was publicized widely. I returned to visit some of the sites 15 years later. There was almost nothing left of the many practices we had introduced. Ironically, the practice that I saw covering many hillsides was one that was secondary to our intentions, a forest of *Gliricidia sepium* originally planted as shade for cacao. The cacao was mostly gone, but the *Gliricidia* was being used for other purposes. That innovation had caught on and spread.

4.2. Why is spontaneous proliferation so important?

Land use decisions in Guatemala are made by millions of farmers, ranchers and forest owners scattered over many millions of hectares. In a developing country, not even the most generous programs and projects can hope to reach more than a tiny fraction of those who should be making improvements in land use. Contrast this with the U.S. or the E.U. where conservation subsidies can have a widespread impact, partly because farms are larger and farmers fewer. Any outside intervention can only be successful if it acts as a catalyst, initiating a chain reaction that continues to spread on its own with minimal outside support. Unless it spreads spontaneously it will not be a success at the watershed level or in terms of development, no matter how much it may have improved the land or welfare of a few individuals. Demonstration plots, model farms and pilot

watersheds are not that difficult to create when project resources and technical attention are abundant. The real measure of their success should not be whether they have been created to specifications, but whether anyone copies these models. Unfortunately most projects end before it becomes clear whether the models are being imitated or what corrections need to be made to ensure they will be.

There is an urgent need to look backward very critically at past projects to identify which practices spread and which did not, to identify the reasons for their success or failure, and learn from them. Unfortunately, despite of the natural laboratory afforded by the wealth of past and present projects in Guatemala and the rest of Central America, I have found few attempts to systematically learn from the past. This notable lack of interest in sifting through the evidence probably has many reasons, among them poor record keeping that leads to short institutional memory, the pressure of deadlines for submitting proposals, the shifting winds of development fads, and perhaps the fear of discovering an uncomfortable truth.

5. Which practices work?

5.1. Need to discriminate: not all that is effective is successful

- Many practices are **effective** in providing watershed cover and also result in productive agriculture or forestry. Textbooks, manuals and project proposals are filled with descriptions and demonstrations of their effectiveness.
- However, in any particular project only a small sub-set of those practices are ever **applied, disseminated and accepted** by farmers on a significant scale during the life of the project. Examples of these abound and project personnel and veterans will describe them with enthusiasm.³
- Unfortunately, only an even smaller sub-set of these ever continue to **spread on their own** after the external support ends. It is this latter sub-set that should be of primary interest to any effort aimed at good watershed maintenance. These are the only practices that can really be considered a success by our criteria.

5.2. Protection first

With the pressure to show positive changes, many projects neglect protecting land that is still in good condition. Yet maintaining current conditions on such land is the greatest and lowest-cost potential impact project impact. It is still all too common to find projects planting trees at great expense on one side of a hill, while on the other the forest is being burned or cut down. Therefore, before considering which practices to apply, conservation of effective vegetative watershed cover should receive priority attention.

Efforts need to focus on legally declared protected areas, as well as community and private reserves within the watershed, especially in the upper reaches. Numerous organizations work with communities in and around such protected areas under the assumption that by intensifying their agriculture, improving their incomes and thereby creating positive relations with the organizations, the communities will put less pressure on the protected areas. Recent worldwide evidence (including that from the Sierra de las Minas in Guatemala) casts doubts on this assumption. A compilation of several studies concludes “that under certain circumstances new agricultural technologies do actually benefit forest cover, but they can also have the opposite effect. In particular, anything that makes agriculture in forested areas more attractive runs a big risk of being

³ It is conceivable that in some cases promotion of such practices is justified, but only if that support can be sustained long enough to achieve the goals (for example: food-for-work or subsidies to treat a watershed with soil conservation). We need to be clear as to the length of support that will be needed and not just assume that some day the farmers will continue on their own.

bad for forests. It may encourage or permit existing farmers to clear additional land or attract new farmers.” (Angelsen and Kaimowitz 2001) Perhaps additional means of protecting such areas need to be undertaken, especially physical demarcation of boundaries and improvements in enforcement. Thus, it is not at all certain that the current expensive approach of improving agriculture is effective in decreasing pressure on neighboring protected areas (Wunder 2001).

Numerous cases demonstrate that allowing the local population to benefit from the management of the protected areas can be very effective. The *campesino* groups and forest industries in the Peten (see Table 1) are correctly managing 350,000 ha of forest of the Maya Biosphere Reserve correctly because USAID-funded projects have helped them make arrangements with sawmills that enable them to capture more of the profits than they would have under traditional arrangements. In the forests covered by the concessions, land invasions and timber theft have ceased, and while wildfires have been dramatically reduced.

5.3. Which practices seem to spread and why?

In Guatemala and elsewhere over the last few years, I have had the opportunity to be involved in some projects that attempted to improve land use (see References). I have occasionally been able to visit sites of old projects and to talk frankly with colleagues who have a long history in this kind of work. I have tried to identify some crops and land use practices that have spread beyond the sites of their original introduction and that have had beneficial effects on the watershed. At the risk of over-generalization I have listed some of these apparent successes in Table 1, hoping to stimulate discussion and lengthen this disappointingly short and tenuous list. It goes without saying that the items on this list are only appropriate if certain conditions are met.

Unsurprisingly, most of the practices (in Table 1 and elsewhere) with truly broad impact which have spread spontaneously are market driven. These are practices from which farmers make money or receive some other short-term, tangible benefit. Nevertheless, even today planners and technicians often overlook this rather obvious principle. Farmers, like all of us, make changes in response to incentives, and not just any little incentive, but one large enough to compensate for the extra work, investment or additional risk. In the land use context, as Table 1 illustrates, the most common incentive is financial, with the market providing the reward. Reduction of the effort required to produce a crop or sustaining soil productivity (legumes for green manure), are also effective incentives but evidently less powerful than the immediate cash income from selling a product.

Lately the question is being asked, “Why pay farmers and forest owners only for products? Why not pay them for services as well?” In watersheds a promising approach is to have downstream users (irrigation districts, hydroelectric works, urban users, industry) pay for the environmental services farmers and forest owners provide in the upper watersheds. The INAB financial PINFOR incentives for managing or conserving natural forests is one example of such an approach. Unfortunately, there are not yet many other examples in Guatemala. Costa Rica has had more success in this area, especially with compensation for carbon sequestration. Certainly, payment for environmental services merits further exploration. Among the limitations is the difficulty of estimating the economic value of such services. Of course in the end, these payments must translate into a direct financial benefit to the farmer and not just a scheme to finance projects that push the same old ineffective practices.

5.4. Which practices tend to fizzle and why?

Reports of land use projects are filled with optimistic accounts of practices that look initially promising, even at the end of the project. Unfortunately, all too many that that sparkled later fizzled out. It is not my purpose here to analyze **why** these practices failed, but simply to observe that the farmers did not propagate them, no matter what beneficial watershed effects they may have had. Table 2 shows some crops and land use practices that I have not seen take off, but that are frequently still promoted by projects. I would be happy if I could be proven wrong and have to shorten this list.

5.5. Organization is everything – or is it?

At the beginning of the development business the emphasis was technical. It was assumed that farmers would pick up technical innovations because of the obvious advantages. The development institutions were manned (yes, very few women) by people who had actually run farms, ranches and agribusinesses. After a decade or two of disappointing progress it became clear that farmers and communities needed to be organized in order for innovations to take hold and spread at acceptable cost. Development institutions now give great emphasis (and correctly so) to rural organizations, participation, motivation and empowerment.

Unfortunately, it is often assumed that quality technical input is no longer needed, that almost anyone can deal with the technical problems. We turn young, inexperienced field technicians loose on the farmers without adequate technical supervision. The result is that in many cases we have created remarkably sophisticated and efficient organizations whose branches extend into some very remote villages, reaching thousands of individuals. But we now have very little to deliver. All too often we now deliver the same warmed-over recipes for dishes no one has wanted to consume, but fail to pay enough attention to technology.

The primary lesson taught by the many projects with watershed orientations in Guatemala and elsewhere in CA seems to be that we have not learned the lessons. Why not? Because nobody in the long chain between the international donor and the farmer has an incentive to point out what does not work – except the farmer, but he does not have the power. He is limited to being a “beneficiary” who receives a “gift”.

6. Which delivery systems deliver?

6.1. The history of delivering services for improving land use

At the dawn of technical assistance in Central America, the vehicles for delivering services to farmers were the national government agencies. After a couple of decades the ineffectiveness of this system became apparent. During the 1980's, the development agencies discovered the NGOs. Unfortunately, they have seldom met expectations for watershed, land-use and conservation projects. Lately, hope is being placed in the municipalities. What will the next delivery system be?

The number of NGOs has exploded as donors have funded them to implement projects. For the types of projects considered here, I have seen little to inspire confidence. The quality of the technical services provided by most NGOs tends to be unsatisfactory, partly because low salaries for field staff do not attract qualified technicians. The NGOs rate high on motivation but low on know-how, they have little to deliver. They are more concerned with meeting overly ambitious targets than with learning how to solve the problems of the farmers. The urgent need to prepare the next proposal in order to stay financially afloat absorbs their best talent. No one has time to learn. In many ways

NOGs have simply become an arm of the development agencies. The list of their weaknesses is long. The solution is not necessarily to dump the NGOs and look for another delivery system, but rather to find ways of making them more responsive and effective. Paying them for results delivered instead of for promises would be one healthy change. Greater technical oversight from the outside would be another.

I think that the new emphasis on strengthening local municipal governments is sound for numerous reasons. However, I am skeptical as to what extent they will be able to deliver services for improving land use until they themselves develop considerably. Because the municipalities tend to be assisted primarily by NGOs, the qualifications of their technicians tend to be even one step lower than those of the NGOs. The instability of many municipal governments, which tend to make a clean sweep after every election, could turn training their technicians into a task worthy of Sisyphus. Hope might be greater for using the municipality simply as a channel to access the many existing community groups, which tend to be more stable. The problem there is the sheer number of these groups. They will require many years of strengthening.

6.2. Supply driven vs. demand driven

All of the above delivery systems are supply driven. In the majority of agricultural extension systems farmers are considered project “beneficiaries.” Extension services are deemed successful to the extent they are able to implement activities and meet goals that have been defined by donor agencies and project managers involved, but not by the farmers receiving the technical assistance. The extension systems operate under the following two critical assumptions. First, the extension services should be accountable to those institutions funding the technical services (whether public or private donors) and not to those who receiving the services. Second, these donor institutions know what farmers want and need. As a result, the technical services provided are determined by what the organizations can and are willing to offer, i.e. in line with the priorities and capacities of the technical assistance suppliers, regardless of the opinions of the farmer recipients. Unsurprisingly, farmers do not adopt many recommended practices, despite considerable investment of time and money.

There is no effective mechanism for farmers to provide corrective feedback on the practices and interventions advocated by the organizations. Hence, despite an overabundance of participatory assessments, the provision of extension services by the implementing organizations is strictly top-down. Conditioned on loose promises, the donors give away money to intermediaries who in turn often pass it on to other implementing organizations, who then donate their services to the farmer. A person who receives a gift is not really entitled to complain. Each link in the chain is controlled by the one above.

The unstated rule of the game is for farmers to accept, thankfully, whatever the organizations offer, however marginal many of those practices may be, simply because the offer is a gift. The chances for the organizations to miss critical opportunities to identify highly effective practices continues as long as the implementing organizations reserve, for themselves alone, the decision on the composition and content of the practices that they promote.

In order to see substantial changes in technology adoption and landscape management, the implementing organizations must adopt extension approaches that consider farmers as informed clients whose expectations they need to meet rather than charity recipients. The implementing organizations must explore and test extension systems that encourage farmers to take the lead in defining the content of technical assistance and evaluating its impact. These alternative extension systems should be based essentially on formal contracts between farmers and implementing organizations whereby the two

parties define one common goal and the technical mechanisms that the organizations should provide to attain them. These contracts should make the organizations more accountable to farmers. At the same time, the contracts should expand the opportunities for farmers to provide feedback, and the organizations should use this feedback to hone skills and hit targets more accurately. Above all, the contracts should reinforce the notion that seeking sustainable development and natural resource management is a challenge that requires the active and leading participation of farmers, and the focused support of the implementing organizations.

6.3. Land use and the market

Obviously, land use responds to market forces. Projects and their delivery systems can usually have greater impacts by helping farmers to access new markets for environmentally friendly products (through value-added processing, identifying niches or other means) than by trying to “educate” them to change their ways. Examples are numerous and make up most of Table 1. Local watershed effects can be very dramatic, for example:

- In the dry western part of Costa Rica I once stood fascinated in front of one square meter of milk cooler that had allowed farmers to switch from extensive and destructive grazing of meat cattle, to growing cut-and-carry grasses and improved pastures for their increasing dual-purpose herd. Until that cooler arrived they had not been able to market milk.
- Over the years, cutting fuelwood for the limekilns above the Lago de Yojoa in Honduras caused considerable destruction of the forest in the vicinity. Driving this road recently, I was surprised to see that most kilns were burning sawdust instead of wood. A project had introduced a blower for injecting sawdust into the kiln. Unlike fuel wood, sawdust is probably free.
- Favorable markets have helped create extensive “forests” of coffee and of rubber on hillsides throughout Guatemala and the rest of Central America.

Of course market effects can also be very negative, as demonstrated by the expansion of extensive grazing into unsuitable areas in response to meat prices or to loans subsidized by international development banks.

In the long run, if watershed problems are ever solved in Guatemala, they will probably be solved the same way they have been in many other mountainous places in the world – by getting the people and the cattle off the hillsides. This usually comes about through market forces that provide people with a better way to make a living than scrabbling around a steep, rocky farm. It has happened in the Alps, it has happened in Connecticut, which now has more forest than at any time since 1650, it is happening in Costa Rica. Well-planned programs can accelerate this trend. *Maquiladoras*, agro industries and other industries that provide alternative employment to woodcutting and farming, especially in rural areas, may well be doing more for watershed management than many watershed projects. Greater investment in educating rural girls and boys not only opens up opportunities for their finding jobs off the farm once they are older, but educated farmers are also more likely to accept innovations and will tend to have smaller families. Education of girls has a particularly high payoff.

6.4. Land use and policies

Of course land use also responds to policies. As USAID knows, effectively executed policies can be more powerful tools than projects in bringing about changes in land use. Examples are the nationalization of forests in Honduras under COHDEFOR in 1976 and their subsequent privatization in 1992. Probably the policies with the greatest impact on land use are those that effect the availability of and accessibility to land. Rental

arrangements or insecurity of tenure caused by lack of clear title tend to restrict improvement in land use, especially those uses entailing major investments in permanent crops, pasture improvement, forest management and infrastructure. Therefore, land titling projects not only tend to solve social problems, they also bring about improvements in land use. Inappropriate land tenure policies are also responsible for the continued topsy-turvy state of affairs throughout most of Central America wherein wealthy landowners make extensive, unproductive use of fertile valley lands while subsistence farmers are forced to cultivate steep hillsides.

7. Conclusions

Traditional short-lived projects and programs that fail to focus on the fact that practices introduced must spread spontaneously once external assistance ends will have minimal impact on the watershed. We cannot afford to continue to spend scarce funding on practices that do not have a high probability of proliferation beyond those points where they were introduced and shown to be effective.

How can we turn this situation around?

For efforts to have a visible impact on the landscape and on the welfare of a significant proportion of hillside farmers, we must look beyond the final evaluation of the project and beyond recent isolated “successes” in selecting future approaches and practices for financing. We need to carefully scrutinize experiences dating back five or ten years, to learn what is likely to catch on on a significant scale. As a corollary, we need to keep records in such a way that years from now someone can learn from our own experiences. We must turn the farmer into a client and empower him or her to decide the assistance that is to be provided. This change would be one way of demanding accountability from extension service providers and donors. Basing payment to these service providers on the results they deliver would be another. Above all, making wiser use of powerful market incentives could bring about desirable changes in land use.

8. Some design tips

For any organization that chooses to work in watershed management projects, the following summarizes some points I think important to consider:

8.1. Learn

8.1.1. *First look backward*

Take a close and critical look at the practices promoted by current and previous projects to determine which practices spread spontaneously and which do not. Find out why. Cover a wide range of projects and donors. For this evaluation do not worry about whether the projects were successful in meeting their targets, but only whether what they created is now alive and growing or else dead.

8.1.2. *Then look around*

After many decades of watershed projects all around the world, much is known. While designing a new effort, invest time in reading and learning about the experiences of others, including those outside your country and region. You do not have to be original, but it does pay to be skeptical.

8.1.3. *Pick a few winning technologies*

Based on your best evaluation, identify a few crops and practices to promote. Start small and learn. Most watershed projects try to do too many things on too large a scale, in too little time, attempting to solve all problems.

8.1.4. Build in a mechanism for continuous, honest learning

Explicitly include components throughout the project whose purpose is to critically evaluate farmer reactions and suggest corrections. Go beyond monitoring targets. In order to be useful, monitoring needs to be an internal exercise driven by the desire to learn and improve, and not just to satisfy donor agencies. Find out why and who and under what conditions. Create an R&D mentality in the project. Instead of trial and error use science and applied research to solve problems. Create incentives for finding answers, not just for meeting targets. Systematic record keeping is essential for learning. Digitize records for each individual farmer who receives assistance so that evaluators can visit him years later and learn what practices he continues to apply. Do not let rural appraisals and diagnoses become an end in themselves but strive for real local participation in the process of managing the watershed.

8.1.5. Strengthen accountability

In the long chain from donor to service provider to farmer, whoever does not deliver funds, services or results as agreed upon should be held accountable and suffer the consequences. Too many organizations and individuals continue in the system even after years of delivering mediocre results. Projects should negotiate contracts through which they pay for results achieved instead of promises vaguely stipulated in proposals. When an organization is not paid for an unsatisfactory result, the lesson is learned quickly.

8.2. Use strong incentives: Money is a great one

8.2.1. Look for solutions not based on land use

Accept the fact that many lands do not have agricultural potential. Others are already used to their full capacity. Trying to intensify use of such lands is only likely to postpone the inevitable crash of a subsistence-based rural economy. Creating alternative sources of income not based on the use of the land is often the best solution. Schooling for the young is one of the most effective tools for creating such alternatives. Educated individuals are also more receptive to innovations for improving land use.

8.2.2. Diversify with cash crops

When asked what they need, *campesinos* will inevitably put income near the top of the list. Projects can do much to improve management of the commercial crops farmers already produce and carefully introduce new ones. Suggestions by experts, not inexperienced extensionists, can be useful here. Do not spend project resources on improving hillside *milpas*. Even large improvements in yields of basic grains do not usually cause sufficient financial improvements to stimulate neighbors to imitate the practices. I have heard numerous anecdotes of *campesinos* buying maize from part of their earnings from cash crops.

8.2.3. Emphasize markets and processing

Projects can do much to identify markets and niches, set up linkages, and assist in establishing processing facilities so as to stimulate the production of watershed-friendly permanent crops. Once a market is available, a dryer for cardamom, a processing plant for cashew, or a packaging plant for Persian limes can have a great effect on improving land use in the watershed. Roads and cheap, competitive transportation from production areas to markets is critical for the marketing of most products.

8.2.4. *Build in an incentive for improvement by turning the farmer from beneficiary to client*

As long as technical services are for free, farmers will not feel compelled or empowered to demand quality in service delivery. This is perhaps the most important reason why projects continue practices that do not work: no one has an incentive to complain.

Recently I have been intrigued by pilot approaches that reverse the flow of funds by allocating the funding for extension services to farmer groups on the condition that they meet at least part of the cost themselves. The groups then choose and contract the extension services and training they might need. In Honduras the Swiss Program with Private Organizations for Sustainable Agriculture in Hillside (PROASEL) is promoting this type of approach whereby interested farmers must contribute with at least one part of the cost of the service.

Through such a mechanism the implementing organizations are able to ascertain the willingness of farmers to pay for technical services they really value. The information on farmers' willingness to pay should be used to design fee-based extension systems. Ideally farmers should cover increasingly larger segments of the extension system's operating costs, until the system is completely self-sufficient. But even if they cover only a fraction of the costs, fee-paying farmers will feel that the system owes them something good in return, and will speak up accordingly.

In the recent past, CARE tested and validated the FEAT model in Guatemala, whereby small farmers paid fees for technical support that private extension agents provided. World Visions Guatemala has tried similar approaches. The Programa Ambiental de El Salvador (PAES) is using this kind of modality in selected watersheds of the Rio Lempa, using firms and NGOs as the agents of agricultural extension, with the farmers paying a steadily increasing portion of the technical assistance costs⁴. USAID should encourage disinterested organizations to test, refine and adopt such mechanisms. They will probably prove to be more efficient, cost-effective and ultimately sustainable approaches to watershed management and economic development.

8.3. It is all difficult, but start with the least difficult

8.3.1. *Protection before rehabilitation*

Protection of land still in acceptable condition, especially natural and secondary forests, should be the number one option of any project. Unfortunately, this least-cost option is often not adequately considered when what drives a project is the compulsion to act, rather than to achieve useful results.

Especially costly is the pervasive bias toward solving watershed problems by planting trees. All too often projects try to plant trees at great expense but neglect those that are still providing good watershed cover. Obviously there is more benefit in conservation. Brush and young secondary forest is a perfectly adequate watershed cover and provides forest products without the high cost and long wait associated with plantations. Emphasize fire control, low-impact harvesting, control of grazing and other simple management practices that cover large areas. Avoid trying to get *campesinos* to plant long-rotation forest trees such as pine and mahogany.

8.3.2. *Start in those watersheds that supply water for households*

⁴ Personal communication from Paul Dulin.

The easiest place to convince people to improve land use is in the watersheds that supply the water they drink. An increasing number of villages and towns are beginning to take steps to manage these watersheds. Unfortunately the steps they often take are ineffective, such as planting a few trees around the spring. Much can be done to help them take more effective measures. Start in the easiest watersheds to gain experience, then expand to more difficult situations.

8.3.3. Pay attention to land use capacity

If land is used with greater intensity than it is capable of sustaining, then that land will be degraded. Simple methods are available for classifying land according to the maximum intensity of use that should be allowed. Projects should follow those guidelines and not promote practices on land for which they are not suited. Do not bother mapping land use capacity over large areas. This work is much too expensive at the scale needed. Just equip extensionists with the simple guidelines and teach them how to apply them.

8.3.4. Stem the flood of useless documents

Too much time of the most qualified people and consultants in many projects goes into producing voluminous documents that are never used. Some of the most costly and least used are watershed management plans. Of course it is more comfortable (and brings more status) to sit in front of a computer screen than to stand on a muddy hillside plot. Projects should include some rules and controls to limit the proliferation of lengthy reports, studies, workshop summaries, strategies, guidelines, plans and more plans. I am skeptical enough by now to realize that this report might just be another one of those not used.

Table 1. Crops and practices with positive watershed effects and successful widespread examples in Guatemala and Central America

CROPS AND PRACTICES	OBSERVATIONS	SUITABLE FOR	
		CAMPESINOS	LARGE PRODUCERS
MARKET DRIVEN			
Coffee	When done correctly, shade-grown coffee is the classic watershed and environmentally friendly crop, as long as pesticides and processing residues are properly managed. Driven by the market, it has been in demand by <i>campesinos</i> and has been spreading with and without projects (Cambranes 1996). However, current prices have greatly reduced its potential. In most cases more can be achieved through improved management and targeting specialty markets than by increasing the area under coffee.	Yes	Yes
Cardamom	A widespread permanent crop suitable for some of the higher elevation coffee areas. Unfortunately price fluctuations tend to be even more erratic than those for coffee.	Yes	Yes
Rubber	In Central America rubber is usually only planted by large producers, but in Malaysia small holders produce most rubber. Current prices are discouraging. Profitability analysis should also take into account the desires and time horizon of the small producer.	Seems worth checking out	Yes
Fast growing, multi-purpose forest tree crops	Common when combined with crops, in small marginal plots or along fences. Most successful with spectacularly fast growing trees such as <i>Eucalyptus</i> , <i>Leucaena</i> , <i>Gmelina</i> that provide roundwood for sale after 3 to 5 years. Fuelwood is a marketable byproduct. Good production requires attention to matching species to site, preparing strong planting stock, site preparation and management. Abundant information available through 15 years of systematic research by Madeleña Project in CA.	Yes	Yes
Fruit trees	Farmers are most interested in improved varieties for market. Obstacles tend to be markets, sources of quality germplasm, and transport, all of which can be overcome with well designed projects.	Yes	Yes
Non-traditional export crops	In recent years a variety of non-traditional crops grown for export have transformed watershed landscapes in Guatemala and Honduras (snow peas, broccoli, berries, ornamentals, cut flowers, mangoes, etc.). Not all are good watershed covers but all are very labor intensive, thus tending to keep farmers off marginal lands.	Yes	Yes
Improved pasture management	Establishment of more productive grasses (<i>i.e. Brachyaria</i> sp.), pasture rotation, fertilization and other good management practices are gradually replacing the extensive, traditional practices in many areas.	No	Yes
Cut and carry forages	The planting of <i>Pennisetum purpureum</i> (king grass, Merker, imperial) has expanded throughout many areas, especially in the drier Pacific Slope regions, providing forage on into the dry	Yes	Yes

CROPS AND PRACTICES	OBSERVATIONS	SUITABLE FOR	
		CAMPESINOS	LARGE PRODUCERS
	the drier Pacific Slope regions, providing forage on into the dry season when traditional pastures and ranges have dried out.		
Live fences and pasture division	Planting of lopped poles of <i>Gliricidia</i> , <i>Erythrina</i> and other species provide a long-lasting and inexpensive alternative to dry posts that must be cut from forests and offer other renewable wood products, fuelwood, forage and shade for cattle. These live fences also help improve pasture management by facilitating the division of pastures and rangelands for rotating grazing.	Yes	Yes
Management of forests for wood and other products	There is an increasing number of examples of private owners and communities managing large blocks of forest for timber and other forest products. Although not in mountain watersheds, in the Petén of Guatemala 350,000 ha of forest are being managed by 22 community groups, industries and cooperatives.	No, unless associated	Yes
Pine resin tapping	In the early days of COHDEFOR in Honduras <i>campesino</i> groups were tapping pine for resin over thousands of hectares, augmenting their farm income and, perhaps more importantly, preventing those forests from burning. Because of the decline of resin prices, the substitution of resin-based products with synthetic ones and other reasons, interest has waned.	Yes, if the prices improve	No
Management of legally declared protected areas	Occasional success of involving <i>campesino</i> groups in some of the benefits of management, such as tourism. Legal guarantees can be of interest to large owners.	No, unless associated	Yes

CROPS AND PRACTICES	OBSERVATIONS	SUITABLE FOR	
		CAMPESINOS	LARGE PRODUCERS
DRIVEN BY NON-MARKET FACTORS			
Reduced use of fire in agriculture	Increasing anecdotal evidence indicates that <i>campesinos</i> are gradually picking up the many admonitions against burning and are turning to minimal tillage practices. In Honduras, under the LUPE Project, many agricultural communities abandoned the use of fire for annual clearing of fields.	Yes	Yes
Legumes for green manure	Have found wide acceptance in some regions. Projects can help by overcoming the initial obstacle of seed supply.	Yes	Yes
Contour plowing and furrowing	Planting on the contour, whether by hand or mechanical furrowing, has been accepted throughout Central America as farmers see the benefits of water retention and control of soil erosion.	Yes	Yes

Table 2. Crops and practices that have been widely tried in Guatemala and Honduras but have not spread

CROPS AND PRACTICES	OBSERVATIONS
Planting long-rotation timber trees	Much money and energy has been wasted on trying to get small farmers to grow blocks of pines, mahogany, and other trees that give no returns for at least 20 years. <i>Campesinos</i> can not wait that long. Financial incentives are almost never enough to cover the large areas needed for a watershed effect. Such plantations are especially inappropriate for emergency projects such as Post-Mitch or the labor generation reforestation in El Salvador during the 1980's where millions of dollars were spent planting trees that the farmers did not want.
Terraces, hillside ditches, stone walls	Require too much labor.
Contour barriers	Farmers will construct live or inert barriers along the contour when pressured by the extensionists, but these seldom seem to be imitated by others, unless part of a commercial cropping package.
Improving <i>milpas</i>	Even if the simple practices such as planting distance and fewer seeds per planting hole are applied, increases in yield are likely not to be high enough to convince neighbors to copy.
Vegetables for the local market	Many projects have encouraged <i>campesinos</i> to grow assorted vegetables. Almost all have failed. Exceptions are highland areas where small farmers already had a tradition of growing vegetables and a market (Siguatepeque, parts of the western highlands of Guatemala). Linking farmers to markets has been the greatest failing.
Ecotourism	NGOs tend to raise expectations that are seldom met. Only successful in a few very special cases, where the attractions are likely to sell themselves, and/or private entrepreneurs provide their own funding.
Fuelwood plantations	Because of the low price of fuelwood, plantations for this purpose alone are seldom justifiable in financial terms. Fuelwood is a marketable byproduct of plantations established for other more lucrative products.

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