12. Technoeconomic, Organizational, and Ideational Factors as Determinants of Soil Conservation in the Dominican Republic

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The concept of culture is occasionally introduced into discussions of economic development as a catchall residual construct to explain behaviors and attitudes difficult to explain using straightforward economic cost-benefit analysis. With respect to soil conservation, different societies (or different communities within the same society) may differ in their inclination to innovate, in their willingness to adopt externally introduced innovations, in the type of innovation that emerges as the preferred form of land use, and in the speed with which change spreads locally. Some groups may simply reject all proposed innovations. When the differences in preferences among groups are not easily attributable to an identifiable environmental, technical, or economic factor, the inclination is to hypothesize that some cultural factor is operating.

To the degree that the term culture is invoked simply to label the noneconomic, the aesthetic, the cryptic, or the unpredictable dimensions of human behavior, it is functioning not as a genuine explanatory construct but rather as a substitute for explanation. This chapter argues that the concept of culture can be effectively operationalized for use by persons concerned with economic development. For soil conservation, a well-defined model of culture can permit the identification, description, and analysis of causal factors that would escape scrutiny or fall through the cracks of standard cost-benefit analysis. The information gathered on two projects in the Dominican Republic constitutes the raw material for this attempt to take an operationalized approach to culture.

This chapter concludes that although expectations of increased economic payoffs were the force driving the farmers' willingness to engage in soil conservation, this drive was not worked out through a straightforward "homo economicus" calculation in which individual farmers anticipated increases in crop productivity. Soil conservation decisions, rather, were mediated by additional social and ideational factors that filtered each farmer's perceptions of potential payoffs. Although they are not particularly mysterious in themselves, nor do they nullify the operation of more straightforward economic considerations, these filtering variables are difficult to incorporate into straightforward economic analysis.

The fieldwork underlying this report was conceived as an anthropological supplement to an economic analysis of soil conservation practices carried out by the World Bank in the Dominican Republic. The selection of the general research question was made by Ernst Lutz of the World Bank's Environmental Policy and Research Division, who posited that, although many factors enter into land use decisions, an acceptable cost-benefit ratio may be the prime determinant of a farmer's decision to adopt (or not to adopt) a soil conservation practice. Other factors were recognized as well. Although the major thrust of the World Bank's research was a technical analysis of economic costs and benefits, a brief anthropological supplement was contracted to explore these other factors.[2] The guiding hypothesis of that supplement was that perceived economic returns to soil conservation are the prime determinant of whether Dominican farmers adopt soil conservation practices, but that other factors operate as filters influencing either the perception itself or the threshold above which the perception is converted into action.[3]

This component of the research adopted a simple case-study approach that compared and contrasted two program strategies for promoting soil conservation among Dominican farmers. It was felt that a comparative glimpse of two approaches would yield more insights into the possible determinants of adoption than a single case study would.[4]

The region chosen was the municipality of San José de Ocoa. First, the documentation on the projects of that region was reviewed, and then two data-gathering trips were made to the research region, one a week-long trip and the other a two-day follow-up trip. A major goal was to visit as many sites as possible from each of the two projects and to converse with project personnel and participating farmers. The principal guide and contact person for this trip was Ing. Carlos Bonilla, former regional coordinator of the MARENA project and current field director of the FIRENA project. Of even greater importance were the contacts made with farmers. The longer trip consisted of visits to villages, interviews with men and women, hikes through protected and unprotected upland fields in the company of farmers, a day-long meeting at which farmers discussed the pros and cons of agreeing to new land use behaviors, and an overnight stay in the house of one farmer. In one-on-one and small group interviews, the farmers' perceptions were elicited of the cost-benefit ratios of both the traditional farming practices and the soil-conserving land use practices that had been promoted by development projects and adopted by many local farmers. This chapter analyzes the findings pertaining to the utility of the concept of culture.

Conceptual framework and guiding assumptions

Anthropologists use the concept of culture in two distinct senses. In its more generic sense, culture refers to a generalized human capacity to invent, diffuse, adapt, and transmit from one generation to the next new behaviors. Used in this sense, it is analogous in some ways to the concept of intelligence as used by psychologists. When used with an article, however, "a culture" refers to a specific cluster of behaviors, objects, beliefs, and rules that a particular human group has produced (or adopted).[5] Used in its more restricted second sense, the concept of "a culture" distinguishes the behaviors, objects, beliefs, and rules of one human group from those of another.

This second understanding of culture is more germane to the purposes of development agencies. Discussions of the impact of cultural variables on soil conservation imply a difference among human groups, and cultural variables are often understood to be distinct from economic variables. That is, whereas some cultures may predispose their members to be receptive to the invention or adoption of new technologies, researchers often ask whether other cultures may be less open to such innovations for cultural reasons, independent, at least in part, of the objective technical, ecological, or economic advantages of the proposed innovation. Stated a bit differently, if this notion of culture as an independent variable is on target, two farming communities with identical economic activities but different cultural orientations might respond differently to one and the same proposed soil conservation innovation. Some such implicit hypothesis appears to underlie discussions of culture that occur among development specialists.

The contention that noneconomic factors determine the timing or shape of land use innovations borders on the obvious. The problem is to incorporate these factors into one's description and analysis of real-life systems. The proposed model construes a culture as a system containing three universal components. The guiding assumption of this approach is that any human culture can be disaggregated and at least partially operationalized into three autonomous but interlinked subsystems: (1) an underlying technoeconomic component,[6] (2) an organizational component, and (3) an ideational component. Cultures differ in the content of these components, but every human culture must make provision for all three.

This discussion of soil conservation is organized around the concept of a cultural system containing these three components. Such a tripartite evolutionary framework has been used by anthropologists to analyze entire social systems. The guiding assumption is that these three components are universal subsystems found in every society, that these subsystems are functionally linked, and that they therefore evolve together. Within this framework, every cultural system has evolving technoeconomic, organizational, and ideational subsystems.[7]

This tripartite analytic scheme is generally applied to the analysis of entire social systems as units. This chapter modifies and adapts the model, however, to make it useful for analyzing targeted subdomains of behavior rather than entire social systems. The targeted domain is soil conservation.

If soil conservation is viewed as a limited form of cultural system, the technoeconomic component of a soil conservation system consists of material interventions applied by humans to protect or restore individual plots of ground, the tools used to apply those interventions, and the mechanical and vegetative structures that result from their application. This material component of a soil conservation system is, so to speak, the vertically oriented cluster of downward inputs used by farmers to protect or restore their soil.

In contrast, the second component of a soil conservation system—the organizational component—consists of all the horizontal person-to-person, group-to-group, or institution-to-institution linkages activated to carry out the technical and material interventions. The organizational component of soil conservation includes the following elements:

- Local land tenure and land access rules, insofar as these rules affect the long-term profitability of investment in improved land use practices
- Labor recruitment strategies that a farmer or other interested party (such as a project organizer) uses to apply soil conservation technologies (family labor, wage labor, and intracommunity exchange labor are the major varieties found across cultures)
- Farmer organizations created to mediate the flow of outside resources and information
- The chain of linkages between outside institutions (including international funding agencies and urban governmental institutions in the host country) and local groups, insofar as these linkages exert an impact on the land use decisions of farmers.

The third cluster of variables to be analyzed as a discrete subsystem within any system of human behavior is the ideational component. The ideational component of soil conservation includes the following elements:

- Underlying value orientations within the local population concerning land (for example, custodial versus extractive attitudes, focus on short-term versus long-term horizons, and so forth)
- Local perceptions and popular beliefs concerning the determinants of soil fertility and the negative impacts of erosion
- The local store of knowledge concerning various soil-protecting or soil-restoring alternatives and beliefs concerning the potential payoffs from using these alternatives.

In principle, this tripartite model can be applied to traditional systems of soil conservation that emerge spontaneously. In view of the rarity of such "uncontaminated" traditional processes in the modern developing world, however, this chapter focuses on soil conservation systems explicitly designed by trained technicians to be adopted (and, of course, fine-tuned and modified locally) by traditional farmers.[8]

Conservation as a system: hypothetical evolutionary scenario

Understood narrowly, soil conservation refers to the specific vegetative or mechanical measures that a landowner may apply to a given plot. Understood more broadly, however, the evolution of a successful soil conservation system entails three types of adjustments in land use.

First, a "zonification" of production occurs, which means a new functional differentiation between plots allocated to annual crops and plots allocated to perennials and other less intensive productive uses. In settings (such as the Dominican Republic) where a single holding may be split into plots in different ecological zones, this functional specialization can occur (and has begun to occur) within one and the same holding. Farmers who formerly cropped even steep hillside plots in annuals begin to distinguish between intensively cropped annual plots and extensively managed perennial stands.

Second, on intensively cropped annual plots farmers apply protective and restorative interventions. That is, "conservation" of steeper plots takes the form of a shift to perennials or other less intensive uses of land. Soil conservation techniques as conventionally defined—terraces, ridges, gully plugs, contour canals, vegetative barriers, and the like—focus on the plots set aside for intensive cultivation.

Third, if the process is successful, at a more advanced stage farmers also begin protecting plots over which they have no proprietary or usufruct control if the degradation of those plots might have a negative impact on their own land. For example, communities mobilize themselves to act directly, or to get authorities to act directly, against upland squatters who are endangering the downstream ecosystem by destroying the forest or undertaking similar activities. If this third facet of evolving conservation behavior occurs, then local communities themselves begin taking on vigilance functions conventionally assigned to public authorities.

This is clearly an idealized scenario. Nonetheless, all three of these processes have begun occurring in the region selected for examination within the Dominican Republic. Although the successful scenario is unfolding in the context of one program approach, it has not occurred in the other.

Two approaches to soil conservation

The deforested hillside landscape of San José de Ocoa is similar in many ways to that of other municipalities on the southern flanks of the Cordillera Central. The topography is hilly, and more fertile and more manageable stretches of flat bottomland tend to be located in larger holdings near the town.

Although more than half of the population of the Dominican Republic now lives in cities or towns, over 80 percent of the Ocoa municipality is rural. The vast majority of the rural population are descendants of migrants who settled the mountains less than three generations ago. They came from the lowlands, pushed by overcrowding and a scarcity of land. The result has been the deforestation of most of the region.

Today, the rural population lives principally by cropping annuals on small holdings. The specific crops grown differ from community to community, primarily because rainfall and temperature regimes vary from one micro watershed to another. In the northern sector of the municipality, higher villages with adequate rainfall grow coffee and beans. Communities at lower altitudes with flatter bottomland and decent road connections enter into agroindustrial relations with peanut-processing factories and grow peanuts as the major cash crop. Before the advent of gravity-fed irrigation systems, communities in the southern sector, which has lower annual rainfall, relied principally on drought-resistant chick-peas as their major cash crop. The communities studied most intensively for this research—newly irrigated hillside communities that have incorporated soil conservation into their hillside repertoire—are cropping (in order of importance) carrots, potatoes, beets, onions, radishes, cucumbers, and other vegetables for Santo Domingo markets. (Farmers cropping unirrigated plots at lower levels in the same communities still rely most heavily on chick-peas.)

Whatever the particular crop configuration, all of the communities in the region share six features in common.

(a) *Small average holding size.* Survey data that the residents of one village (Los Ranchos) themselves collected from about sixty farms in the community show an average farm size of about 25 tareas (about 1.5 hectares) cropped per household a year. Even if one doubles the average to take into account pastureland, fallow land, and other land not incorporated by villagers into their survey responses, the holdings are still small. The findings for this particular community are consistent with estimates given by members of other communities.

(b) *Strong community-internal differentials.* In Los Ranchos, the largest holding is 100 tareas, the smallest is 4 tareas. The standard deviation of such a distribution is of a magnitude to render questionable not only the concept of "homogeneous peasant community," but even the relevance of using a mathematical average to discuss landholdings. This skewed land distribution creates problems not only from an equity perspective but also from the point of view of the technology of soil conservation itself. Such distributional issues are often viewed as being hopelessly outside the realm of problems with which a funding agency or project can deal. Steps taken voluntarily by the community in question suggest, however, that such distributional issues may be more amenable to pragmatic policy intervention than is often believed.

(c) *Strong market orientation.* A recent study by the German government found that communities in the region reserve only about 5 percent of their total agricultural production for home consumption, consigning the rest to the market.

The entire population is heavily involved in cash markets and is dependent on food purchases for much of the year. Most of the crops are slated for sale in the nation's internal markets. Because of their involvement in markets, farmers are open to changes in cropping patterns as long as the short-term profitability of these changes can be made plausible. The same openness applies, other things being equal, to the incorporation of new soil conservation practices.

(d) *Heavy capital needs.* The shortage of land is the principal problem of many farmers, but, for practical purposes, the shortage of productive capital often keeps farmers from engaging in optimal use of their land. The heavy need for capital proved to be the gateway through which one of the soil conservation projects described here entered the region.

(e) *Unusually active farmer organizations.* Ocoa differs from other nearby municipalities because it has a uniquely active and effective local, private organization, the Asociación para el Desarrollo de San José de Ocoa, commonly known as the Junta. Unlike many town-based organizations in Latin America, which focus their developmental planning and fund-raising energies on projects of interest principally to town dwellers, the Junta serves as a major transmitter of developmental resources—and developmental ideas—for economic, health care, and educational projects in the rural areas.[9] Most of the villages in the area send representatives to and participate in the activities of the Junta.

(f) *Ecologically inappropriate agrarian technology.* All communities in the region—a characteristic of particular importance to this report—apparently practice a traditional agrarian technology virtually bereft of soil management techniques appropriate to the cropping of hillside plots. When undertaken by a population with appropriate soil conservation technologies, the agriculturally motivated removal of trees need not result in ecological devastation. But in the case of the Dominican Republic, including the rural areas of Ocoa, the two go hand in hand. The absence of soil conservation technologies presents no great mystery. The migrants to the hills brought with them agrarian technologies poorly adapted to the cropping of ecologically fragile slopes and passed these technologies to their offspring. Although farmers were repeatedly questioned about their knowledge of soil conservation practices before the projects began, they consistently denied earlier knowledge. The traditional agricultural practices learned from their elders, as several farmers insisted independently, were devoid of measures designed to protect the hillside slopes they farmed.[10]

The promotion of appropriate soil conservation techniques among smallholding farmers has been a matter of discussion for decades. The U.S. Agency for International Development (USAID) began financing conservation activities in 1981. As of the summer of 1991, the date of the visits to the area, soil conservation activities had been promoted for exactly one decade.

Two quite different types of projects have been attempted. Although both approaches focused on the same type of technical intervention (vegetative barriers, principally grass strips), they differed from each other along two critical dimensions:

(a) One approach focused principally on soil conservation as a major output of the project, which was undertaken without an additional economic catalyst; that is, soil conservation itself was the major program "offering" to the farmers. The other introduced soil conservation as an adjunct to a genuinely profitable technological shift, the installation of gravity-driven hillside irrigation systems. In this project, the most valued input was irrigation; soil conservation was an auxiliary productive and protective measure, but not the central offering on the project's menu.

(b) The funds of one approach were channeled through and managed by the Ministry of Agriculture in Santo Domingo. The locally active Junta was bypassed during both the planning and the management of the project. In the second approach, the Junta itself, in consultation with its rural clientele, established project goals and (above all) were the direct recipients of project funds. The ministry's financial participation consisted solely of paying the salaries of the state employees who were, in effect, assigned to the new project as managers and technicians.

Although the visit was too short to evaluate the contrasting results of these two approaches systematically and with any quantitative rigor, the two projects appear to differ markedly in their results. Project personnel and participating farmers unanimously agreed on this point. To add to the credibility of the comparison, many of the key personnel in the first project were retained for the second, and most of the communities that participated in the second project had also participated in the first. This situation provided an excellent opportunity to contrast the two approaches.

MARENA: SOIL CONSERVATION AS A MAJOR PROJECT GOAL

USAID approved project MARENA (Manejo de Recursos Naturales) in 1981. This US$11 million project was to pursue two major goals: (1) the "institutional strengthening" of the Secretaría de Estado de Agricultura (SEA), and particularly the Subsecretariado de Recursos Naturales (SURENA); (2) the promotion of soil conservation among hillside farmers in two major watersheds, including the one in which San José de Ocoa is located.

As is often the case in such projects, most of the funds were effectively captured in Santo Domingo by the targeted beneficiaries of the first goal: SEA and SURENA. Although the funds were disbursed, there is doubt as to whether SURENA was successfully strengthened. In interviews, current and former employees of SURENA seemed to agree that the institution is weaker now than it was in 1981.

This discussion focuses, however, on the soil conservation component. The technical focus of MARENA was on the use of *barreras vivas*, live barriers. Grass strips were the measure of preference, and the distance between one barrier and another varied according to the plot's slope.[11] Diversion canals were also constructed along every third or fourth vegetative barrier. The project did not build walls, ridging, or terracing, which had been tried in other projects on the island.

Farmers were understandably skeptical about using space on their small plots for vegetation that would decrease short-term yields. To deal with this dilemma, MARENA offered the incentive of credit. Two lines of credit were opened in the state-run Banco Agrícola: production credit and conservation credit. The credit was intended to serve two purposes: it would encourage farmers to use soil conservation interventions on their land, and it would enable them to practice an intensified form of agriculture that would offset any marginal loss to traditional productivity.

Since local campesinos are blocked as much by a shortage of capital as by a shortage of land, they are very interested in obtaining access to productive credit. Under MARENA, to acquire productive credit, farmers had to construct appropriate soil conservation devices on their land. They even had to borrow to do this. From the project's point of view, the central field-level goal was soil conservation. Productive credit was injected as a supplementary carrot to pursue the ecological goal that was foremost on the project's agenda. But small farmers have their own agendas, and for them, access to productive credit was the primary goal. Many credit-needy farmers viewed the installation of grass strips as a silly project hoop through which they simply had to jump. Farmers did this, somewhat lackadaisically, and generally using their own labor. The "conservation credit" that they ostensibly borrowed to pay for labor was often used for other purposes.

MARENA had problems from the outset. The most frequently cited problem was the large amount of project cash that remained in the capital city of Santo Domingo and, consequently, the small amount of cash that reached the project areas in Ocoa and Padre las Casas. According to the former Ocoa field director of the project, cash flow arrangements within the institution meant that the Santo Domingo–based office captured an inordinately high percentage of the funds. Field-level disbursements from the ministry to MARENA were both meager and delayed. A related problem was that MARENA bypassed the Junta, the dynamic private organization that had been formed by leading Ocoeños and that was already carrying out numerous activities in the rural areas. The Junta participated neither financially nor operationally in MARENA. Further problems were created by a new project director, who alienated members of all participating groups, including USAID project managers.

Because midstream and end-of-project evaluations showed some positive results, and because natural resource agendas were achieving increasing prominence in the Dominican Republic, USAID was reluctant to cease all activities in the project area or in the natural resource domain. Most of MARENA's problems appeared to be attributable to institutional arrangements. USAID decided, therefore, to finance a separate follow-on project channeled through a different institutional route. MARENA's original life span had been slated to run from 1981 through 1986. The ministry had been timely only in its disbursement of funds for internal institutional needs and had delayed the disbursement of funds for field operations. Because substantial sums had not yet been disbursed, an extension of an additional year was granted until the end of 1987.

Nevertheless, at the end of this period nearly US$1.5 million earmarked for field activities still had not been disbursed. USAID decided to reserve this as the start-up money for a follow-on project. This project differed from its predecessor at both the technoeconomic and organizational levels. Many of the personnel of MARENA, including the field director himself, were carried over into the new project. Because of radical shifts in technical emphasis and institutional channeling, the project was, in effect, totally new and was given a different name.

FIRENA: SOIL CONSERVATION EMBEDDED IN AN IRRIGATION CONTEXT

As MARENA began winding to a discouraging close, doubts about the economic value of soil conservation were already being voiced, not only by farmers but also by project personnel themselves. One of the more progressive and highly organized villages (Los Martínez) requested the installation of a gravity-driven sprinkler irrigation system. MARENA personnel agreed, provided several financial and organizational stipulations were met. For the first time in the history of the region, a community of small hillside farmers had access to irrigation. This experiment occurred too late to salvage MARENA and its lackluster attempts to focus on soil conservation. But it provided the guiding stimulus for redesigning the new project, FIRENA (Fondo de Inversión en Recursos Naturales). FIRENA differs from MARENA in two critical ways:

(a) The project focuses on the installation of gravity-driven sprinkler irrigation systems and is undertaken only in communities where such a technical option is available. Soil conservation is an obligatory technical adjunct rather than the main offering of the project.

(b) The project is managed in a mixed public and private implementation that bypasses the central offices of the Ministry of Agriculture in Santo Domingo. The Junta is the legal owner and implementer of the project, and funds no longer pass through the ministry. Technicians from the Ministry of Agriculture are still involved, however, as managers of the project.

These differences between the design of MARENA and FIRENA derive from differences in the actors who wrote the respective proposals. MARENA, brainchild of urban-based technicians, emphasized soil conservation. FIRENA, written with direct input from the Junta and its rural clientele, includes soil conservation but embeds it in the context of a much more important productive input, irrigation. MARENA was captured in its entirety by the Ministry of Agriculture; FIRENA is managed by the Junta.

FIRENA is much more restrictive than MARENA in its selection of project communities. The prime requisite for participation is the availability of sources of groundwater that can be tapped or diverted within a few miles of the community. Because no pumps are used, the water must be above the level of the fields to be irrigated, capable of being gravity-driven to catchment tanks within the community, whence it is channeled via plastic piping to the target plots themselves.

This decision created problems from a simple perspective of equity; many communities that could participate, or actually are participating, in soil conservation activities are excluded from the new project. From the perspective of economic development, however, the decision is more than justified. Investments in soil conservation by itself produce at best mediocre economic payoffs; all communities have equitable access to something of limited short-term productive value. In contrast, project investments in water stand a chance of doubling or trebling the number of crops that can be grown each year, increasing the yield per unit of each plot and substantially increasing the annual income of the participating families. From a simple conservationist perspective, access to water inputs creates local openness to soil conservation in a way not seen in communities where soil conservation is the project's major offering.

The feature that distinguishes FIRENA from other irrigation or soil conservation projects is the obligation imposed on beneficiaries to subdivide their holdings. During the project's design stage, the controversial decision was taken by the Junta to bar from the project any landowner with an irrigable plot who refuses to turn over a substantial portion of his land for rent-free use by community members who have no irrigable land. A landowner who wishes to be included in the irrigation system must turn over a specified percentage of his holding to neighbors.

The rules of the game, however, were structured so that participation is in the economic interest of landowners as well as of *asentados* (community members being "settled" on the plots). In no case have landowners been obliged to turn over more than half of their land to neighbors, and landowners with small amounts of irrigable land are required to turn over a substantially lower percentage. Furthermore, owners do not have to deed over the land to the neighbor. They merely sign a contract guaranteeing that as long as the water continues flowing, the *asentado* can crop the agreed-on plots rent-free.

This rule governing land redistribution is the most striking organizational feature of the new project, but other conditions and rules apply as well.

(a) All recipients of water, whether a landowner (*propietario*) or a settler (*asentado*), agree to cease cropping their upland plots in annuals and to begin planting them in fast-growing wood trees.

(b) They agree to cover all their plots, particularly the irrigated ones, with appropriate, project-approved soil conservation measures at their own expense.

(c) They agree to reimburse the project for the cost of installing the irrigation system, thus permitting project funds to be used again in other communities.

(d) They agree to refrain from bringing in outsiders as partners in the cropping of the land (because FIRENA does not provide production credit, farmers seek out such arrangements because they lack the capital to exploit the irrigated plots fully).

Under the conceptual model discussed in the introduction, all of these rules belong to the "organizational" domain of a soil conservation system. That is, they are conceptually distinct from and independent of the technical interventions applied on the hillsides themselves to prevent soil runoff. Yet without a system enforcing these (or functionally equivalent) organizational rules, most of the decisionmaking economic actors in the region simply would not find it worth their while to apply the technical interventions in the first place.

FIRENA responded to the defective organizational arrangements of the implementing institutions that also plagued MARENA with a creative administrative arrangement that neither fully depends on nor fully bypasses the institutions of the state. Its mode of project organization permits a publicly funded project to be managed by government employees at a level of efficiency more characteristic of privatized administration. Although the director of FIRENA and many of the project technicians are employees of the Ministry of Agriculture, which continues to pay their salaries, the project agreement places their day-to-day operations under the authority of the local Junta. The flow of project resources also bypasses the Ministry of Agriculture. The funds ultimately come from USAID's PL480 funds, which are generated by the local sale of surplus food. The money generated by this sale passes to the Controlaría General de la República Dominicana and is under the budgetary authority of the Secretariado Técnico de la Presidencia (Technical Secretariat). The Technical Secretariat authorizes the Controlaría to write checks for the project. Whereas under MARENA the Technical Secretariat would then have disbursed the funds to the Ministry of Agriculture, with the resulting problems already discussed, under FIRENA the funds are channeled directly to the Junta-controlled FIRENA office in San José de Ocoa. No ministerial functionary or office has authority to delay, divert, or otherwise obstruct the flow of cash to the project site. This arrangement constitutes an administratively effective alliance of governmental and nongovernmental strengths. It is a pragmatic, evolutionary compromise between the customary insanity of burying project funds in the maws of extractive ministries, on the one hand, and several more recent attempts to bypass the state completely, on the other.

Major project results

TECHNOECONOMIC COMPONENT

This report proposes an integrated scenario in which the spread of soil conservation has three dimensions: first, an internal "zonification" of production; second, the application of appropriate soil conservation methods to intensively cropped plots; and finally, the development of farmers' concern with the ecological condition of upland plots over which they have no control, but whose ecological mistreatment could have negative downstream impacts on their own holdings.

The differentiation between intensively cropped and extensively managed plots could not and did not occur in MARENA. The turn to extensive protective management of some plots presupposes that the farmer has access to both the land and the inputs required for a conversion to intensified production on smaller, more appropriate plots. MARENA had no such offering for the farmers.

In FIRENA, this internal conversion to internally differentiated production within the same holding can occur because the input of water opens up an intensification option not formerly available to the community. However, water is a necessary but not a sufficient condition. Even the technical objectives of the soil conservation component would have been sabotaged if a simultaneous organizational shift had not accompanied the introduction of irrigation. If the project had not dealt structurally with the dilemma of access to land, the ecological payoffs from the introduction of irrigation and soil conservation would have been at least partially neutralized.

Even in this community, a serious, unresolved dilemma must be recognized. The technoeconomic goal is to allocate all the land of a region to an appropriate use (including total nonuse in the case of some zones). The intensification of production has been achieved on some plots, but extensively managed production of the remainder of the community's land has not yet been achieved.

Some farmers have begun experimenting with planting fast-growing wood trees on unirrigated land. The current scarcity of wood in the Dominican Republic, and current market prices for wood of all types, whether for fuel or for construction, creates ideal commercial conditions for planting fast-growing wood as an income-generating crop. This option has been viewed as the ideal upland counterpart of the intensification of lower-lying land via irrigation. Several farmers were interviewed on this matter. One of them had pioneered the local planting of fast-growing wood for this purpose. He had consulted with wood merchants and learned that he could expect to receive RD$25 (about US$2.00 per tree at the exchange rate at that time) for the trees he had planted some four years previously. A spacing of 2 meters by 2 meters would yield 2,500 trees to the hectare. This would give a gross income of US$5,000 per hectare through a tree-growing cycle or, assuming a four-year rotation, US$1,250 per hectare a year. A number of factors—the costs of seedlings, labor, tree mortality, and the like—may reduce this, but the final outcome would more likely be higher than the US$5,000. Farmers would be paid US$2 per tree by an intermediary at the farm gate. If they transported the wood themselves to Santo Domingo, they would easily double this monetary yield.

For nearly eight years, this option of planting fast-growing wood as an income-generating crop has been talked about in the region. Numerous farmers are interested, but the current situation is a dismally spectacular illustration of the ability of structural variables to sabotage technoeconomic variables. Current Dominican forestry laws make it a criminal offense to cut any tree, including domesticated trees planted on one's own property, without permission from the army. (The forestry authorities are part of the Dominican military.) Several farmers did, in fact, plant trees for commercial purposes in the early 1980s and even secured prior authorization to harvest them. They even secured another permission before harvesting the wood. Nonetheless, the entire truckload of wood was simply confiscated at one of the army posts on the road to Santo Domingo. This structural condition makes planting wood a risky venture.

An even more macabre illustration of the sabotaging role of this structural impediment is seen on the irrigated plots themselves. Following faulty technical advice, several farmers planted *Eucalyptus camaldulensis* on the border of their irrigated fields, next to the road. The desiccating impact of the maturing eucalyptus caused serious crop losses within several yards of each tree, yet the landowners face fines and possibly even jail if they cut down the trees. The trees remain standing to this day, reducing the yield on intensively cropped irrigated plots.

To sum up, the internal differentiation of cropping between intensively and extensively cropped plots has begun to occur under FIRENA, but the process is still being impeded by the existence and enforcement of perverse government policies.

The second systemic facet of soil conservation is most commonly associated with the term in common parlance: the application of protective measures to plots cropped in annuals. In the technology of soil conservation itself, there was no fundamental break between the measures used by MARENA and those used by FIRENA. The principal soil conservation device is the planting of grass strips, with interspersed diversion canals.

All farmers participating in both projects had to plant such barriers as a precondition to obtain access to project resources (credit in one case, water in the other). The technical quality of the barriers, and the farmers' willingness to maintain them, seems to be much higher under FIRENA than under MARENA. Now that MARENA has ceased, farmers can let the grass strips wither with impunity. Although no formal survey was conducted, most of the MARENA plots seem to have reverted to their original condition. Although project personnel note with satisfaction that many farmers maintain their grass strips even though the project has ended, the vestigial remnants of barriers left to decay are a striking sight.

In contrast, the soil conservation activities in FIRENA communities appear to go beyond what is strictly mandated by project policy. In some irrigated fields, farmers have physically removed rocks from the center of plots to clear more land for irrigated farming and have placed them at the sides to create barriers. The grass strips are planted densely and carefully in straight lines. In the community of Los Martínez, the post-rainfall buildup of soil behind the barriers has resulted in configurations that strongly resemble bench terraces. To reach the irrigated valley, it is necessary to traverse several kilometers of dry, eroded, treeless landscape. On rounding a bend and entering Los Martínez, one sees aesthetically planted grass strips and quasi–bench terraces and has the impression of being suddenly catapulted out of the Caribbean and into Southeast Asia, Madagascar, or some other setting where soil conservation has a long tradition.

This vista of carefully protected irrigated hillsides gives wind to the sails of explanatory models that place heavy emphasis on the material underpinnings of social change. Although the soil conservation technology used and the messages promoted by FIRENA are similar to those of MARENA, the technical result has been quite different. The improved cost-benefit dynamics created by irrigation have given great impetus to soil conservation. Nothing analogous can be seen in the lackluster results in MARENA communities.

The third facet of an advanced soil conservation system involves the emergence of an awareness on the part of a "downstream" population that upstream behaviors have a negative impact on their own livelihoods and the emergence of mechanisms translating this awareness into action. This has begun to occur in the Ocoa area, but only in the FIRENA project.

The rules of the land reallocation system specify that if, for whatever reason, the irrigation project ceases, all plots will revert to their original owners. The major threat to the irrigation system is that the streams feeding the system will dry up. Farmers are aware that such a catastrophe could come in the wake of upland deforestation of the hills surrounding the streams. FIRENA communities, therefore, have organized vigilance committees to patrol, at their own expense, the public park areas above their communities. During the field visit, one of these committees reported the presence of illegal slash and burn agriculture above their community. The report was not filed solely to comply with project norms; the community affected held a meeting about the matter and contacted the forestry department. Two forest rangers came up, met with the community, and promised to take action.

Although one may not be optimistic about any follow-up on the part of the forestry department, one can nonetheless be impressed with the evolution among farmers of a concern for environmental matters even outside their immediate community. Not surprisingly, this concern is motivated not by the generic concerns that motivate environmental constituencies in the industrial world, but by immediate, pragmatic concerns with ensuring their flow of water. In the presence of such a bona fide material concern, no promotional campaigns are necessary to spur the farmers to take action against upland slashers and burners.

ORGANIZATIONAL COMPONENT

The land redistribution mechanism is by far the most important structural "invention" that has emerged in this project. Although inventions are conventionally associated with the domain of technology, the land reallocation mechanism, it can be argued, is an invention every bit as critical to soil conservation as technical interventions are. At first glance, this organizational decision to reallocate access to land appears to be an equity-driven humanitarian measure with little direct relevance to the technology of soil conservation. Such, however, is not the case. It is important to distinguish between external equity and internal equity. External equity between communities has had to be temporarily sacrificed under the FIRENA model because some communities benefit from water, while others do not. Internal equity considerations, however, threaten to sabotage even the technical objectives of the project.

The problem is as follows: even within communities fortunate to be within striking distance of upland water sources, the accidents of local topography and of local land tenure mean that only a small number of lucky landowners benefit from the newly installed system. This is not only problematic from a social, humanitarian perspective but also defeats the technical goal of promoting soil conservation itself. Farmers with land only on steep hills are forced to continue in their traditional ways, planting inappropriate annuals on land that should be covered with tree canopy and having little economic motivation to apply conservation measures since these new measures only generate meager increases in production. MARENA tried to reach such farmers, but with mediocre effects.

This is a pragmatic illustration of a theoretical point made earlier: the impact of a breakthrough at the technoeconomic level can be either facilitated or thwarted by organizational variables. For the introduction of irrigation to trigger more ecologically appropriate uses of community land, access to local land had to be reorganized. Some mechanism had to be instituted to permit poorer farmers who were restricted to land on higher slopes to shift their cropping to the irrigated plots. The solution adopted was the requirement that landowning beneficiaries of irrigation cede a given proportion of their holdings. This type of organizational invention, or some functional equivalent, is every bit as critical to the emergence of a soil conservation system as the technological measures applied.

A second major organizational "invention" made in FIRENA has already been discussed: the combination of public and private management. FIRENA's cash flow arrangements and lines of authority permit state employees to carry out major technical and managerial tasks without permitting capital-based offices to delay or divert the flow of funds to the field operations of the project.

Ideational component

Although no hard data are available, both MARENA and, especially, FIRENA apparently succeeded in changing local beliefs and attitudes toward soil conservation. Farmers indicated that, at the beginning, they engaged in soil conservation in compliance with project norms and in expectation of obtaining project resources. If they could have acquired credit or water without soil conservation, most would have done so. Farmers were engaging in cost-benefit calculations of whether to practice soil conservation or not. The perceived costs were the apparent productivity lost by taking up space with grass barriers of questionable utility. The perceived benefits were the access to project incentives rather than the increased productivity of the protected plots.

In the case of MARENA, the carrot was access to credit. As discussed earlier, however, what was administratively categorized as "conservation credit" was in fact used for other purposes. In the case of FIRENA, the incentive was access to irrigation. All participants, whether landowners or *asentados*, were obliged to protect their plots with project-approved soil conservation interventions. In principle, they were also supposed to protect their upland plots, although the enforcement of this stipulation seemed meager.

At this start-up phase, it is highly doubtful that local farmers would have invested in soil conservation without project incentives. The difference between this domain and irrigation is striking. Farmers were willing to go into heavy debt to gain access to irrigated land; they were willing to commit themselves to substantial regular payments to reimburse the project for the pipes and other material inputs used to construct the irrigation systems watering their fields. The increased production derived from irrigation is so impressive and so secure that farmers leapt to gain access.

In contrast, the productive increments to be expected from soil conservation were viewed (correctly) by the farmers as neither impressive nor secure. Whereas the turn to irrigation was recommended spontaneously by the local population, soil conservation was initiated and promoted by outside agencies for reasons somewhat murky to the farmers. They could be (and were) coaxed to go along only under project-mediated incentives.

At this juncture, numerous farmers made unexpected comments: farmers in both projects who employ soil conservation measures indicated an apparently genuine appreciation of their value. They were asked questions about the value of soil conservation that were purposely phrased to sound skeptical and, possibly, to elicit admissions that farmers continued to practice soil conservation for extraneous motives generated by the project. These attempts were apparently misguided. The appreciation of the value of soil conservation now seems genuine on the part of those farmers who have practiced it for more than one or two cropping cycles.

What surfaced, however, was the widespread (and perhaps predictable) tendency to value soil conservation for its short-term protective, rather than its long-term productive, payoffs. That is, the advantages to soil conservation are generally phrased as the absence of the rilling and gullying that traditionally occurred on their plots. Farmers perceive the advantages of soil conservation more as the absence of damage to fields rather than as increments in production. Whatever the specific perceptions, however, conservation practices are now viewed as highly desirable. Several of the farmers interviewed berated themselves and their parents for not attending in the past to what now seems an obvious matter.

Summary and discussion

Culture as a system

In its traditional vernacular sense (culture as personal refinement, erudition, aesthetic appreciation, and so forth), the concept of culture has little value to analysts of soil conservation. The alternative definition developed here seeks to equip the term with utility for analyzing economic development. Doing so moves away from two other uses of the term common among anthropologists and sociologists: (1) culture as a personal or corporate worldview and (2) culture as the cluster of features that distinguish a particular society from others.

This chapter proposes instead a systemic definition of culture as a system of techniques, implements, behaviors, beliefs, rules, group structures, and other elements. Following the lead of other anthropologists, this kaleidoscopic hodgepodge of elements is organized into three logically coherent clusters: a technical-economic component, an organizational component, and an ideational component. Under this paradigm, a community's technology, its market system, and its profit-maximizing and risk-minimizing strategy are viewed as one component of (rather than separate from) its culture.[12]

Departing somewhat from conventional social science, which uses this paradigm to analyze entire societies, this chapter attempts to examine the specific domain of soil conservation using the paradigm. It might even be useful to analyze individual projects in this light, examining each project's technical and economic offerings, organizational and institutional channels of resource flows, and stated rationales, motivational messages, educational structures, and channels of information flow.

Primacy of technoeconomic variables

Lodging the economy and technology as components in a broader cultural system in no way detracts from their primacy. The use of this paradigm is perfectly compatible with an economic hypothesis of the priority of cost-benefit variables. The culture-system model only demands that the analyst also gather information on organizational and ideational variables and incorporate them into a description and analysis of a system. The three components are not autonomous. To the degree that they are a genuine system, change in one component triggers change in another. In theory, change could be initiated in the realm of ideas and trickle down to new organizational forms and new economic behaviors. In actuality, significant systemic change is more often impelled by changes at the base. Changes in technologies and cost-benefit ratios can trigger organizational and ideational change more often than vice versa.

A compromise proposition that is compatible with the findings of this research and that incorporates all three clusters of variables into a causal model would be the following. The emergence of soil conservation may possibly, but not necessarily, occur in the wake of, and as an adjunct to, some productivity-enhancing technical, economic, or commercial breakthrough—a profitable new crop, a productivity-enhancing technology, a change in market conditions, or the like—that enters a system of land use. In this research, the introduction of water was the catalyzing variable. To state the matter strongly, without some catalyzing technical or economic change that dramatically alters the lethargic cost-benefit regimes of traditional agrarian systems, it is unlikely that new soil conservation will spread, either through spontaneous local development or through project-mediated promotion. A significant decline in productivity can, of course, be one of those catalyzing factors.

Soil conservation: facilitator, not prime mover

In the search for technical or economic engines to drive change, soil conservation should not be assigned this role naively. The results of this brief investigation suggest that soil conservation is best analyzed (and promoted) as an ancillary, auxiliary force rather than as a prime mover in its own right.[13] That is, the short-term, productivity-enhancing capacity of soil conservation measures in isolation—in the absence of simultaneous breakthroughs in other technical or commercial domains—is quite reduced, at least in the cases studied here.

If these case studies can be generalized, innovations in soil conservation should not be expected to function as the catalyzing technical innovation that catapults a dormant agrarian system into forward movement. Rather, soil conservation as a domain is most effectively introduced as an ancillary adjunct to inputs more capable of generating increments in short-term productivity. This limitation of soil conservation is particularly true in the impoverished subsistence systems that have already come under stress in much of the tropical world. In such systems, enthusiasm for soil conservation is high only when the increments in productivity likely to come from new land use practices rise above a certain threshold. Soil conservation by itself rarely creates or sustains such threshold levels of increments. Rather, soil conservation is generally adopted in conjunction with, and in response to, other technological or economic shifts.[14]

Dominican farmers are more open to soil conservation measures when these measures are presented not as the principal element in the project, but rather as secondary, ancillary items in a menu featuring innovations with impressive short-term, income-generating potential. Gravity-driven sprinkler irrigation of hillside plots was the catalyzing input in this study; soil conservation came in its wake. In contrast, an earlier program that focused on soil conservation itself produced mediocre results in the same region. That is, although this research points to the primacy of economic factors in the spread of soil conservation, the perceived advantages of soil conservation itself paradoxically were not the catalyzing factor that spurred Dominican farmers toward the initial adoption of soil conservation. The catalyzing innovation observed here was gravity-driven hillside irrigation; soil conservation was a project-mandated adjunct without which farmers could not gain access to the water. Once irrigation entered the local farming system, however, with its radically altered cost-benefit ratio, farmers maintained soil conservation spontaneously, even when project monitoring became lax.

The role of organizational inputs

Even when soil conservation makes economic sense, the shift may not come spontaneously if essential social or political conditions are not present. Organizational variables—local land tenure arrangements, government policies concerning trees, institutional traditions regarding the use of donor funds, the presence or absence of farmer groups willing to pool labor for soil conservation—interact with cost-benefit variables to affect farmers' interest in soil conservation. Such variables must therefore be factored into descriptions and explanations.

The impact of social and political variables on soil conservation technology goes back in time. In ancient times, organizational prodding took the form of coercive labor levies by which states (the Incan state is a case in point) organized the construction of bench terrace systems. The installation of such systems is rarely if ever the product of decisions that small farmers make without the external influence of the community. Social and political variables intervene to determine whether objective technoeconomic potentials get converted into behavioral facts.

In the Dominican cases observed here, the social and political prodding took the form of a carrot rather than a club. The project made access to water contingent on a farmer's adoption of appropriate hillside soil conservation practices on irrigated plots. One could ask why farmers would not, when faced with irrigation possibilities, spontaneously devise their own soil conservation measures without external prodding. The answer would have to be that human social systems do not function in neatly mechanistic stimulus-response pathways. Evolving technology and cost-benefit regimes merely establish new objective economic potentials, but organizational and ideational factors heavily determine whether these potentials get translated into behavior. The irrigation variable (the technoeconomic input) created the conditions in which soil conservation might make more economic sense in the Dominican communities studied, but social and political engineering were necessary to ensure the conversion of that potential into behavioral reality. It is highly unlikely that soil conservation practices would have been adopted as rapidly, or at all, if the project had not created a strong incentive in that direction.

THE ROLE OF IDEAS AND MESSAGES

Where does the third level of the model, the level of ideas, enter the equation? If change must enter the system "from below," as is being argued here, does any role exist for programming in the realm of information and ideas, for new technical ideas, for the construction of educational messages, and for the promotion of a new overall conservation mystique?

The population among whom this research was conducted was, until a decade ago, unaware of several simple soil conservation measures whose application has since led to visible declines in rilling and gullying. Several farmers said independently that the application of these techniques led to substantial increases in the productive capacity of their land. Educational inputs—which clearly fall into the ideational component of our model—proved to be a key variable.

Just as the shift to conservation would not have occurred without social and political facilitation, the ideas, information, conservation values, and messages that embody these ideas are equally necessary. The project examined here delivered not only plastic pipelines to farmers but also one stream of messages about how to install and use the pipes and another about the why and how of soil conservation. Messages were not limited to factual information; an attempt was made to promote a new mystique of soil conservation as well. Placing emphasis on the determining power of cost-benefit factors does not eliminate the need for ideas and messages.

Observations made in this research suggest, however, two types of caveats concerning project-mediated manipulation of messages. In the first place, messages and exhortations can only act as facilitators and accelerators of change, not as prime movers. The developing world is dotted with poorly conceived soil conservation projects that lavishly fund the production of flip charts, slide shows, and motivational rallies as the prime causal agent in promoting soil conservation. Such a reliance on messages as the prime vehicle of change is flawed both theoretically and practically. In our culture-system paradigm, the message component of a soil conservation project should be conceptualized somewhat as the manual that accompanies a new computer. Excellent technology is not used if the intended users are ignorant of either its purpose or mechanics. Concepts and new information must accompany material inputs; computers must be accompanied by documentation.

But more than one soil conservation project has in effect allocated all of its resources to what would figuratively be the preparation of the manual—educational messages and motivational gimmicks—leaving impoverished farmers to figure out how to acquire the material inputs required to implement the instructions. The FIRENA project, in contrast, began with a bona fide material input—irrigation—to which farmers were given access. (It should be recalled that access was extended through reimbursable credit, not through gifts.) Then and only then were soil conservation techniques and messages built around the core input. In our causal model, information, ideas, exhortations, and other ideational phenomena are necessary systemic adjuncts to technical and economic change. Such messages and educational inputs are usually doomed to failure, however, if they are the project's principal offering.

The second caveat is that the power of demonstrations and messages (at least in the projects observed) increases substantially as a function of the socioeconomic similarity between the sender and receiver of the message. During the observations in the Dominican Republic, a group of farmers from another part of the country strongly reacted to and commented on the protected plots of farmers in a project community; it is doubtful whether an equivalent impact could have been achieved through demonstration plots managed by project technicians. These visitors listened to talks given by two participating farmers from the project community, and these talks appeared to elicit deeper responses than similar talks given by project personnel. A dilemma of this or any project is, of course, that such farmer-managed demonstrations or messages are not available until a project has already been successfully implemented in at least one community; project-managed demonstrations and talks are necessary, but in the long run, the motivational impact of the message depends somewhat on the identity of the message sender. The patterns of impact have yet to be analyzed in detail. On occasions, messages from high-prestige outsiders have greater impact than messages from locals. Observations underlying this research also indicated, however, the special power of messages emanating from peers already implementing the activities proposed.

Errors occur when projects erroneously attribute independent causal power to such messages and squander entire budgets on preparing messages, rather than on lodging these messages in their proper material context. No amount of educational promotion can induce sustained soil conservation practices in the absence of objective economic returns to these new behaviors. Programs placing excessive hope on educating minds as the prime vehicles of change may be founded on flawed premises. Despite these caveats, educational messages do have a role to play in spreading soil conservation. Although our model attributes causal primacy to objective cost-benefit factors, educational and other ideational inputs influence the direction and speed of change.

The question of artificial incentives

Informative and motivational messages, then, remain important. What about the issue of artificial incentives that are used by many projects? Should projects give extraneous rewards to farmers for soil conservation or artificially subsidize its cost? If objective cost-benefit ratios are the major sustainer of soil conservation, why becloud these ratios by introducing artificial benefits to farmers that may motivate compliance for spurious reasons unrelated to the objective benefits of soil conservation?

The matter merits much longer discussion than is possible here. The concrete experiences of the FIRENA project, as well as abstract principles derived from a culture-system model, argue for flexibility rather than dogmatism in this matter. Dominican farmers had no reason to believe in the efficacy of the new soil conservation measures proposed by project technicians; they applied these measures simply out of a desire to gain access to project water. Once installed under such partially artificial incentives, however, the measures impressed farmers as contributing substantially to their economic returns on irrigated plots (and further as adding an unprecedented order and aesthetic beauty to their hillsides). The soil conservation measures will probably be maintained in some fashion even if project policy ceases to make them mandatory. The artificial incentives seem to have functioned positively in this particular case.

In contrast, the earlier MARENA project is a case study in the misuse of artificial incentives. In that project, the major input was soil conservation itself, and the project made credit available to farmers willing to participate. Some of the credit was supposed to pay for the labor and inputs required for soil conservation; the remainder of the credit was for agricultural production. Farmers jumped at the opportunity to obtain credit and compliantly filled their hillsides with the required vegetative barriers (doing the labor themselves and using the credit for extraneous purposes). Because no new dynamic farming system was introduced, the increments in production that were derived from soil conservation were viewed as minimal to null. The farmers complied, but many of the barriers have since been abandoned.

The principle appears to be that if project technicians have solid reasons for believing that the soil conservation measures will be part of a transformed farming system with dramatically increased returns to farmer investments, then a role may exist for incentives that prime the system. Where increases to farmer revenues are tenuous, the use of incentives may be simply a project gimmick to engineer farmer compliance and the illusion of project success.

Analyzing perverse institutional impacts

The model proposed permits—or rather forces—negative institutional variables to be identified in the description and analysis of soil conservation programs. Even brief fieldwork within this framework uncovered two institutional glitches that sabotage projects in the Dominican Republic.

The first concerns early project monopoly of funds by predatory government agencies based in the capital city. The lackluster performance of MARENA occurred largely because the urban bureaucracy captured more than 85 percent of project funds. This capture was, in turn, made possible by the disbursement practices of USAID. The problem was rectified in the follow-on FIRENA project, in which money was channeled directly to a nongovernmental implementer in Ocoa. Government technicians were then assigned to the project. This arrangement is working. Thus the superiority of FIRENA can be attributed only partially to irrigation; if the channels of resource flow had not been readjusted at the outset, even FIRENA would have succumbed to the institutional predation that crippled its predecessor. The point at issue is that institutional variables are as important as technical variables in analyzing the progress of soil conservation.

The second institutional glitch, a matter of perverse policy, continues to paralyze the villages. As indicated earlier, a major goal of FIRENA was to restrict the cultivation of annuals to protected, irrigated plots and to convert steeper slopes to fast-growing, income-generating wood trees destined for sale in local pole and charcoal markets. But the current policy of the Dominican government is to prohibit the cutting of any wood, whether natural forests or trees planted by farmers on their own land. Several farmers allocated part of their holding to wood trees, only to learn that early government guarantees of harvest rights had been rescinded. The prohibition is so draconian that it affects even farmers who, under poor technical advice, had planted a small number of eucalyptus trees on the border of their irrigated plots. The trees are now competing for water and causing serious declines in production on those plots, but the farmers will be fined and incarcerated if they remove the trees.

Far from being tangential to cost-benefit analysis, these institutional variables either impede the flow of benefits by capturing funds for central offices or create serious costs to farmers by making it economically irrational for them to engage in otherwise rational economic behaviors, in this case the planting of trees. In standard economic analyses of soil conservation, these institutional variables would be considered tangential. In the culture-system paradigm proposed here, they are incorporated into the analysis.

Can noneconomic factors be quantified?

Even descriptive data on these factors are useful for theoretically understanding the processes and practical programming of activities. Can they be quantified and, possibly, included in formal cost-benefit analysis? Although not attempted in this paper, it is not, in principle, impossible. The analyst might have to settle for a weaker ordinal level of measurement than the interval or ratio levels used in traditional economic analysis, but some numbers could potentially be assigned.

To illustrate, let us examine two villages, A and B, with similar economies and ecologies. Village A enjoys a well-organized farmer group with a positive track record in mediating farming systems projects. Village B has no such group. If the hypotheses discussed here are correct, even given identical plots and cost-benefit regimes, farmers in village A will respond more quickly to soil conservation than farmers in village B. A standard economic analysis, however, would show identical cost-benefit ratios for both villages.

The higher likelihood that the first village will respond could be captured in numbers by a threshold factor. The perceived profitability of the new interventions would have to be very high in village B to trigger action, but much lower in village A. The presence of a well-organized farmer group could be coded, for example, as a 20 percent threshold-lowering factor. If it would take an anticipated profit increase of RD$1,000 per hectare to spur village B into soil conservation, farmers in village A would be predicted to need only RD$800 more profit per hectare to engage in soil conservation. Positive factors (such as an active farmer group) would lower the required threshold. A negative factor, such as broken promises in earlier projects, would raise the threshold. The precise, appropriate figures are, of course, not known at this point. The actual factors and percentages used would have to be based on empirical data not yet available, and the manner of including them in equations would be explored by the economists responsible for precise numerical analysis. The point is, however, that the organizational and ideational factors discussed in these pages are amenable to some quantification.

Notes

1. In the execution of this work, the author benefited from the assistance of many people. He is grateful to Ernst Lutz of the World Bank for his invitation to carry out

this research and to Dr. José Abel Hernández for documentation on the projects and the regions. In San José de Ocoa, he received much assistance from the staff of FIRENA and from that of La Asociación para el Desarrollo de San José de Ocoa and is particularly grateful to Ing. Carlos Bonilla and P. Luis Quinn. Also, comments by Jan Bojo and Stefano Pagiola are gratefully acknowledged.

2. This was carried out by José Abel Hernández, who also selected the specific region and projects to be examined in the Dominican Republic; see chapter 9 of this volume.
3. In the nonmonetized tribal subsistence economies with which much of traditional anthropology used to concern itself, this hypothesis would have to be qualified. Returns to investment would have to be measured by a variety of nonmonetary payoffs, some of them difficult to measure. Such a qualification is, however, unnecessary in the Dominican Republic, where the rural population is heavily involved in production for local and international markets and where popular concepts of returns to investment are phrased in Dominican pesos. In the region where this research was carried out, the rural areas of San José de Ocoa, recent research financed by the German government has revealed that small farmers reserve less than 5 percent of their agricultural commodities for home consumption. The bulk is consigned to the market. Explicit monetary calculations are therefore central to the cost-benefit considerations governing the behavior of the population to be discussed here, including their decisions to use or not to use new soil conservation practices on their land.
4. The original intent was to study two projects in ecologically and socioeconomically different regions of the country, but this was abandoned in favor of examining two different program approaches to soil conservation implemented in one and the same region.
5. Many anthropologists restrict their definition of culture to the underlying rules and other ideational and attitudinal factors. As we shall see, the approach used here treats the cognitive dimensions of culture as merely one component of many.
6. The term technoeconomic has been coined in anthropology to refer generically to a cluster of underlying ecological, economic, technological, and demographic factors whose evolution triggers simultaneous change in the realms of social organizational and ideational systems. It is a compound term analogous in its morphology (although not in its meaning) to socioeconomic, psychosocial, sociocultural, and other similar labels.
7. This view assumes that the three subsystems generally do not have equally strong mutual causal impacts. At most times and in most cases, the evolution of the underlying technoeconomic subsystem will exert more causal impact on the evolution of the other two subsystems than vice versa. Economists would, on the whole, be sympathetic to this hypothesis of the causal priority of technical, economic, and other material factors. A model such as this performs the additional task of incorporating the "other" factors not as problematic afterthoughts, but as essential components of the overall system.
8. The distinction between these two types of systems should not be exaggerated; effective modern systems of soil conservation often draw on preexisting traditional systems. Nonetheless, it must be made clear at the outset that the systems being discussed would probably not have been adopted if external agents had not designed and promoted them.
9. The presence of this unusual organization has many causes, not the least of which is several decades of unusually effective activism on the part of a local priest. The Junta itself, though private, remains nonsectarian.
10. Farmers constructed certain types of small ridges for some of their crops, and these ridges were part of the traditional technology antedating project interventions. When asked about these, farmers replied that the traditional function of those ridges was to maximize water retention. The area is semiarid, and before the arrival of irrigation, farmers could produce only one crop a year. These ridges helped capture and hold the moisture. That is, the traditional ridges were not for soil conservation, but for water retention.

11. A species of vegetation (*limoncillo*) used in the original project was found to be defective; it withered and died after a short time, leaving gaps in the barriers. It was eventually replaced by hardier species.
12. This view of culture admittedly runs counter to the convention of contrasting cultural factors with economic factors; it rather subsumes economic elements as a component of a cultural system. This inclusive model in no way defines economics as a subfield of cultural anthropology. Economists and anthropologists not only have different conceptual tools and methods but also tend to focus their attention on different strata within the pyramid. Economists focus more on the bottom level of the pyramid; anthropologists traditionally allocate more attention to organizational and ideational phenomena. The fragmentation of scientific disciplines should not, however, blur our vision of the unified nature of the real-world systems being studied. A culture-system model attempts to recognize this unity and coherence.
13. This point has also been made by Norman Hudson, Francis Shaxson, Piers Blakie, and others.
14. Here we depart somewhat from traditional anthropological analysis, which has focused on the catalyzing impact of negative shifts. Several classic studies have described situations in which improved land management practices were adopted with a view not to enhancing profits, but simply to sustaining traditional levels of productivity per capita in the face of burgeoning populations or declining soil fertility. Valid as these analyses may be in their respective settings, in modern times such clusters of negative stress factors are losing their ability to trigger innovative land use strategies. The stress-driven innovations discussed in many classic studies occurred in populations with few, if any, nonagrarian alternatives. Communities in those settings, when confronted with declining production and no access to alternative agricultural land, were forced to use more labor-intensive techniques, such as soil conservation, to achieve even marginal increments in production. This is no longer the case in the Dominican Republic, where more than half of the population now lives in towns or cities; nor is it true in many other parts of the contemporary developing world, where farmers under stress are more likely to leave farming. Once a certain rural-urban demographic threshold has been crossed, and abandoning agriculture becomes a viable alternative, agrarian stress factors lose much of their capacity to stimulate widespread adoption of remedial conservation practices. Ecologically and economically stressed farming communities in such settings will be inclined, instead, to seek solutions in nonagrarian sources of income.

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Economic and Institutional Analyses of Soil Conservation Projects in Central America and the Caribbean

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