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INTERNATIONAL RANGELAND DEVELOPMENT SYMPOSIUM

SOCIETY FOR RANGE MANAGEMENT
RENO, NEVADA - FEBRUARY 15, 1990

LOW INPUT SUSTAINABLE YIELD SYSTEMS: IMPLICATIONS FOR THE WORLD'S RANGELANDS

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Contents

Dedicated to Walter L. Graves

For his unfailing advocacy of programs in sustainable rangeland development (long before the term became fashionable), and his laudable efforts towards their success.

A Foreword

Sustainable development is an idea whose time has come. It is seen in the "green consumerism" of the supermarket, the concern for global warming and carbon dioxide release, the quest for clean water, and the growing awareness for protecting genetic diversity. It is embraced by captains of industry and workers who make the minimum wage. It is a grass roots movement that cuts across national borders and philosophical dogmas.

Inherent in the movement is the desire to stop hunger and raise the lifestyles of the less fortunate of the world. A major goal of the effort is the development of a secure food supply through sustainable agriculture.

Sustained yield is not new to range people and others with ecological training. The cornerstone of sustained yield is ecological land management. But the development of a sustainable agricultural system requires merging ecological principles with economic reality. Sustainable agriculture requires that the economic system -- communities and society itself -- not just the grass crop, be sustainable. It is a concept, a philosophy, and ethic, a way of life.

Hundreds of definitions have been written recently. All attempts to describe the movement mention four characteristics of sustainable agriculture. First, there must be equity for people on the land; the farmer should have a desirable lifestyle. Second, there must be equity for future generations; options must be kept open. Long-term stability must take precedence over short-term gain. Finally, the environment should be enhanced; we should leave the world better than we found it.

Good land stewardship is a goal of the Society for Range Management. Our Society will proudly continue to contribute to the sustainable development of agriculture and the broader economic system.

Thadis W. Box
Gerald Thomas Professor
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Las Cruces, NM
1990

Preface

The results of development efforts should be judged by two criteria: (1) has the change wrought improvement? and (2) is this improvement sustainable? The critical need for sustainability seems intuitive in retrospect. However, it is a concept that has often been neglected in the clamor to develop. Those with experience in international development are all too familiar with unsustainable technologies; we can recall landscapes littered with the broken pumps and rusted tractors of past projects. Often, development efforts have introduced programs, such as commercial mono-cropping for peasants or settlement for pastoralists, that have ultimately reduced the sustainability of basically sound indigenous systems. The alarming degradation of the global natural resource base is exposing the dire consequences of ignoring sustainability in development planning. Only now has this issue been assigned the governmental and public support that it deserves. However, the question remains: *how can development activities be modified to realize sustainable agricultural production?*

Representatives from a broad spectrum of development organizations were invited to the symposium to address this question. Several of these authors have already established a reputation in the expanding arena of sustainable development, and all are well placed to address the issue. Papers appear from the donor agencies of USAID and the World Bank, and from contractors, including a private firm (Development Alternatives, Inc.), the Title XII Universities, and a non-governmental organization (Heifer Project International). Notably, the pertinent topic of sustainability in American agricultural practices has been discussed by a member of the US Soil Conservation Service Office in Washington, DC.

Because of their arid and fragile nature, the world's rangelands are among the first ecosystems to show the symptoms of resource misuse. Thus, the Society for Range Management has a large stake in this dialogue. We are very pleased with the support received from the development community and with the thought and preparation demonstrated in the papers presented herein. We trust you will find these proceedings useful as well as interesting.

The Editors

THE ROLE OF NGOs IN SUSTAINABLE YIELD SYSTEMS

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ABSTRACT

Since agricultural NGOs usually work with small-scale, low-resource farmers, their emphasis is more on sustainable development than on sustainable yields. However, the NGO process, concentrating as it does on people and the environment as much as on quantifiable yield, can demonstrate how flexibility and response to social factors can contribute to sustainability in several aspects of agriculture: economic, social, and environmental. Examples of HPI's work, locally as well as internationally, are used to illustrate this process.

INTRODUCTION

Before going too far, perhaps we had better make sure we are all speaking the same language. First, NGO's (non-government organizations), as they are referred to internationally, or PVO's (private volunteer organizations) in USA jargon, operate under their own mission statements, and are governed by independent boards of directors rather than by the government, as the name would suggest. "Sustainable yield systems" will not be quite so easily explained, since nearly everyone operates under a unique definition of these terms. For clarity, let me offer you our view as a livestock development organization that works directly with small-scale farmers throughout the world. For us, sustainable yield means that the programs we support continue to yield benefits indefinitely after we have withdrawn from the process. But this immediately introduces some ambiguity, since "yield of benefits" for an NGO does not mean the same as "yield systems" in a more focused agricultural sense. Since we define sustainable yield as long-term benefits to the community, a major focus is on the people and the environment, rather than only on the yield that leads to income or improved nutrition.

To illustrate how yield is only a part of the problem, we can examine the outcome of a project that obeyed all the criteria for successful yield, but failed to produce sustainable development for the community. Latin America has provided us with many lessons, not least of which is the effect politics can have on any attemps to develop local economies. In Guatemala our commitment to helping subsistence farmers help themselves ran counter to the government policy of providing large, commercial, USA fruit companies with cheap labor. When the beekeeping project in a village was successful enough to provide income for the families, the men were able to build a carpentry business for the hives and sell wax and honey to pay taxes instead of migrating to the plantations as seasonal labor. First, the labor brokers came into the village to burn the carpentry operation, and when this did not stop the villagers, the men

were all called to a meeting and shot by the government for insurrection.

Because of these cultural, political and environmental factors that have to be taken into consideration to ensure a sustainable yield, the term "sustainable development" is now widely used. The World Commission on Environment and Development has defined sustainable development as "Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (WCED, 1987). They point out that protection of the environment is the basis of sustainable agricultural production, but that poverty is a critical element to be addressed in the process of environmental protection (Heifer Project Exchange, 1989). As Miguel Altieri has pointed out, "sustainable agriculture" is a rather ethnocentric Northern term. Poorer countries are more concerned with poverty (CODEL seminar, 1989).

PHILOSOPHY OF DEVELOPMENT OF NGOs

NGOs are perhaps unique in this focus on people and the environment rather than on the yield or technology. Dr Richard Harwood points out that the NGO process is directed towards groups of people (communities) and clusters of appropriate technologies (Harwood, 1989). This approach lends itself to a rather different and certainly more difficult evaluation process from those based on a measurable objective such as yield or income. For one thing, the period of time needed to see results is far longer than that needed for measuring production of annual crops alone. Documentation can become a major problem. However, Will Getz points out that lack of documentation does not mean lack of effectiveness, just that one cannot easily measure effectiveness. The issue is further complicated for us as a livestock organization because in most cultures animals play a socio-cultural-religious role, with more than the usual measurable monetary or direct nutritional value. Since crops rarely have all these values, crop agricultural development is far easier to document. Will Getz came to the conclusion that the effectiveness of NGOs in livestock development often depends on having "the right person there at the right time." Development doesn't happen at the convenience of the consultant who is only there for short periods. This requirement is easier for NGO's since they commonly employ committed people who are there "for the long haul" (Getz, 1985). The challenge for these committed people is to avoid creating a dependency which would run counter to the aims of development.

For sustainable development to happen in our projects, we have found that three elements are essential. First, the local farmers must feel enough need and ownership in the whole process that they volunteer active involvement in management and planning from the outset. Second, the benefits must spread within the community rather than just enrich the lives of a few. And third, the environment must be protected so that the benefits will not diminish over time. These criteria are not the exclusive property of

NGO's, but can be applied by anyone working in the field of sustainable agriculture anywhere in the world. In summary, the aim is to assist people in their struggle for economic, social, political, and environmental security. Economic security is achieved through increased income from productivity or yield, but equally importantly, social and political security comes from a confidence gained through personal dignity and sustainability of their livelihoods.

So far we have discussed our approach to sustainable development. Let us now turn our attention to the topic at hand: the role of NGOs in sustainable yield systems. The WCED came to the conclusion that NGOs' who deal with development and environmental issues "will be ever more important in the future. An increasing number of environmental and development issues could not be tackled without them." According to this commission, increased support of internal NGO's that will allow them to expand their services represents an indispensible and cost-effective investment, and these groups should be accorded high priority by governments, foundations, and other private and public sources of funding (WCED, 1987). Of course, we have every reason to agree with their assessment.

These services the WCED would like to see expanded are almost always associated with small scale. The environment and conditions of the people in one place may be very different from those in the next village, and also may vary over time. This small scale emphasis enables grassroots NGOs to respond to and respect the real and felt needs expressed by local farmers (Development Forum, 1989). NGO administrations, being relatively decentralized, are able to be flexible both with respect to time and place. If a group of farmers starts developing their productive capability, for example, their needs will change to include the need for new markets, transportation and storage.

In fact, a common denominator for small-scale farmers all over the world is their relative isolation from the benefits provided by the mainstream structures. In this context, development can lead to only limited benefits unless linkages can be made between poor, rural people and their own governments or local institutions. These may be markets, financial institutions, extension services, or technical training centers. For development to be truly sustainable, these linkages must be made, and the NGO's can serve as the "brokers" while the glue is setting, so to speak.

A recent USAID report "The Effectiveness of the Private Voluntary Organizations" identified both the characteristics that contribute to PVO ability to design and manage sustainable projects, and those that impede this ability. Those that contribute are
--Sensitivity to local conditions, social and cultural constraints and opportunities
--Contacts with local organizations and local leaders
--Cost consciousness that relies on local resources and management
--Continuity: maintaining a presence in the community for

many years.

In the interests of objectivity, we should mention those that impede the process. These include:
-- a tendency to emphasize short- as opposed to long-term results
-- inadequate attention to market forces
-- limited human and financial resources: small projects are often confined to small populations in limited areas and are underfunded
-- limited organizational development skills for teaching how to manage problems and mobilize resources from a variety of sources
-- limited access
-- humanitarian paternalism (Development Forum, 1989).

No one would argue that NGO's suffer from limited financial and human resources, and it is probably true that humanitarian paternalism often accompanies a strong sense of commitment, especially where development is accompanied by direct or even indirect missionary aspirations. And in their enthusiasm to get to work, many NGO staff fail to take the time to improve their skills in administration, evaluation and planning.

However, the development philosophy of our organization, like that of most others, has evolved dramatically over the last forty years. Given our country's flourishing economy and optimism during the post-WWII years, who can blame NGO's during the fifties for wanting to spread our successful technological systems and modern culture to every corner of the globe? Much of this modernization euphoria was accompanied by missionary efforts, both directly through evangelism or more subtly through US-style education in mission schools and training centers. However, it soon became obvious that the Green Revolution was not always helping the vast number of small-scale subsistence or below subsistence farmers who were the primary target of improved food production efforts (Wolf, 1986). Thurl Metzger, who has been with Heifer Project since its infancy in the early 40's, called these the "Copy our Culture" years. He sees these as being followed by the "We are here to help you" period, in which we all felt magnanimous and sophisticated when we could say, "Tell us what your problems are and how we can help. If your request meets our guidelines and resources are available, we will support you." But he holds that our Western arrogance and paternalism still showed through. Today, we have learned from the people we work with that the roots of hunger and poverty go beyond the individual, the community or the country. We are in the "Here is a problem to be solved" years, in which we in the USA, as a dominating global power, realize that the requirements of our economy and the demands of our lifestyle have contributed to a host of environmental and resource distribution problems for the whole world. We now realize that we are in the process of cooperating with other cultures and ideologies in order to find global solutions for our common future. Just as there are no purely African, or Latin American, or Asian problems, there is no simple American or Western solution (Metzger, no date). A more

direct statement comes from an Aborigine woman, who said "If you have come to help me you can go home again. But if you see my struggle as part of your own survival then perhaps we can work together" (NGO News, 1989).

THE NEED FOR INTERVENTION

From our own perspective, the special capabilities of grassroots NGO's are: sensitivity to the local people; flexibility to adapt to local conditions; and ability to link the small-scale farmer to the available systems. These will be best illustrated by discussing some actual field experiences.

But first we should clarify why our services are requested and intervention is necessary in the first place. Many of our requests come from people who have moved from their traditional environments to a new setting, and are being forced by external forces to change. In these situations our job is to assist in finding an appropriate technology for the new type of farming required, as well as an effective way to transfer this technology. These external forces could be a volcanic eruption that destroys the land and cattle of a pastoral people, as in the case of the Fulani people in Cameroon. These people made the decision to settle and attempt dairy farming, since the government had resettled them and provided housing and their pastoralism was threatened anyway by decreasing availability of uncultivated land. HPI works with both the men and the women in the dairy project, in both the production and processing of milk. The technology of choice for these dairy cows is "zero-grazing," an environmentally-sound production practice.

Or the external force could be the government. In Thailand the government has threatened to take over and reforest any land that is not terraced by the highland farmers, who traditionally practice slash-and- burn. This tradition was sustainable as long as population pressure was low enough to allow long fallow periods, but is destructive today. Our role in this setting is to provide water buffalo for the labor required to build terraces.

Population pressure coupled with the closing of an unproductive tin mine in the highlands also drives highland families in Bolivia into the tropical rainforests to farm. Once again, their highland farming tradition does not serve them well in the rainforests and we are able to provide access to agroforestry/pasture/small-scale livestock systems which can combine with their crops to make a more sustainable system. And in the USA farmers are being forced to look at the benefits of changing to lower capital inputs in order to survive financially and to prevent the pollution of groundwater and other environmental problems.

HPI IN THE USA

Our agricultural work in the USA is actually two-fold. We have found that the conditions of people in the pockets of rural poverty in the South, the Northeast, Appalachia, and

the many Indian reservations are very similar to those in the non-industrialized world. Here we follow our traditional process of livestock assistance, technical training and networking that we practice internationally. But in the spirit of our most recent philosophy ("Here is a problem to be solved") we recognize the need to work with the small-to-medium-sized commercial farmers in the USA as well. Everyone in this room, by attending a conference on sustainability, must have some grasp of the changes our modern agriculture has inflicted on farmers and the global environment. Fossil fuel-based technology has been a major contributor to the greenhouse effect. Chemical control of insects and weeds in monocultures has led to pollution of groundwater. Overuse of antibiotics and pesticides have led to resistance. Lack of adequate erosion control has led to rates of soil loss that match those of the Dust Bowl era. And farmers struggle to make a living on 1,000 acres where their grandparents were proud of the living provided by forty. Much of the indigenous knowledge of farming practiced by our grandparents in these environments has been lost during this modernization. These methods (contouring, crop rotations, integration of crops and livestock etc) along with the newer adaptations such as intensive grazing, integrated pest management and allelopathy all require some research and extension through whatever channels can be activated. NGO's have a special role to play in this arena, based on their mission to improve the lives of people and/or the environment. Given their lower level of interest in modern technology and production measures, it is not surprising that a National Academy of Sciences report found that the whole movement towards sustainability was led by NGOs rather than institutions and government initiatives (Alternative Agriculture,1989).

NGOs in the USA operate in a position midway between individuals and institutions, which allows for more flexibity in practicing, testing, and demonstrating innovations or alternatives in agriculture. An example of this niche can be seen on our land in Arkansas, where HPI owns 1,225 acres. Even though we do face the requirement of providing a return on HPI's investment in livestock and land, we are not facing as severe a risk as individual farmers. On the other hand, we also do not face the restrictions placed on researchers in institutions to come up with publishable, single discipline research projects in the space of a few years at the most. The land was a cattle ranch when we bought it in 1971, and we have stayed in this tradition. However, over the last ten years we have diversified into a commercial sheep and cattle ranch, as well as added working demonstrations of self-supporting, smaller-scale units of other domesticated livestock found in the USA. We also have a working model of a two-acre, integrated, farm to demonstrate ecological, low-capital-input principles we have learned from small-scale farmers in the non-industrialized world.

Our approach has been to demonstrate our own transition from dependency on chemical herbicides and fertilizers, grain from Iowa, and bermuda/fescue pastures to a more intensive grazing that encourages a polyculture of grasses and legumes

and requires high management and fencing inputs rather than chemicals and grain. Our greatest challenge was to excite our own staff into wanting to change, rather than to mandate the conversion from above. This move was critical since we have staff on the ranch who are active in the local Cattlemen's Association and other organizations. Without their enthusiastic participation, we would lose our credibility with our neighbors in our own community in Arkansas. The second challenge is to attempt to document the changes in the cattle and the pastures during this conversion. Since we are actively involved in farming, it is important for us to do this documentation in a way that is acceptable to scientists in institutions, but at the same time is workable by fulltime farmers. We think that this is essential if the move to farmer participation in research is to ever to gain ground. We would welcome any suggestions on these topics!

Another niche for NGO's in the USA is a relatively new one for HPI. This role recognizes the contribution made by the USA to global environmental and social problems that hurt the poor first, but all of us eventually. A test of our determination to listen to those we work with came when leaders from the developing countries at an FAO meeting requested that the USA spend 25 % of its AID money on educating its own citizens about the developing countries. And in another forum, the Asia regional advisor to USAID has stated "NGO leaders from Southern nations urge their Northern partners to give greater attention to the policies of their own countries that work against the achievement of broadly based environmentally sustainable development in the South." (NGO Networker, 1987). In response, HPI added a new statement to its mission. This has been called "development education," and focusses on learning and teaching about the "root causes of hunger." Besides the traditional global studies approach, with text books and teacher training for schools and churches, we have land available to offer an experiential classroom, with a working model of a subsistence farm and many other sites where students of all disciplines and ages actually participate in their own learning. The conversion of our own ranch shows how we can decrease the level of our domestic demand for fossil fuel-based energy and other resources. For example, 86% of the energy consumed in beef production is used for feed production (grains), and each kilogram of fertilizer applied to pastures is eqivalent in energy to 2 litres of gas. Also, rotational grazing combined with a cutback in supplemental feeds can save a further 15-19 thousand gallons of transportation fuels annually on a large ranch (Poincelot, 1986). Since we in the USA are only 6% of the world's population and use 40% of the world's energy resources, we hope to raise the general public's awareness of energy and general food system issues both in our own country and in the other countries where we work.

THE NGO PROCESS OF DEVELOPMENT

To illustrate the roles of NGOs and their niche in the sustainability movement, we will examine the process we follow in our projects. A few of the key factors involved

in our development process are: an emphasis on training and education; a long-term commitment as opposed to a "quick-fix" solution; the autonomous organization of community groups; and response to peoples' own felt needs -- intellectual, political, spiritual, social and physical. Appropriate technology and the concept of "passing on the gift" (both resources as well as knowledge) are also important in our process. The strengths of NGOs that we have discussed are
1) flexibility to adapt to the people and environments as either they change or we learn from them.
2) ability to link people to institutions that can serve their needs.

Flexibility:Probably the main precondition for the ability to adapt to a given situation as it develops is a continuous presence in the area. NGOs are usually staffed by either someone living in the area already, who knows and is trusted by the people, or else someone from outside who is committed to the people in the area and is willing to stay more than a couple of years. Recognition and satisfaction for these staff or volunteers comes from the community rather than from an institution outside of the area, which encourages them to respond to signals that will lead to positive change for these people.

This response to people in the area rather than to external career measurements can be illustrated by a project we participated in in Cameroon. Initially, in 1968, we participated in the development of a USAID-funded research station, with the idea that the research done there would benefit the small-scale farmers in the area. For six years we sent pure-bred dairy heifers to the station, where management practices, breeding and dairy practices were researched by the extension service to be duplicated on small farms in the area. In accordance with HPI contracts, for every heifer provided, one offspring was passed on to a villager in the community.

As HPI worked with the small farmers, they found that the results of the research were not applicable to small farm situations. But perhaps more disturbing was their discovery that this did not bother the researchers. In fact, the researchers were even reluctant to release these high quality animals to the farmers at all, because their research was more efficient if the cattle remained at the station. The center relied on a level of inputs and management that were beyond the reach of small farmers, and HPI learned that pure-bred heifers were of no real value except at the station. In fact, production suffered even at the station once the HPI technicians left.

To cut a long story short, by working with the farmers themselves, HPI realized that they had done the farmers no favors by giving them pure-bred heifers, and began encouraging crossbreeding with local cattle. We also realized that conditions were more suited to providing a single animal for domestic consumption than to establishing small commercial herds as the original plan had called for. Given the lower maintenance requirements, and a level of

production not significantly lower in the crossbreeds, HPI severed its ties with the research station, who refused to change their strategy, and began working in the community. Today, HPI is no longer needed. The community has formed a cooperative that is registered by the government for marketing milk products, and a measure of their success is the fact that they now sell milk to the research station.

Linkages to Institutions: It is difficult to separate the lessons we have learned into categories, but our experience in the Philippines will illustrate both an ability to adapt to farmer needs and a niche that can be filled in linking farmers to the services and infrastructure that are potentially available to them. Having started our work there during an earlier phase of our own development, we worked through an institution, distributing livestock to farmers with the contract to "pass on the gift," and providing technical assistance. But in 1987 we sponsored a conference during which farmer leaders in small group discussions worked through a process of defining their problems. Three major problem areas emerged:

1) access to quality breeding stock
2) animal health care in rural areas (of the 1,500 vets, most live in the cities) and
3) access to information on feeds and feeding.

To quote our Asia director, "if giving an animal could solve the problem, they wouldn't need the animal in the first place." However good the supply project was, sooner or later it would run up against the constraints unless someone provided the services.

In response to this, we have taken on the role of resource coordinators, accessing information and networking with people at universities and other NGO's in the area. Where no alternatives exist through normal structures, we provide training to the local groups, so that the basic "para-vet" needs can be taken care of locally. If a group needs feed, HPI can help locate by-products from local industries or commercial agricultural enterprises. And as a logical next step for this type of networking and information exchange, all the regional staff meet regularly and share reports. In this way, staff from China, the Philippines, Thailand, India and Indonesia exchange successes and failures. The success of this approach can be seen in Thailand. HPI was lucky enough to find a project leader from the indigenous Lahu population to manage the water buffalo project described earlier for terracing the hillsides. Niwatchai attended an Asian regional meeting and was introduced to the alley cropping for hillsides (SALT) used for erosion control in the Philippines. He was excited enough to transfer his enthusiasm to the villagers in Thailand. Today, this method of erosion control has been so successful that the extension service from the lowlands regularly bring agents to the mountains to learn from the Lahu.

Building on the lessons learned in Guatemala and elsewhere in Latin America, we have been able provide channels for linking agencies and groups of many kinds. For example, a series of conferences that address animal production and the environment have been held in connection with our projects

in Peru, Bolivia, and Ecuador. These meetings provide channels for communication between technicians, leaders, and HPI personnel, who exchange problems, successes and failures in small groups. The culture of the indigenous people is a major focus in these meetings, along with the environmental constraints. Action plans are made and have served well in educating farmers who have moved to new environments.

CONCLUSIONS

On reading over this paper to see if some sort of conclusion could possibly be be drawn out of the morass, it occurred to me that this paper itself demonstrates some of the characteristics, be they positive or negative, that NGOs have to offer in the arena of sustainable development. Instead of taking NGOs, a statistically valid survey of all NGOs, we chose to focus on particular projects of our particular NGO. Although we have documented the technical aspects of our work, such as the value of crossbred vs. purebred cattle, we have also drawn conclusions about what "works" and what doesn't based on the shared experience of committed people living and working with small-scale farmers over long periods. We offered no data to support these more people-centered evaluations. Our methodology is based on trial and error rather than on blueprints drawn up from our own rigorous research or that of other organizations.

But although we have focused on HPI, there is evidence that the approach of our organization is representative of those taken by NGOs in general. In 1984 a meeting of 44 NGOs met to produce a set of recommendations for the World Food Council. Their conclusion was that during the decade since the last meeting of this council in 1974, several new realities have emerged. One of these was the realization that hunger was not simply a problem of developing countries. Another was that industrialized countries, no less than developing, food-importing countries, are wrestling with common issues such as assuring fair incomes to food producers, protecting small-farm agriculture, producing food in environmentally sustainable ways, and improving the quality of rural life (Hunger Notes, 1984). All these challenges require solutions far more complicated than a focus on yield alone can accomplish.

Focusing on the local environment and the local people allows us the flexibility needed for effective development work. The absense of preconceptions allows us to trust the local peoples' view of their situation rather than an outsiders' research results. We are able to view as a success the risky step of handing over management to indigenous people even though our staff have more experience and could probably do the job more "efficiently." And the freedom from having to rely only on quantifiable results gives each of our projects its own set of criteria for success or failure. One project might be evaluated as a success partly because in the village a handicapped man and a widow (among others) were able to improve their lifestyles and status in the community. The handicapped man was able to marry with the bride price made possible by a HPI project and the widow was able to sell her excess milk to pay for

her daughters to attend school. On the other hand another project yielding impressive economic results, like the beekeeping project in Guatemala, would have to be evaluated as less successful on some level, because it could not be sustained under the political oppression.

But we do recognize that documentation as well as improved management and technical skills could make our work more effective in certain situations. The assessment of the advisory committee to USAID was accurate in this. Richard Harwood has stated that "there has been a major gulf between the NGO community and the scientific institutions because of the differences in philosophy and development goals. With a move by mainstream scientists towards sustainable agriculture and an increasing understanding of organic, agroecological and other approaches commonly used by NGO groups, the communication gap is narrowing and ideas and appropriate technologies can hopefully flow more freely in both directions" (Harwood, 1989).

The potential impact of grass roots work is large. A Club of Rome study found that in Latin America some 25 million peasants have benefited from NGO projects; in Africa, 12 million; and in Asia, 60 million. Within this context, many NGOs are seeking to take into account the broader context provided by government policies. NGOs can provide an urgently needed bridge between macro-politics and micro-needs and help to build local priorities into national plans (Reid, 1989).

For NGO's sustainable yields cannot be separated from sustainable environment and social equity issues. Neither can the problems associated with food production in industrialized countries be separated from those in the non-industrialized areas. But this commitment must be supported by technical expertise and broader perspectives. By the 1994 meeting of the World Food Council, perhaps the reports will be different. Perhaps the strengths of NGOs will have combined with those of universities and multilateral agencies to move us all in a more sustainable direction. But in the final analysis, the work of NGOs like HPI is based on the belief that solutions can ultimately be found in the commitment between people to help each other.

REFERENCES

Alternative Agriculture, 1989, National Academy of Sciences Press, Washington DC.

CODEL Seminar, 1989, "Sustainable Agriculture: Opportunity and Challenge for Development." New York City.

Getz, Will R. 1985, "Effectiveness of Private Voluntary Organizations in Animal Agricultural Activities," unpublished draft.

Harwood, Richard. 1989, "PVO and NGO Perspectives and Activities on Sustainable Agriculture," Panel presentation, FSR/E Symposium, Oct 9-12, Fayetteville, Arkansas.

Heifer Project Exchange, May/June, 1989.

Metzger, Thurl, undated, The Road to Development, Heifer Project International.

NGO Networker, September 1987, page 8.

"NGO News: People's Participation in Sustainable Development," 198? ECOFORUM, Volume 14 (1), page 3.

"NGOs Look Ahead," 1984, Hunger Notes: a newsletter of World Hunger Education Service.

Poincelot, Raymond P. 1986, Toward a More Sustainable Agriculture, AVI Publishing Company, Connecticut.

Reid, Walter V.C. 1989, "Sustainable Development: Lessons from Success." Environment, 31 (4), pp 7-34.

"When the End is the Beginning," 1989, Development Forum, XVII (3), pg 4.

Wolf, Edward C. 1986, "Beyond the Green Revolution," Worldwatch Papers # 73, Washington, DC.

World Commission on Environment and Development, 1987, Our Common Future, Oxford University Press, Oxford.

THREE FACES OF SUSTAINABLE DEVELOPMENT:

INSTITUTIONS, PEOPLE, AND RESOURCES

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ABSTRACT

Sustainability is like happiness -- everyone believes in it but everyone has a different definition. This paper proposes an interdisciplinary approach to improving the quality of life for the resource-poor farmers of the Third World. It incoporates three key factors -- institutions, people, and resources. Institutions -- both public and private -- can provide information, material, and training that people are free to reject, accept, or modify, but which will, over time, hopefully maintain, if not improve, the productive capacity of the local, natural resource base. More is known and understood about local institutions than about national institutions, yet at both levels participation and ownership, as well as leadership and flexibility, appear to be crucial. More is now known and understood about the relationship between resource sustainability and the people dependent on these resources. Since sustainability cannot be achieved independently of, or in opposition to, the interests of the rural poor, their needs and priorities should receive informed attention, specifically ways in which they can achieve livelihood security through ownership of, or access to, resources and income-generating activities. The third component, the natural resource base, incorporates local knowledge of both land-use and production systems, as well as ways in which to generate appropriate technologies for maintaining productive capacity.

INTRODUCTION

Sustainability is like happiness -- everyone believes in it but everyone has a different definition. In fact, sustainability has become so all-encompassing as to be virtually toothless whether it is financial, institutional, economic, environmental, technical -- to name a few of the more common manifestations. What does **sustainable development** mean? In the domain of rural development, **sustainability** should mean that the local population does not degrade its natural resource base, at least not irretrievably, but rather conserves or even improves it. For example, the definition favored by the Brundtland Commission refers to the maintenance or enhancement of resource productivity on a long-term basis (Food 2000 1987). But such a definition says absolutely nothing about the quality of life of the people involved.

Development is different since it demands that human life somehow improve. Neither sustainability nor development is static; both are dynamic. Whereas nouns suggest substance and continuity, verbs suggest substance and continuity and more faithfully reflect the realities of the Third World (White 1987). Sustainability is no exception and should be considered within this changing situation. The question that must always be borne in mind is the following (Redclift 1987:33):

> Is it possible to undertake environmental planning and management in a way that does minimum damage to ecological processes without putting a brake on human aspirations for economic and social improvement?

Perhaps the simple definition of **a continuously improving quality of life** is best, since it allows for cultural gains as well as material ones and for a future of continuing hope (Jolly 1989).

In more practical terms, whether dealing with policy and strategy, program and project, the key question to be answered is: **What is to be sustained?** This paper seeks to provide some practical answers by drawing on the recent development literature and lessons learned from both ongoing and completed development initiatives in the Third World.

THE ENVIRONMENT, THE POOR, AND SUSTAINABLE DEVELOPMENT

Two critical challenges have been thrust to the top of the development agenda for the 1990s: the reduction of poverty and protection of the environment. While there is now a pervasive, increasingly global **green awareness**, the relationship between environmental degradation and rural impoverishment is not yet widely understood or appreciated. Sustainability cannot be achieved independently of, or in opposition to, the interests of the rural poor. Sustainable improvements in the environmental health of the earth require prior and parallel

improvements in the economic health of the poor. Environmental degradation is not a problem of the relationship between people and their habitats but of relationships among peoples competing for access to productive resources (Horowitz 1988).

In many marginal, rural areas growing numbers of poor people inevitably have to degrade the environment a little more each day just to make ends meet. Three major demographic factors interact to place long-term environmental protection concerns in conflict with the short-term survival strategies of the poor (Leonard 1989):

* Rapid population growth

* Land consolidation and agricultural modernization in fertile areas

* Prevailing inequities in land tenure

These factors have induced growing numbers of poor people to migrate to new lands or to already burgeoning urban areas. The world's poorest people are thus increasingly clustered in two types of areas: remote and ecologically fragile rural areas and the edge of growing urban areas.

According to the World Bank, the lives of nearly two billion people -- 40 percent of the world's population -- still are controlled by extreme poverty (World Bank 1988). The vast majority -- over 85 percent -- live in Africa, Asia, and Latin America and of these at least 80 percent live in rural areas, where they depend overwhelmingly on agricultural activities for their daily subsistence. This drastic situation is exacerbated by two factors: first, more and more of the poor live in households headed by women; and, second, a growing number of the world's poorest lack access either to potentially productive land resources or to good employment opportunities.

Land is the provider of last resort in rural areas. Lacking jobs to give them purchasing power, poor people seek land anywhere they can get it for subsistence food production and fuelwood (Leonard 1989:16):

> Often the lands where the intinerant poor end up are those that were previously only sparsely settled because of their remoteness, marginal nature, or ecological fragility. The point is that economic progress in the world at large, and successful economic development within middle-income developing countries, have resulted in the gradual emergence of de facto" poverty reservations" in geographical areas that have higher propensities than other areas to be the receptacles of the world's poorest people.

Those already marginal to the mainstream are forced to retreat to marginal lands, thereby becoming more marginalized in the process.

WHAT IS TO BE SUSTAINED?

At the risk of oversimplifying what is basically a very complex problem, let us assume a situation where some change -- either locally or externally inspired -- has produced some tangible benefits for the local population. How are these benefits to be sustained -- where the definition of sustainability may be broadened to include the provision of the necessary economic and political security for the local population to pursue sustainability on their terms? One could answer according to one's background and discipline. Hence, a social scientist such as myself might say it is all a question of training, organization, and empowerment; a range management specialist might emphasize the importance of improved pasture, reseeding and rehabilitation, and planned grazing systems; and a livestock expert might highlight animal health, nutrition, and breeding stock.

But those living on marginal lands are resource poor and their agriculture is complex, diverse, and risk-prone. Sustainability of this **third agriculture** -- in contrast to industrial and green revolution agriculture where higher production and sustainability have come from intensification of inputs and simplification and standardization of practices -- derives more from diversifying enterprises and practices (Chambers 1989). Hence what is called for is an interdiciplinary approach that incorporates three key factors -- institutions, people, and resources. Institutions -- both public and private -- can provide information, material, and training that people are free to reject, accept, or modify, but which will, over time, hopefully maintain, if not improve, the productive capacity of the local, natural resource base. Each of these will be discussed briefly below.

INSTITUTIONS: PUBLIC AND PRIVATE, NATIONAL AND LOCAL

If public sector institutions are to be sustainable, they require a certain level of institutional capacity in terms of planning, budgeting, coordinating, and implementing, and a certain level of political support and commitment -- as well as the ability to meet recurrent costs. There are various ways of looking at and analyzing institutions and among the more relevant for assessing sustainability are the following (Brinkerhoff 1988):

* **Stakeholder Analysis:** Analyzes interest groups, key actors, social structure, coalitions, and politics.

* **Sustainability Assessment:** Examines links among performance, capacity, and environment -- with a focus on benefit continuation.

* **Public Choice Analysis:** Analyzes interactions among economic policies, organizational structures, and characteristics of goods and services.

* **Policy Environment Assessment:** Looks at characteristics of policy in relation to impact on incentives, performance, and sustainability.

The International Development Management Center at the University of Maryland is presently conducting research on the sustainability of agricultural research and agricultural education institutions in the Third World. Drawing on systems theory, contigency theory, and political economy, the research framwork has four principal components: a system; its environment; the systems's interaction with the environment; and the system's internal processes or strategy (Walker et al. 1988). Preliminary results from Bangladesh, Indonesia, Morocco, Pakistan, Thailand, and Trinidad indicate that the more sustainable institutions are characterized by the following (Finsterbusch et al. 1989):

* **The Personal Factor:** Personal networks are key and the director, as well as key staff members, try to keep on good relations with the decision makers. Most of the upgrading and reform projects originated with the director or the funding agency.

* **Involvement Brings Support:** Considerable involvement of staff, beneficiaries, and other stakeholders is key. As power is shared with them, they claim ownership of the institution and help make it relevant to their needs.

* **The Law of Deterioration:** There is a tendency to deteriorate over time and some institutions seem to depend on a cycle of renewal, backsliding, and renewal again.

* **The Random Factor:** Idiosyncratic factors appear to be quite important. While performance counted for sustainability and is the main factor in gaining support, in most cases random factors accounted for more.

At the community level, a recent study analyzed the factors which contributed to the sustainability of five successful development efforts initiated by non-governmental organizations (NGOs) -- two geographically limited and three geographically extensive programs, although they started on a smaller scale (Chambers 1988). Sukhomajri/Nada in the

Himalayan foothills of India began as a soil and water conservation project which expanded its objectives to encompass equitable resource management, including social fencing of degraded forest land, a stake in new village resources for all villagers, and sustainable livelihoods for the poorest. Tin Aicha in Northern Mali sought to enable destitute nomads with no previous experience of cultivation to take up settled agriculture which they despised, and create a new community from people with different origins.

The three programs present a contrast in scale. The Lampang Applied Nutrition Program in Northern Thailand, the Baudha-Bahunipati Family Welfare Project in Nepal, and the Guinope Integrated Development Program in Honduras all cover wider geographical areas. Each includes elements of health and agriculture. Lampang and Guinope drew on experience gained by their organizations elsewhere and have followed tested approaches and procedures.

For the achievement of sustainability, five major lessons can be drawn:

* **A Learning Process Approach:** Follow the learning process rather than the blueprint approach, well described and analyzed by Korten (1984). One of the more exciting aspects of recent work in Third World development has been the increasing acceptance that development is a process of change which is often unpredictable, that programs are designed and implemented on the basis of limited information, with the undersstanding that as new information is provided, strategy and goals will change accordingly. This calls for an admission on the part of "experts" such as ourselves that we do not know everything and, furthermore, that we are prepared to learn from our mistakes (Gow 1988). In the examples under review, the ability to recognize, embrace, and learn from error and failure, and even to change objectives, was the key to success.

* **People's Priorities First:** Put people's priorities first. All the case studies were successful because sooner or later they managed to identify and meet people's perceived needs. These were linked with livelihoods: fodder for animals and agriculture; incomes from ropemaking and irrigation; food and incomes from soybeans, ducks, beekeeping, goats, donkeys, and camels; and savings bank reserves in the form of privately owned trees.

* **Secure Rights and Gains:** Once their very basic subsistence is assured, poor people's ability to take a long-tern view depends on how secure they judge their future rights and gains to be.

* **Sustainability Through Self-Help:** Achieve sustainability by starting with self-help. All the major case studies stress self-help, and contributions from people. The importance of using beneficiary resources such as voluntary labor is well documented (Morss et al. 1975). The use of available local resources is one way to reduce the costs of delivering goods and services. Beneficiary involvement in planning and implementation may produce additional cost savings. Frequently, their knowledge of the local situation will prevent wasteful and inappropriate interventions designed by outsiders. Also, when the local population in interested enough to make direct commitments to the development interventions, cost burdens are shared, ownership ensured, and sustainability enhanced (Morss et al. 1985).

* **Staff Calibre, Commitment, and Continuity:** Calibre, commitment, and continuity of staff are crucial. Calibre refers to sensitivity, insight, and competence. Commitment refers to determination, self-sacrifice, and dedication to working with and for the poor. Continuity refers to working consistently over at least several years. There is increasing evidence that institutional commitment is unlikely to materialize unless there is strong individual leadership at the program or project level. Development projects in Africa, funded by A.I.D., concluded that such leadership is a necessary condition for successful project management and that other factors cannot compensate for weak leadership (Honadle 1986).

HUMAN RESOURCES: SUSTAINABLE RURAL LIVELIHOODS

The relationship between sustainability and the rural poor is of increasing concern and relevance. As discussed earlier, there is a growing realization by social scientists of the close relationship between resource degradation and poverty, though little evidence that this empirical knowledge has been seriously considered in contemporary development thinking until very recently (Leonard et al. 1989). One way to deal with the Pandora's Box of sustainability is to think of it in terms of **livelihood security.**

The Bruntland Commission's Advisory Panel on Food, Agriculture, Forestry, and Environment developed **sustainable livelihood security** as an integrating concept and defined it as follows (Food 2000 1987:3):

> Livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. Security refers to secure ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies.

Sustainable refers to the maintenance or enhancement of resource productivity on a long-term basis. A household may be enabled to gain sustainable livelihood security in many ways - through ownership of land, livestock or trees; rights to grazing, fishing, hunting or gathering; through stable employment with adequate remuneration; or through varied repertoires of activities.

In normal professional usage, poverty is a synonym for deprivation and is measured in terms of flows, whether of income or consumption. No account is taken of stocks or assets. Those who are defined as falling below the poverty line have developed various adaptive strategies for survival which may vary by season and location. There is mounting evidence that people living in fragile lands which are subject to dramatic changes -- natural, man-made, or a combination of both -- respond with a high degree of flexibility and an escalating set of strategies, according to the gravity of the situation (Waddell 1983).

For example, in the case of the semi-arid tropics of Northern Nigeria, farmers have developed a hierarchy of coping mechanisms for dealing with lack of rainfall (Watts 1983). These include intercropping, water conservation, the exploitation of several microenvironments and, in cases where early rains are followed by drought, the replacing of their millet and sorghum with different, quick-maturing cereals. After a poor harvest, villagers know that cereal prices will increase exponentially. Accordingly, they try to generate cash income to buy grain through wage labor and craft activity.

If this is insufficient, then they will seek support from extended kin through the **economy of affection** -- the networks of support, communication, and interaction among different African groups connected by blood, kinship, community, or religion (Hyden 1983). Should this in turn prove insufficient, then they will begin to dispose of their productive assets, such as smallstock, or seek a loan from a local merchant. But in extreme conditions, villagers will sell their farm and migrate permanently to another location (Gow 1987).

Increasingly, trees are regarded in the same way as livestock. In the case of Haiti, for example, crop failure is so frequent and the market for wood and charcoal so secure, that farmers prefer to leave their trees as a bank against future emegencies (Murray 1987).

In such a situation, the conventional development approach is to try and assure farmers employment, a job, training, or an asset that will provide for all or almost all their needs. But a more viable alternative is to strengthen their existing strategies (Chambers and Leach 1987). A common, perhaps universal priority expressed by poor people is the desire for an adequate, secure, decent livelihood which provides for

physical and social well-being and this includes security against sickness, early death, and impoverishment. But once basic survival is secured, under safe and secure conditions, there appears to be a strong propensity to stint and save when the opportunity arises and take the long view -- for example, the sacrifices parents will make to invest in their children's education or the extraordinary tenacity with which farmers will struggle to retain rights in land.

Such empowerment -- providing people with the necessary base on which to build and create for the future -- is a prerequisite for good stewardship (Chambers 1989:3):

> Secure tenure and rights to resources and adequate livelihoods are prerequisites for good husbandry and sustainable management. Moreover, sustainable livelihood security is a predisposing condition for a stable human population in the long-term, for when livelihoods are secure it becomes rational for poor people to limit family size. Enabling poor people to gain secure and sustainable livelihoods in resource-poor and forest areas is, thus, the surest protection for the environment. **The poor are not the problem; they are the solution** (emphasis added).

In practice, this means that development interventions should concentrate on assisting local people to develop their productive resources and, in cases where these resources are limited or insufficient, assisting them to create new resources. This was the key to success in the five NGO activities discussed briefly above. Possibilities include:

* Secure rights of ownership and usufruct of assets, including sale and inheritance.

* Transform small-scale tenancy and sharecropping into inheritable rights to land.

* Allocate degraged forest land to poor households for growing trees and, where appropriate, for growing crops and raising livestock.

* Reinforce livelihood strategies by supporting diversification, including non-agriculutural activities.

These findings are partially corroborated by a recent report, part of a larger study financed by A.I.D. to address an important aspect of development sustainability -- natural resource management (NRM) in the Sahel (Shaikh et al. 1988). The report focuses on a host of on-farm agricultural production practices that show promise for sustainable

agricultural growth in Gambia, Mali, Niger, and Senegal. The emphasis was on what works and a total of 70 successful NRM intitiatives -- many small-scale and localized -- were visited.

The most important conclusion to emerge from this study is that interventions have the greatest impact when they have resolved the problems of the local population involved -- rather than those of the environment per se (Shaikh et al. 1988, Vol.1:43):

> The basic concerns of rural Sahelian populations center around achieving at least a stable and, hopefully, improving standard of living. This in turn has historically depended on the status of the principal rural production systems: agriculture, livestock, fishing. Precisely because environmental degradation now visibly threatens these production systems, populations have turned to natural resources management to accomplish two things, both of which directly affect their income: first, to protect the soil and water resources on which their production depends (e.g. the full range of soil and water conservation, soil fertility improvement and related measures) and second, to provide new opportunities for income (pole production, orchards and gardens, firewood and fooder sales, etc.) to compensate for declining and uncertain yields in customary productive activities.

Among the specific conclusions drawn in the analysis, the following are the more salient (Shaikh et al. 1988, Vol.1: 47-48):

* **Values, Interest, and Knowledge:** Information transfer should harmonize with local experience and knowledge since there is local interest in stabilizing productivity and improving natural resource management activities.

* **Conflict Resolution:** This is an important but neglected aspect of natural resource management and one element -- resolution of land tenure issues -- is critical for success.

* **Initiatives and Techniques:** First, use adaptable technologies that build on traditional practices to increase the chances of success and which can be taught by one farmer to another; second; productivity-increasing NRM activities may stabilize the rural population and lead to investments in more intensive forms of resource use ; third, ensure that programs have time horizons that increase proportionally with the novelty of the proposed technical innovations; four, involve farmers in the design, implementation,

management, and evaluation of the program; and, finally, coordinate program activities with existing government activities.

THE NATURAL RESOURCE BASE: STRUCTURE, KNOWLEDGE, AND TECHNOLOGY

Institutions and organizations

There is a growing consensus from contrasting ends of the political spectrum that beneficiary participation -- often in the form of local organizations -- can play a key role in achieving sustainability. In the field of rural development, there are seven distinct natural resources to be managed -- each of which has distinct organizational requirements, a consequence of the differing relationships local users have with their resources. These resources include the following: forests, rangelands, irrigation waters, watersheds, crop lands, coastal resources, and protected wildlands. The resource being managed will affect how desirable certain institutional options are. Three key characteristics to be considered are: **resource renewability, seasonality,** and **public perception of the resource** (Uphoff 1986).

The less renewable the resource, the greater the risk that poor management will have drastic consequences and the greater the justification for some involvement by the central government. The length of time for a natural resource to be renewed varies greatly. For example, grass on a range may reappear after a few weeks, whereas trees in a forest can take 20 years and longer, depending on the species. As a result, range management can -- within some limits -- be left to local institutions whereas forest maintenance, a long-term commitment, has traditionally required more centralized institutional arrangements.

Seasonality may also affect institutional options. The flow of local institutional activity is generally affected by variations in the agricultural seasons. Under conditions of high seasonality, the institutions charged with resource management have to operate with more fexibility and speed than is usually found in centralized, government bureaucracies. For example, a community forestry project in Niger found that during the time when it required the most involvement from villagers, they were busy planting their field crops and unwilling or unable to assist the Forestry Department in planting operations (Brechin and West 1982). Experience in Zambia, however, indicates that the best time to plant may be some weeks **before** the rains come (Gow 1989).

How natural resources are perceived by users is a third important consideration. Of particular importance is whether potential users of a resource see it as a public or a private good, to be managed for collective or for individual benefit. In principle, if individuals or groups have improved a

resource, they have established a right to the ensuing benefits. If groups are unable to exclude non-members from using a resource, they have little incentive to invest in its development or protection.

In the case of the Agroforestry Outreach Project in Haiti, for example, project staff had to counteract the prevailing notion that trees planted by a farmer on his own land belonged to the state and might eventually be used as a pretext for expropriating that land. With the understanding and guarantee that the planter had complete and exclusive ownership of the trees came the willingness to plant trees for individual gain, both economic and environmental (Murray 1987).

Beneficiaries and users

In the field of natural resouce management, it is more appropriate to talk about users rather then beneficiaries, since usually the users of the resource are expected to be the primary, direct beneficiaries of the proposed intervention. There are important differences among natural resources in terms of the **boundedness** of users and resources, that is the extent to which they are delimited and identifiable. In many situations, the users are an ill-defined set of people with no existing mechanisms for making or enforcing decisions. When the amount and availability of a resource are known for certain, the possibilities for effective management are greatly increased. When there is less knowledge and predictability, institutions are important for reducing risk, focusing more on insurance and welfare functions than productivity (Uphoff 1986). The accompanying figure schematically represents different kinds of resource management situations.

In addition to whether or not users are a definite set of people and have some recognized authority structure, three other characteristics are important to consider, namely **interdependence, homogeneity, and tradition** (Uphoff 1988: 32-34). To the extent that resource users are dependent upon one another for their livelihood and even survival, the incentives for making local institutions work well are greater, as in the case of irrigation water management. The same may hold true for rangelands where the availability and adequacy of water for both livestock and people is a dominant concern.

Certain resource management technologies may require interdependence. If bench terraces are constructed to control soil erosion, there must be cooperation in constructing toe drains and waterways to carry away the runoff. If reforestation is to be effective in watershed management, then a high percentage of local residents must participate, since a shotgun approach -- with random, haphazard, widely dispersed participation -- may actually exacerbate the problem.

Figure 1

Resource Management Situations

Users Are:	Natural Resource Is: Known and Predictable	Little Known and Unpredictable
Identifiable and coherent group	Irrigation water management	Coastal fishing by groups
Lacking group identity and structure	Forest management	Rangeland management

Source: Uphoff 1988:26

The tasks of local institutions are greatly simplified when users are homogenous -- they use the resource for the same purpose -- since decisions can be more uniform. Heterogeneity occurs when the resource has multiple uses and various groups may be competing for the same resource. This may happen when pastoralists and farmers compete for the same marginal lands in semi-arid environments or when indigenous people and settlers compete for the same land in the humid tropical lowlands (Macdonald 1988).

Conflict over resource use is less likely when users see themselves as unified by kinship, occupation, geographical location, class, or by some other common characteristic. But where such conflict predominates, local administration or local government may be more effective than membership organizations in reaching decisions, since the incentive is great for one set of users to predominate when scarce, valued resources are at stake. Since compliance with decisions and regulations is rarely achieved through coercion, processes of consultation and consensus will be needed.

Tradition is not a synonym for sustainable resource management. It is wishful thinking to assume that resource users living in traditional social settings are necessarily able and willing to manage forests, soil, and water productively, equitably, and without conflict. Under certain circumstances, traditional forest peoples can use dynamite and chain saws just as destructively as the most recent settlers.

However, where traditional roles are relatively intact, the capacity of local institutions to manage natural resources appears greater (Siy 1982).

The fact that some communities do not manage their resource base well does not necessarily imply that they are unaware of the problem. Diminished capacity often accompanies the decline in traditional institutions, such as those operated by chiefs and councils of elders (Roe and Fortmann 1982). In the case of communal rangelands, overgrazing may well mean that external forces work against existing controls as, for example, in the case of traditional authorities who are also salaried, government employees. In serving two masters the more unscrupulous can play the government off against their local constituency (Artz, Norton, and O'Rourke 1986).

Local knowledge and appropriate technology

While the standard transfer of Western technology has been roundly criticized, much has been learned during the past decade concerning land-use systems, local technical knowledge, and approriate technology -- particularly for farmers who are resource-poor, those who live on the steep hillsides, in the tropical lowlands, and in the arid flatlands, where soils are shallow and poor.

The productive potential of the existing natural resource base can be better understood and appreciated through land-use planning, whereby potential and actual land use are made to correspond. **Land-use capability** is defined as the most intensive use that a piece of land is able to sustain on a continuing basis without suffering degradation (Zadroga and Tschinkel 1987). This capability can then be compared with actual land use to determine whether a particular piece of land is being degraded through overuse or could be used more intensively.

While there are many ways of classifying land, one that has proven to be effective is the Holdridge Life Zone System, widely used in Central and South America. The principle underlying the life zones is simple. They can be thought of as groups of ecological associations related through the effects of three climatic factors -- heat, precipitation, and moisture. The life zone comprises only the first-order category of environmental divisions. Subdivisions are necessary for more specific analysis and for inclusion of second-order environmental factors, such as soils, drainage, topography, strong winds, mists, and various patterns of rainfall distribution, in the classification system (Holdridge 1967).

A recent critique highlights certain limitations of such land classification techniques: first, they cannot measure land productivity directly or identify the impacts of land-use

conversions; and, second, they may neglect gradual changes in biophysical factors that result in varying limitations in land uses (Hyman et al. 1988). In more practical terms, land-use planning assumes that an optimum balance of natural resource uses can be found, which can combine productivity with conservation goals in agriculture and forestry -- optimism leavened with rationality. Underlying this approach is the need to understand fully present land-use systems and their accompanying technologies.

Recent work in Brazil compares indigenous land use -- in this case the system practiced by the Kayapo Indians of southern Para state -- with the two dominant regional land uses: livestock and colonist agriculture (Hecht 1989). The Kayapo designate 14 types of land use for agriculture -- broadly defined -- and include ceremonial planting, reforesation, trek gardens, as well as swidden plots. They practice concentric ring/crop segregation agriculture based on sweet potatoes, manioc, yams, and perennials, periodically intercropped with maize, beans, cucurbits, introduced rice, and numerous other minor crops and ritual plants.

Their production system includes a soil taxonomy, selection for varietal diversity, a complex spatial planting pattern of concentric rings, intercropping, continuous planting for certain crops, relay planting and successional strategies. Soil-conserving practices include the use of spatial segregations of plantings; multiple cropping systems; crop rotations; crops which climb; concentrated tillage; direct additions of nutrients in the form of applications of ashes, mulches, ridues, dung, and enriched soils; complex coplanting; transferred forest litter; composting; and controlled, periodic, in-field burning.

The dominant forms of land use in the Amazon are pasture and short-cycle agriculture -- both notorious for their lack of sustainability and low rates of economic return (Browder 1988). The features of Kayapo agriculture are outlined and compared with these two land-use systems in Figure Two.

The Kayapo yields per hectare over five years are approximately 1.75 times greater than those of the livestock system and approximately twice as high as those for the colonist system. Over 10 years, animal production is a mere 700 kg/ha in conventional livestock systems, compared to more than 84,000 kg/ha of Kayapo product. Since colonist agriculture rarely continues beyond five years, there is no basis for comparison. The results are the same for protein production. Kayapo protein yields from vegetable sources are roughly double those of colonists and more thasn 10 times the protein production of livestock systems.

Figure 2
Comparison of the Structure of
Kayapo, Colonist, and Livestock Production Systems

	Kayapo	Colonist	Livestock
Clearing	Slash & burn	Slash & burn	Slash & burn
Clearing size	About 1 ha	2-5 ha	Up to 20,000 ha
Planting Patterns:			
Cropping zonation	Yes	Rarely	No
Continuous cropping	Yes	Sometimes	Yes
Continuous planting	Yes	Rarely	No
Relay cropping	Yes	Rarely	No
Monocropping	No	Often	Usually
Intercropping	Yes	Sometimes	No
Polyvarietal crops	Yes	Rarely	No
Arboreal species	Yes	Rarely	Rarely
Cultivated species in field	10-42	5-10	1-5
Harvest pattern	Continuous	Seasonal	Seasonal
Soil conservation practices	Yes	Rarely	Rarely
Main crops	Sweet potato, yams, manioc, maize, musa, beans, squash	Rice, manioc	Panicum, Brachiaria
Labor	40 days/month	25 days/month	4.5 days/month

Source: Hecht 1989:174

Impressive as these differences are, they do not imply that we can discover ecologically sound agricultural practices among indigenous peoples and then teach them to other small farmers in other parts of the world. A recent review of experiences with ecodevelopment in Latin America and the Caribbean concludes that much of what is termed traditional agriculture is disappearing of its own accord because new techniques come along which require less labor and are more productive (Chapin 1988:141-142):

> In other words, "traditional" knowledge is everywhere being discarded for a variety of reasons, and the farmers are simply not interested in holding on to it. By the same token, peasants who possess no particular store of "traditional" knowledge are seldom enthusiastic about learning it and putting it into practice in their fields.

What these results do indicate, however, is that there is considerable potential for managing the natural resource base in a more sustainable manner -- particularly given farmers' propensity to adapt and experiment.

One approach has been the creation of the Farmer First (FF) model, based on the premise that succesful technology generation must begin and end with the farmer, the farm household, and the community (Chambers 1989). With this approach, farmers are first given a chance to analyze their own needs, and then, based on their assessments, given an array of strategies -- a **basket of choices** -- to select from.

These are open-ended options which farmers can accept, adapt, or ignore depending upon local conditions and the farmers' view of suitability to their needs. In contrast is the conventional Transfer-of-Technology (TT) approach in which the scientist establishes the research priorities, generates the technology, and passes it to extension agents to transfer to farmers. These differences are highlighted in Figure Three.

The Guinope Integrated Development Program in Honduras, discussed briefly earlier, followed a modified version of the FF approach (Bunch 1988). The root problem in the Guinope area was severe soil erosion and the continual monocropping of corn. The first year, yields often increased by three to four times previous levels. The extension methodology had been developed earlier by World Neighbors in a similar program in Guatemala (Gow et al. 1979). A very limited number of interventions, preferably only one or two, that respond to the limiting factor in local agricultural production -- in this case, soil quality -- are introduced through field demonstrations and the use of farmer-run, small-scale

Figure 3
Transfer-Of-Technology and Farmer-First Compared

	TOT	FF
Main objective	Transfer technology	Empower farmers
Analysis of needs & priorities by	Outsiders	Farmers assisted by outsiders
Primary R & D location	Experiment station, laboratory, greenhouse	Farmers' fields and conditions
Transferred by outsiders to farmers	Precepts Messages Package of practices	Principles Methods Basket of choices
The "menu"	Fixed	A la carte

Source: Chambers 1989:182

In addition to the serious, but practical role accorded participation, the key to the success of the FF model lies in its simplicity and non-directive approach -- ultimately it is the farmer who decides **what** he will adopt and **how** he will adapt it to his own particular needs. In the Agroforestry Outreach Project (AOP) in Haiti, the planting and harvesting of trees was promoted as a cash crop (Conway 1988). By the end of 1989, after eight full years of implementation, the AOP had produced and distributed more than 50 million trees to 200,000 peasants, 30 percent of whom were repeaters planting for the second time.

Conway (1986) conducted in-depth research on the decision-making framework for tree planting among project participants. His study highlighted several important -- and unpredicted -- aspects, including:

* Farmers were producing wood for domestic use.

* Soil conditions and their improvement were of major concern to many farmers interviewed, and formed their primary motivation in planting trees.

* Some farmers were using trees in an effort to transform whole subsystems of farm production, for example, using trees to establish or re-establish coffee groves.

* Several farmers were using trees as a means of storing capital resources. In an environment where crop failure is frequent, the peasants prefer to leave the tree as a "bank" against future emergencies. This use of the tree as a bank made particular sense, given the slaughter of their traditional bank, the pig, in the early 1980s -- thanks to an outbreak of African swine fever.

* Farmers were using project trees to address objectives that relate directly to their current and future access to the two most important factors of production -- labor and land. For example, farmers have planted trees to establish a firmer claim on inherited land and tenants have planted trees on plots of land leased for several years in order to assure "the first right of refusal," if the land is ever put up for sale. In addition, some owners, particularly households headed by women without access to male labor, are using project trees as a distinct, alternative strategy for dealing with relative and absolute labor shortages within the production unit.

Lowenthal argues that the importance of this study is that it illustrates the peasants' necessity and ability to adapt introduced technology to their own needs and systems. It also illustrates how little the outsider -- as well as the insider, for that matter -- can really predict in the design of an intervention. He writes (1990:27):

> What we are witnessing here is the appropriation of project trees as a tool, by the peasants themselves. Their subsequent application of that tool -- in its myriad capacities as a biological, social, and symbolic resource, to a diversity of management tasks and objectives, may have profound implications for their capacity to survive the current crisis in the agricultural sector.

A corollary of this lesson is that neither planner nor technician, anthropologist nor forester, could ever have foreseen or recommended to farmers the strategies and technologies that have evolved using this new resource. Thus, while it is crucial that projects be designed from the viewpoint of the peasant, this is no substitute for participation of the beneficiaries in project implementation and feedback loops (Gow et al. 1989).

THE THREE FACES OF SUSTAINABLE DEVELOPMENT

This paper has attempted to move the discussion of sustainability from the realm of toothless rhetoric and wishful thinking towards the practical realities of how to continuously improve the quality of life for the resource-

poor farmers of the Third World. A three-pronged approach for achieving sustainable development -- incoporating institutions, people, and resources -- has been proposed. Given the present state of our knowledge, more is known and understood about local institutions than about national institutions, yet at both levels participation and ownership, as well as leadership and flexibility, appear to be crucial.

More is now known and understood about the relationship between resource sustainability and the people dependent on these resources. Since sustainability cannot be achieved independently of, or in opposition to, the interests of the rural poor, their needs and priorities should receive informed attention, specifically ways in which they can achieve livelihood security through ownership of, or access to, resources and income-generating activities. Without this security, sustainability of both human and natural resources will remain at the best ephemeral.

The third component, the natural resource base, incorporates local knowledge of both land-use and production systems, as well as ways in which to generate appropriate technologies for maintaining productive capacity. This not only calls for a desire to observe, to listen, and to learn, but also a willingness to experiment and to learn from the experience -- curiosity and courage tempered with a little humility.

Neither sustainability nor development is static -- both are dynamic -- and the approach to sustainable development outlined here is, metaphorically speaking, more **feline** than **canine**. According to the poet (Reid 1988:53-54):

> Dogs say cats love too much, are irresponsible,
> are dangerous, marry too many wives,
> desert their children, chill at dinner tables
> with tales of their nine lives.
> Well, they are lucky. Let them be
> nine-lived and contradictory,
> curious enough to change, prepared to pay
> the cat-price, which is to die
> and die again and again,
> each time with no less pain.
> A cat-minority of one
> is all that can be counted on
> to tell the truth; and what cats have to tell
> on each return from hell
> is this: that dying is what the living do,
> that dying is what the loving do,
> and that dead dogs are those who never know
> that dying is what, to live, each has to do.

REFERENCES

Artz, N.E., B.E. Norton, and J.T. O'Rourke 1986, Management of Common Grazing Lands: Tamahdite, Morocco. Proceedings of the Conference on Common Property Management. The National Research Council, editor, pp. 259-280. National Academy Press, Washington, DC.

Brechin, S. and P. West 1982, Social Barriers to Implementing Appropriate Technology: The Case of Community Forestry in Niger, West Africa: Humboldt Journal of Social Relations, Vol. 9, No. 2, pp. 81-94.

Brinkerhoff, D.W. 1988, Institutional Issues: Issues and Ideas. Discussion note prepared for the World Bank. International Development Management Center, University of Maryland, College Park, MD.

Browder, J.O. 1988, The Social Costs of Rainforest Destruction. Interciencia, Vol. 13, No. 3, pp. 115-120.

Bunch, B. 1988, Guinope Integrated Development Program, Honduras. The Greening of Aid: Sustainable Livelihoods in Practice. C. Conroy and M. Litvinoff, editors, pp. 40-44. Earthscan Publications, London, UK.

Chambers, R. 1989, Reversals, institutions and change. Farmer First: Farmer innovation and agricultural research, R. Chambers, A. Pacey, and L.A. Thrupp, editors, pp.181-195. Intermediate Technology Publication, London, UK.

---------- 1988, Sustainable Rural Livelihoods: a Key Strategy for People, Environment and Development. The Greening of Aid: Sustainable Livelihoods in Practice. C. Conroy and M. Litvinoff, editors, pp. 1-17. Earthscan Publications, London, UK.

Chambers, R. and M. Leach 1987, Trees to Meet Contingencies: Savings and Security for the Rural Poor. IDS Discussion Paper 28. Institute of Development Studies, Brighton, UK.

Chapin, M. 1988, Misadventures in Ecodevelopment. Report submitted to the Inter-American Foundation. Washington, DC.

Conway, F. 1988, Agroforestry Outreach Project, Haiti. The Greening of Aid: Sustainable Livelihoods in Practice. C. Conroy and M. Litvinoff, editors, pp. 78-83. Earthscan Publications, London, UK.

---------- 1986, The Decision-Making Framework for Tree Planting in the Agroforestry Outreach Project. Report submitted to A.I.D./Haiti. University of Maine, Orano.

Finsterbusch, K. et al. 1989, Field Applications of the SCOPE Framework. Report submitted to A.I.D./Washington. International Development Management Center, University of Maryland, College Park, MD.

Food 2000, 1987, Food 2000: Global Policies for Sustainable Agriculture. A Report of the Advisory Panel on Food Security, Agriculture, Forestry and Environment to the World Commission on Environment and Development. Zed Books, London, UK.

Gow, D.D. 1989, A National Community Forestry Strategy for Zambia. A proposal presented to the Forestry Department, Government of Zambia and FAO, Lusaka, Zambia.

-------- 1988, Beyond the Project: The Quest for Sustainability in the Third World. DESFIL Working Paper. Development Alternatives, Inc., Washington, DC.

-------- 1987, Sustainable Development of Fragile Lands: The Case of Extensive Livestock Production in Africa: Agricultural Administration and Extension, Vol. 24, pp. 3-32.

Gow, D.D. et al. 1989, Social Analyis for Third World Development: Towards Guidelines for the Nineties. Development Alternatives, Inc., Washington, DC.

---------- 1979, Local Organizations and Rural Development: A Comparative Reappraisal. 2 vols. Development Alternatives, Inc., Washington, DC.

Hecht, S. 1989, Indigenous Soil Management in the Amazon Basin: Some Implications for Development. Fragile Lands of Latin America: Strategies for Sustainable Development. J.O. Browder, editor, pp. 166-181. Westview Press, Boulder.

Holdridge, L.R. 1967, Life Zone Ecology. Revised edition. Tropical Science Center, San Jose, Costa Rica.

Honadle, G.H. 1986, Development Management in Africa: Context and Strategy -- A Synthesis of Six Agricultural Projects. A.I.D. Evaluation Special Study 43. A.I.D., Washington, DC.

Horowitz, M.M 1988, Anthroplogy and the New Development Agenda: Development Anthropology Network, Vol. 6, No. 1, pp.1-4.

Hyden, G. 1983, No Shortcuts to Progress: African Development Management in Perspective, University of California Press, Berkeley, CA.

Hyman, E.L. and B. Stiftel 1988, Combining Facts and Values in Environmental Impact Assessment: Theories and Techniques. Westview Press, Boulder.

Jolly, A. 1989, The Madagascar Challenge: Human Needs and Fragile Ecosystems. Environment and the Poor: Development Strategies for a Common Agenda. H.J. Leonard and contributors, pp. 3-45. Overseas Development Council, Transaction Books, New Brunswick.

Korten, D.C. 1984, Rural Development Planning: The Learning Process Approach. People-Centered Development: Contributions toward Theory and Planning Frameworks. D. C. Korten and R. Klauss, editors, pp. 176-88. Kumarian Press, West Hartford.

Leonard, H.J. 1989, Environment and the Poor: Development Strategies for a Common Agenda. Environment and the Poor: Development Strategies for a Common Agenda, H.J. Leonard and contributors, pp. 189-215. Overseas Development Council, Transaction Books, New Brunswick.

Lowenthal, I. 1990, Social Soundness Analysis of the National Program for Agroforestry. Development Alternatives, Inc., Washington, DC.

Macdonald. T. 1988, Another View: Indigenous Perspectives: The DESFIL Newsletter, Vol. 2, No. 1, pp. 8-12.

Morss, E.R., D.D. Gow, and C.W. Nordlinger 1985, Sustaining Project Benefits. Implementing Rural Development Projects: Lessons from AID and World Bank Experiences. E.R. Morss and D.D. Gow, editors, pp. 217-243. Westview Press, Boulder.

Morss, E.R., D.R. Mickelwait, and C.F. Sweet 1975, Strategies for Small Farmer Development. 2 vols. Westview Press, Boulder.

Murray, G. 1987, The Domestication of Wood in Haiti: A Case Study in Applied Evolution. Anthropological Praxis: Translating Knowledge into Action, R. Wulff and S. Frisk, editors, pp. 223-240. Westview Press, Boulder, CO.

Redclift, M. 1987, Sustainable Development: Exploring the Contradictions, Methuen, New York.

Reid, A. 1988, Weathering: Poems and Translations. University of Georgia Press, Athens.

Roe, E. and L. Fortmann 1982, Season and Strategy: The Changing Organization of the Rural Water Sector in Botswana. Rural Development Committee, Cornell University, Ithaca.

Shaikh, A. et al. 1988, Opportunities for Sustained Development: Successful Natural Resources Management in the Sahel. 4 vols. E/DI, Washington, DC.

Siy, R. 1982, Community Resource Management: Lessons from the Zanjera. University of the Phillipines, Quezon City.

Low Input Sustained Yield Systems

CHANGING STRATEGIES FOR DEVELOPMENT IN U.S.A.I.D.

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Throughout the history of AID and its predecessor organizations, over half of all development assistance resources have been allocated to food, agriculture and nutrition activities. This also includes the areas of natural resources that are related to agricultural pursuits. Institutional development has been the mainstay of these agricultural development efforts -- establishing or strengthening faculties of agriculture, national agricultural research centers, agricultural extension services, agricultural credit agencies, and the other government agencies that provide regulation or services to the farm sector. These institution building initiatives have concentrated on training, particularly degree training at U.S. universities, to provide developing nations with the human capital to run their institutions. In addition, there has been substantial technical assistance provided, much of this by the Land Grant Universities. AID has been fortunate to have access to an outstanding science and education community in the U.S. from which to draw project support. In a few cases, AID has also funded the construction of the facilities needed to house these new institutions and provided specialized equipment for operations.

As a result of these efforts, most of the developing countries have functioning faculties of agriculture, many of which have graduate schools, and a range of other research and development institutions necessary for the independent operation of a modern agricultural sector. While it is still recognized that these agricultural institutions need continued assistance in staff development and specialized technical assistance, AID's historic commitment to institutional development is changing. Much of the funding for the further development of these institutions is now coming from the multilateral donor organizations such as the World Bank and the Regional Development Banks. In addition, much of the in-service staff

training is being provided by the network of International Agricultural Research Centers (IARCs) that have developed over the past twenty years. Thus the role of the U.S. in agricultural development is changing and thereby altering AID's relationship with U.S. universities and other sources of American technical expertise used for international development efforts.

A growing plethora of development and environmental imperatives have prompted AID to spread its resources more thinly. Underlying this change is an emerging consensus that real development is a systematic process. Therefore, agricultural development must come in conjunction with assistance in health, population planning, nutrition, education, and other essential needs. The end result has been a decline in the level of resources for agricultural development as well as a refocusing of the development mandates into two main emphases. One is to work closely with the World Bank and the IMF to leverage changes in basic policy that open up the incentives for greater agricultural productivity. This activity has been called, "policy dialogue and reform." The second area of shifting emphasis, that closely parallels the first, is on developing the private sector, including a wide range of industries that provide service to agriculture such as processing, distribution, handling, marketing and export of the products from agriculture.

Against the backdrop of these changes, AID has begun to establish new working relationships and general procedures through which it operates. When concentrating on technical areas such as agriculture, rural development, nutrition, health, population, and education, AID formerly used narrowly focused projects with very specific objectives. Much of the input into project development was done in partnership between the individual AID missions and the Bureaus in Washington, DC. This project development and management relationship is also changing. Over the past few years, most of the authority for project selection, design, implementation and evaluation has been delegated to the individual Mission directors in each AID recipient country, with minimum oversight and involvement of the Bureaus in Washington. An even more recent trend is the establishment of regional development funds, the first being the Development Fund for Africa, that have much broader objectives and very few restrictions on allocating resources.

In the past the budgets were approved and allocated by Congress to the various technical sectors. Under the new regional development fund concept, these allocations are left largely to the discretion of the Missions. The end result is that technically focused projects are being substituted by large multisectoral programs with final implementation in control of the host government rather than by AID contractors in the U.S. These trends have very significant implications for members of the Society of Range Management who have direct interests in international agricultural development.

The trends that I have just outlined are also being influenced by changes in national opinion on global problems that impact international development. These include a growing interest in environmental issues, particularly sustainable agriculture, integrated pest management, global warming, water pollution, deforestation, etc. These environmental imperatives are being promoted by a wide range of private voluntary organizations (PVOs) and non-governmental organizations (NGOs) that have mobilized into a very influential political force both nationally and internationally. Because of their wide influence, an increasing number of the activities financed by AID are being contracted to these PVOs and NGOs. Furthermore, they are having a major impact on the program directions of AID and other international development organizations. Their particular interest in the environmental damage caused by the overgrazing of vast rangelands in the developing world presents an ideal opportunity for this Society to merge efforts. The members of the Society of Range Management should consider means by which they can more fully interact with this very popular community of PVOs and NGOs.

The deterioration of the U.S. trade balance in the early 1980s has helped call attention to the importance of international trade and export markets for U.S. goods. Today there is emerging realization by American agricultural leaders that the predominant future markets for U.S. agricultural products will be in the developing countries. They are beginning to look at agricultural development in these countries as the crucial engine for broad-based economic development, one which indirectly stimulates demand for an ever increasing array of American farm products, especially the value added products that bring higher profits. As a result, there is rising support for international agricultural development activities

by the U.S. farm community rather than a hostility that emerged during the early 1980s. The U.S. university and scientific research communities are sharing in this increased commitment to international development, partially due to their self interest in the explosion of new scientific capacity abroad.

The U.S. agricultural research system dominated global research for many years and trained a high proportion of the world's scientists. However, over the past two decades a highly qualified global agricultural research network has developed that dwarfs the U.S. system. It is one from which the U.S. is increasingly isolated and excluded by its own policies, funding methods and complacency. We now appear to have less than 10% of the world total of agricultural scientists and are no longer a leading exporter of agricultural technology. In fact, over the past few years we have become a net importer of agricultural technology.

International agricultural research is vital to U.S. domestic agricultural policy and market position. Since new technology is increasingly being developed abroad, we must link into its development through collaborative research and information exchange, or risk the consequence of becoming second users of the latest technology and lose our competitive edge. The U.S. Department of Agriculture and other government agencies have begun to respond to these concerns by formulating new policies and programs that directly address international agricultural research and development. AID is also moving in this direction. This is evidenced by an increase in new technology development projects contracted out to U.S. universities and research institutions.

The U.S. private sector is also becoming more acutely aware of our economic interdependence with developing nations. In the past decade, U.S. industry has surpassed the public sector and is now the dominant source of new technology, rather than the unversities or government experiment stations. Prospects for future access to new technologies, genetic resources and export markets have prompted this sector to seek new partnerships in the developing nations and join the growing advocacy for foreign aid.

In summary, I would conclude that the traditional projects that characterized international agricultural development by AID are rapidly diminishing and being replaced by large multisectoral progams implemented by the host governments. Decision-making on resource allocation and priorities is increasingly in the hands of the local AID staff in the individual countries. The number of technical professionals in AID is rapidly decreasing to the point where technical decision-making is dependent on non-AID staff. Other international organizations are replacing the historic efforts in institutional development that were originally funded by AID and implemented by universities and other U.S. institutions.

The future of U.S. development assistance will be significantly impacted by the growing environmental concerns and the realization that the U.S. is in a highly competitive global agricultural economy. A new environmental constituency is mobilizing in the U.S. and changing our national priorities. The Society of Range Management should become more involved with the environmental community as the degradation of the world's rangelands is a significant contributor to environmental deterioration. Indeed, there appears to be a very different and growing understanding of "development" -- one focused on the emerging transnational issues of development and their impact on American interests. The Society of Range Management should closely monitor this changing national opinion and link up with the new partnerships forming to facilitate international agricultural development.

NOTE

The opinions and views expressed here are my own and not necessarily those of the U.S. Agency for International Development.

Low Input Sustained Yield Systems

CHANGING TRENDS IN THE WORLD BANK'S LENDING PROGRAM FOR RANGELAND DEVELOPMENT

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ABSTRACT

Following disappointing experiences with earlier livestock development projects, a strategy is evolving regarding the World Bank's rangeland lending program, which (i) places rangeland development in the context of a broader natural resource management effort; (ii) pays increased attention to ensuring an appropriate incentive frame work to motivate of the livestock herders to invest in rangeland conservation and improvement; (iii) focusses on private institutions (herder groups, village associations) to take responsibility in natural resource management; and (iv) aims at ecological, financial and economic sustainability, while reducing or eliminating Government subsidies. The paper will review the initial results with these new initiatives and indicate future research and development requirements.

INTRODUCTION

Livestock and range development have been important components of the World Bank's lending program for agricultural development in the Third World. This interest is based on livestock's importance as a source of income, rural employment and food production, often accounting for 20-50 percent of the agricultural value added in developing countries, and rangelands prime function in sustaining that production. However, as a result of poor performance, Bank lending for livestock development declined dramatically over the last decade. After a peak of US$340 million [2] per year over the period 1974-79, World Bank lending declined to US$240 million per year over the period 1980-85 and is now at about US$100 million per year. Funding for rangeland development dropped even sharper than funding for other livestock activities.

After a brief summary of the key characteristics of range/livestock production in the Third World, I will in this paper first review the reasons for failures in earlier range development projects, which caused this dramatic decline in range/livestock lending. I will then describe how lessons from these earlier projects have been incorporated in present World Bank-funded range development efforts, highlighting the increasing concern for financial, economic, institutional and ecological sustainability and the widening focus towards integrated natural resource management. Finally, I will provide some results of these newer approaches and conclude with recommendations for future research and development. I will focus on experiences in the arid and semi-arid (less than five month growing season) areas in Sub-saharan Africa (SSA) and West Asia and North Africa (WANA), because that is where the majority of World Bank-funded range development projects were, and still are, carried out.

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[1] Paper to be presented at the International Rangeland Symposium, Reno, February 15, 1990. Views expressed in this paper are the author's and should not be attributed to the World Bank or its affiliates.

[2] Current US Dollars.

I will not deal with other forms of livestock development like dairy and poultry production, which have a better record in World Bank lending.

RANGE/LIVESTOCK PRODUCTION IN THE DEVELOPING WORLD

Range/livestock production in the arid and semi-arid tropics is characterized by highly mobile herds and herders, who adapt their migrations continuously to the quality and quantity of available feed and drinking water. The main objective of these pastoral producers is survival through risk limitation, an objective best served by the high mobility, a high number of animals per family, multi-species herds and the distribution of one's animals over various herds. Very complex land and labor arrangements have traditionally emerged in support of these strategies. There is a strong mutual dependency between range/livestock production and crop farming through the exchange of millet for milk and crop-residues for manure, and the sale of animals to crop farmers for traction and investment purposes.

This system is coming increasingly under stress. Population growth is causing widespread crop encroachment, removal of the perennial tree cover for fuel wood and increased stocking rates. For example, in WANA, the range area declined over the last two decades by 13 percent, while livestock numbers increased over the same period by 42 percent, leading to an increase in the stocking rate from 2.8 ha per Tropical Livestock Unit (TLU) in the early sixties to 1.7 ha per TLU now (Glenn, 1988). This crop encroachment affected especially dry season grazing areas in areas of high potential areas, like river valleys and flood plains, which are essential links in the viability of pastoral production. Moreover, livestock ownership is shifting towards absentee owners. Changing lifestyle preferences have induced the wealthier pastoralist to seek an urban life and favorable cereal/livestock price relationships have encouraged crop farmers and civil servants to invest in livestock. As a result, herding decisions are now increasingly made by herders, who do not own the herd. For example half the livestock population of the Sahelian countries is now estimated to be herded by paid herders. These hired laborers and crop farmers do not have the authority to impose discipline in range management and a shift from traditionally well managed communal lands to a "free for all" over-exploitation, typical of an open access resource is occurring. This shift has been reinforced by government policies to declare rangelands public property and undermine traditional communal ownership patterns and land use control.

PAST EXPERIENCES

Overview.

Faced with such a complex and already efficient operating system, it is not surprising that early range/livestock projects have not been successful. The most important weaknesses in earlier projects included: (i) inadequate appreciation of the efficiency and complexity of the traditional production systems; (ii) too narrow focus on range and water development; (iii) inappropriate incentive frame work; (v) lack of appropriate technology and (vi) weak implementing agencies.

Understanding the traditional system.

Lack of appreciation for the complexity and the ecological and economic efficiency of the traditional system has probably been the most important single cause of failure of the first generation (pre 1970) ranch development projects, and still has been a major factor in the disappointing performance of the next generation of range development projects.

The failure of ranching. The first generation projects sought to transfer western ranching technology to the arid tropical rangelands, investing heavily in capital improvements (fencing, water and exotic breeds) to increase productivity per animal. This approach neglected prevailing economic conditions, and was contrary to the needs, as it introduced capital to save labor in a situation where labor was abundant and focussed on meat production per animal in a situation where land was scarce, and therefore production per unit area ought to have been the key criteria. They furthermore worked generally through parastatal organizations, which proved to be incapable in providing the flexible management required in dealing with livestock in a fragile environment and changing economic conditions.

The earlier range development projects. As a result of these earlier negative experiences, the focus shifted in the seventies from ranch to range/livestock projects. These second generation projects centered almost exclusively on improving range and livestock production, without regard for other users of the area, and kept pursuing the ranching objective of beef production, neglecting the pastoral objectives of risk reduction and subsistence dairy production. These projects included the allocation of land use or tenure rights to groups to interest them in rangeland improvement and forego over-exploitation. These projects opened up these areas through improved infrastructure and water points, tried to settle nomadic producers and to reduce grazing pressure through improved marketing, or sometimes through imposing controls on herd size. However, as these interventions were generally planned without an adequate understanding of the existing production system and its supporting socio-economic fabric, they were very poorly adopted by the target population and did not produce the expected benefits. The so-called improved land allocations did not provide the flexibility required under erratic rainfall regimes and paid insufficient attention to traditional movement practices (Sandford, 1983). Moreover, they neglected existing social structures and focussed only on rangeland improvement. The reforms introduced often resulted in disrupted traditional movement patterns, benefitted only the wealthier pastoralist (who could afford to be less mobile and influence decisions), or became sources of friction between croppers and herders. Improvements in water supply, while permitting a short term expansion of the grazing area and increase in herd productivity, contributed to a breakdown in the traditional mechanisms of water and grazing control, and thus led in the longer run to overgrazing. Settlement reduced the ecological versatility of the pastoral production system and made them more vulnerable, especially in times of drought. The mostly parastatal meat marketing companies, established to increase off-take from the range, developed into unmanageable bureaucracies, which undermined previously well-functioning traditional systems and thus stifled rather than encouraged increased off-take. Similarly, Government agencies proved incapable to control stock numbers. They lacked the authority to replace traditional grazing discipline, but by trying to impose inflexible controls in a situation where a flexible response was required, frequently worsened the situation. Thus, these earlier range projects became associated with overgrazing and range degradation.

The incentive framework.

Range/livestock development in most developing countries has been hurt by inappropriate input and output pricing, interest rates, foreign exchange rates and cost recovery policies, which favored capital intensive, feed grain based production systems, but discouraged de-stocking and investments in rangeland improvement and conservation.

Grain/fodder price relationships. With -- especially in WANA -- high subsidy levels for imported feed grains and locally produced cereals under the misguided objective of achieving food self-sufficiency in all

foodstuffs, there was little incentive for livestock producers to invest in fodder production or to improve natural rangelands. Indeed, subsidies on local cereal production and drought relief policies encouraged the opposite. Subsidized cereal production caused extensive crop encroachment of marginal cropping in good range areas, as shown by the vast range areas in WANA, which over the last two decades have been plowed up for marginal, erosion prone, wheat or barley cultivation. Moreover, the supply of free grain and fodder to drought stricken areas to save affected herds, while imperative for political and humanitarian reasons, constitute a disincentive to de-stocking and fodder conservation and eliminate the essential recuperation period of the range after the drought.

Prices and costs of other inputs. Similar distortions occurred in producer pricing and cost recovery policies. On the one hand, livestock producer prices were generally kept low under a policy of providing the politically influential urban areas with cheap meat and milk. Moreover local production suffered from unfair competition from imports, which could penetrate the markets at artificially low prices, thanks to policies of overvalued exchange rates and unrestricted access of subsidized (dumped) meat and milk from the developed world. On the other hand, animal health care, water and grazing were provided free to the pastoralist. This not only kept the pastoralist out off the cash economy and provided a disincentive for them to sell surplus stock, it also undermined the financial viability of the services, as Governments were increasingly unable to provide from its own resources the necessary maintenance costs.

Technologies.

The availability of technology for range development is skewed. Proven technologies in the area of water development and diseases control have opened up previously under-utilized areas and eliminated the risks confronting livestock a few decades ago, but need to be accompanied by an increase in the biomass production of the range, to increase the carrying capacity of the land. However, in this area results have been disappointing. The introduction of new species and reseeding failed because of the poor competitive capacity of the introduced species, compared with the aggressive annual species of the natural vegetation. Reseeding with already occurring species (including shrubs) and fertilization has shown to increase dry matter production, but meat/labor, meat/mechanization and meat/fertilizer price ratios rule out the economic application of these techniques.

Implementation.

Range/livestock development in the Third World has been typically entrusted to livestock or veterinary departments. These departments lacked the interdisciplinary skills and interest to tackle the complex social and technological problems of dry land resource development. Furthermore, they did not have the management capabilities to solve the specific logistical and staff problems inherent in working in the vast, sparsely populated and remote and inhospitable areas without adequate services. Earlier projects relied therefore heavily on special project units to bring together the necessary disciplinary and management skills. This helped most projects to proceed relatively rapidly in terms of physical implementation, but undermined the central government by taking away its best staff and did not create the institutional and staff development base, necessary to sustain project activities after project completion (OED, 1985).

Conclusion.

In summary, range livestock projects were perceived as extremely poor performers, because they showed substandard adoption rates by the target population, were not sustainable, yielded unsatisfactory economic results and contributed to overgrazing.

CHANGING PERCEPTIONS

This picture is changing. First of all, there has been a growing appreciation of the efficiency of the traditional systems. This was brought about by research like the Dutch/Malian Primary Production Research (P.P.S) in Mali, which showed that, while the productivity per head is low, the production of animal protein per hectare of the Sahelian rangelands equals or surpasses that of ranches in the USA or Australia under similar rainfall conditions (Breman and de Wit, 1983). Moreover, comparisons between traditional production and ranches in Africa showed that the production of protein per ha under the traditional production system is significantly higher (de Ridder and Wagenaar, 1984). Secondly, there has been increased sensitivity regarding the complexity of the traditional systems and more interest for the possibilities of using traditional institutions in range management. This is to a large extent the result of an increased input of anthropologists in project design, who, while only involved in the preparation of a minority of the range/livestock projects in the seventies (Sandford, 1981), are now involved in the preparation of practically all World Bank-funded projects dealing with range areas. Thirdly, there has been a growing realization that resource degradation and desertification of the range areas are not only caused by overgrazing, but is the result of a much more complex interaction between population pressure, crop encroachment, fuel wood needs and livestock numbers (Gorse and Steeds, 1985, and Nelson, 1989). In fact, it is not useful to single out any one of these factors as a cause of resource degradation, they should be seen together and in function of the human carrying capacity of the land. In this environment, livestock forms such an integral part of the agricultural production systems, that it can not be neglected. Finally, the incorporation of the lessons learned in earlier projects has led to some promising results in the latest generation of projects, which, to some extent, has rekindled the interest.

RECENT TRENDS

Thus, more recent World Bank-funded projects seek to (i) place rangeland development in the context of a broader natural resource management effort; (ii) focus on private institutions (herder groups, village associations) to take responsibility for natural resource management and adopt more innovative approaches in project organization and management; (iii) pay increased attention to the motivation of livestock herders by ensuring appropriate incentives and regulations for them to invest in rangeland improvement; and (iv) aim at ecological, financial and economic sustainability, while reducing or eliminating Government subsidies. These main elements of more recent project design are reviewed below.

Integrated Natural Resource Management.

Arid and semi-arid zones. In these zones, range development is increasingly seen as part of the development of an entire production system, and current projects dealing with rangeland areas include crop farming and forestry activities as integral parts of an overall resource development effort. This is shown on the land tenure side, where current models focus increasingly on the total rural community, including crop

farmers and try to introduce better land rights and more rational resource management from the bottom up through a negotiating process with all the parties concerned. For rangelands per se, the trend is to arrive at more flexible tenure arrangements, with water rather than grazing rights, and preferential users rights, rather than exclusive ownership as the main features, and, where relevant, with the allocation of dry and wet season grazing areas, so that the introduced tenure system resembles more closely the traditional system and is better adapted to prevailing ecological conditions. On the technology side, current projects aim to maintain rangeland productivity and condition, rather then increase production. Increasing human numbers are sought to be accommodated by--wherever possible--increased crop production and by migration to higher potential areas. For the dry areas, the focus is thus on erosion control and soil fertility maintenance and improvement. In these activities, the emphasis is on many small scale localized operations rather than reliance on blanket coverage with one technique for large areas. Water harvesting, micro-catchment agriculture, and the planting of localized wind breaks with fodder trees are some of the techniques used. Erosion control via large scale, mechanized soil engineering like soil bunding has proven expensive as well as disappointing in its outcome. Vegetative bunding using non-palatable grasses such as Vetiveria spp. in South Asia (Grimshaw, 1989), and stone-bunds as introduced at village level in Burkina Faso (Lewis, 1989) seem to be more useful and cheaper approaches. For the rangelands per se, grazing management techniques (deferred grazing) and de-stocking through stratified production (i.e. breeding cow/calf operations on the range and fattening in the higher potential zones on crop residues by small holder farmers) are about the only feasible interventions pursued.

Sub-humid zones. However, the scope for improvement in the arid zone will remain extremely limited, and excess human and livestock populations will have to move towards more favored areas -- such as the higher rainfall tropical savannahs, currently being opened up because of better control of human and livestock diseases. These savannahs offer more possibilities for technological breakthroughs, and are the major focus for livestock research by the International Agricultural Research Centers, sponsored by the Consultative Group on International Agricultural Research (CGIAR). This include forage research on (i) improved grass species (especially Hyperhenia) in the acid, phosphate fixing soils of South America's tropical [illegible]and savannahs, pursued by CIAT; (ii) fodder reserves (fodder bar[illegible]) with high quality legumes for dry season supplementation (especially Stylosanthes), cultivated under a low-input system pursued for Africa's tropical perennial savannah's by ILCA; and (iii) fallow improvements with annual medics as pursued for the North African and Middle Eastern crop/livestock areas by ICARDA. These technologies could make important contributions to sustainable rangeland exploitation of these areas and seem well adapted to the prevailing physical conditions and appear to fit well into the farming system. They are presently being tested under producer conditions, and success or failure of these tests could make a major difference in the outlook for rangeland and livestock productivity in the Third World. Moreover, they are urgently needed as the danger for irreversible degradation seems to be much greater for the highly sensitive perennial vegetation of the sub-humid areas, than for the much more resilient annual vegetation of the drier areas. The annual vegetation of for example the Sahel regenerates very rapidly after a couple of good rainfall years, but the current bush and weed encroachment in extensive areas in SSA's sub-humid savannahs is a much more difficult threat to revert.

Implementation.

The private sector. With the disappointing experience with government implementation of range development projects, the current trend is to transfer the responsibility for implementation as much as possible to private organizations, limiting the public sector's role to a catalytic and advisory one. Pastoral organizations involved in range management and village organizations involved in land management are now being sponsored under Bank and other external financing in most SSA and Maghreb countries. The constitution of these pastoral or village associations is preferably done through non-government organizations (NGO). The grass root associations are mostly formed following traditional societal structures, acknowledging the drawbacks mentioned by Sandford (1983) of solidifying prevailing inequalities and limiting opportunities for new and possible more innovative initiatives, but can involve also other social structures. These groups are normally constituted around those inputs which the pastoralist or villagers see as important (i.e. veterinary care and water in pastoral situations), to evolve progressively towards resource management and the allocation of preferential land use rights and as a channel for credit. The initial emphasis is on grass root level organization, although different levels of organization can emerge for different responsibilities. For example, the organization of basic animal health care requires a different (lower) level of organization than natural resource management or marketing. The final aim is to arrive at consolidating these grass root organizations into regional and national organizations, to act as partners to government services in the policy dialogue.

Public Sector. The increased emphasis on private organizations does not mean that we can do away with the public sector. The public sector is essential for responsibilities such as the control of contagious animal diseases, research and extension. Current projects focus increasingly on strengthening these services, improving the effectiveness of the sanitary protection and enhancing the multi-disciplinary skills of the research and extension agents and integrating range/livestock development into agricultural extension services. This is done most often in a national approach, integrating project activities into existing government services, with the emphasis on improving decentralization and local decision making, strengthening grass root extension and bringing about a two-way flow of information between the producer and the research and extension establishment.

Donor organization. The change of thrust towards localized and somewhat disperse interventions combined with long term institution building efforts, requires a more flexible approach from the donors. First, the very localized nature of the interventions, with many options to be tried, means a much heavier reliance on pilot projects to determine what works and what doesn't at a particular site. This, in turn, requires a greater programming flexibility and a decentralized decision making from the donors side. Second, as these are long term endeavors, donors should be willing to accept a commitment beyond the traditional four to seven years project periods. Third, as the emphasis has shifted from capital investments to institution building, the investment requirements are low. Donor organizations, especially the World Bank, have to accept that these projects, which require a lot of manpower in their design and supervision, require only very limited funding and thus do not show well on the balance sheet. Part of the solution to these problems is to shift from detailed project agreements covering a relative short period, towards flexible program financing covering a ten to fifteen year time span, with expanded decision making on expenditures shifted to the local level. I see a gradual move in that direction in the World Bank's lending program. Furthermore, the World Bank sees its specific role in leading the policy and strategy discussions.

Incentive framework.

Since the early to mid eighties, more attention is given to ensure that projects have the appropriate incentive and regulatory environment so that the envisaged investments can have their effect. In this respect, in particular the Magreb countries have made a major effort to eliminate input and interest subsidies and free local cereal, meat and milk producer prices, thus redressing some of the bias against investments in range development. Terms of trade between cereal and livestock production are being rectified and several countries have introduced measures against dumping to protect their local livestock industry. Most of these measures have been taken, however, only recently and need more time to "seep in" and demonstrate discernable effects. From the limited information available, it seems that they lead to a decline in intensive dairy production -- although small holder dairy remains viable -- and favor meat production under extensive conditions, especially from small ruminants. They seem to generate an increased interest in forage production, but it is not yet clear whether they engender the pursued increased investment in range conservation. There has been little progress in including better drought relief policies, in Bank funded projects. More progress has been made regarding cost recovery. All experiences indicate that traditional producers are willing to pay the full cost of most services, provided the service is reliable and of good quality. Thus, cost recovery is becoming generally accepted in SSA and WANA for veterinary services, and to a somewhat lesser, but still considerable extent, for livestock water. Grazing fees for the use of communal grazing lands are still only introduced in some isolated associations, but need also to be pursued as an important element in achieving sustainable range production. However, cost recovery is only effective if the proceeds are used in the maintaining and improving the service they are charged for. This is generally not a problem, if charged by private institutions, but can become a major issue, if charged by the public sector. Decentralization of the decision making authority on the use of these fees to the implementing ministries, and even further to the local level of these implementing ministries has thus become also an important goal to be pursued in arriving at financial sustainability of the necessary services involved in communal land management.

Sustainability.

Thus, sustainability is the central focus of our current range development projects. Institutionally, it is pursued by strengthening traditional land tenure rights and structures in imposing the necessary resource conservation discipline, by incorporating all concerned parties in the planning and implementation process and by strengthening the public agencies in the key supporting tasks of sanitary control, research and extension. Ecologically, it is pursued by focussing on overall land use, giving high priority to soil fertility and range conservation and leading to integrated natural resource management programs. Economically, it is pursued by removing distortions and creating the correct incentive framework for the private sector to invest in natural resource conservation. Socially, it is sought by supporting the emergence and development of herder and village associations. Finally, financially, it is pursued by eliminating government subsidies, by introducing realistic cost recovery measures for services it provides and by establishing a direct feed back of the revenues in the services.

Holistic Resource Management (HRM).

With the growing realization that the integration of all human, physical and financial resources is essential in arriving at sustainable resource management, the HRM planning model (Savory, 1988), which has similar aims,

is receiving increased attention at the World Bank. HRM has been implemented by FAO/World Bank staff since 1986 in UNDP funded pilot trials in six WANA countries. While it is too early to provide definite results, an evaluation mission in early 1988 noted: "HRM ensures that goals are set, the socio-economic and ecological factors are given appropriate attention and that a comprehensive and flexible management system is produced, which is applied to the land and closely monitored". This institution building aspect seems to be the most relevant feature in our future resource management project planning and implementation, much more important than the introduction of the short-duration high intensity grazing system, with which HRM is frequently associated.

EVALUATION CRITERIA AND IMPACT

Evaluation Criteria. The World Bank and most financing agencies have placed a great importance on the Economic Rate of Return (ERR) as the key yard stick for project success and failure (Gittinger, 1982). However, this ERR is developed for typical industry or other "hardware" projects, where costs and benefits for the "without" and "with" project situation can be accurately estimated. This is not the case in most range/livestock projects, where the effects of the resource decline in the "without" situation and the impact of institution building and resource conservation in the "with" situation can not be accurately quantified in economic and financial terms. Furthermore, the ERR tends to force project planners to be more optimistic regarding expected benefits, compressing the period in which the results are to be obtained, in order to project the ERR necessary for project approval. This is contrary to the long term perspective sought in natural resource management projects. Various alternatives are proposed (see for example Schramm and Warford, 1989) to capture these long term and less tangible effects, but generally accepted criteria do not yet exist.

Impact. The impact assessment of more recent World Bank-funded rangeland development efforts will therefore remain subjective. At the national level, legislation is now introduced in most SSA and North African countries, to make range water development conditional on the carrying capacity of the surrounding area, and the presence of an appropriate rural organization to manage the rangeland concerned, thus stopping the indiscriminate water development and consequent overgrazing of earlier times. In those countries where feed subsidies have been abolished, there is a stronger interest in rangeland conservation. At the local level, initial signs are encouraging. Pastoral associations have shown to be capable of organizing their own basic animal health care and are stating to get involved in water and range management. Some examples: In Eastern Senegal, village associations negotiated among themselves the boundaries and introduced better resource management for their village areas, which reportedly improved the condition and increased the carrying capacity of these rangelands. In Mauritania, pastoral associations, created under the Bank-funded livestock project, are very actively involved in environmental protection, notably in the prevention of tree cutting and grass fires. In Burkina Faso, village based erosion control programs are rapidly expanding. In Niger, where water development is already for some time made fully conditional on the existence of pastoral associations, resource management plans for parts of the country are now being developed by a union of pastoral associations. In the Central African Republic, specific grazing areas are being allocated to producer groups and rotational grazing introduced on hitherto communal grazing areas. Similar positive experiences are reported from the involvement of tribal groups in resource management on communal rangeland areas in Morocco and Tunisia. On the other hand, much remains to be assessed. There is no evidence that we will succeed in the crucial area of control

of stock numbers and overgrazing, nor has the efficiency of these groups been adequately tested under condition of stress, like severe droughts. Still, it seems the only option open to the sustainable development and conservation of an important resource to many SSA and WANA countries.

FUTURE NEEDS

Prospects for directly raising the productivity of the arid and semi-arid rangelands are bleak, and we clearly need to retain the present objective of range conservation, combined with eventual increases of the total human carrying capacity of the land through crop and fuel wood production improvements. Within these objectives, more innovative and activist interventions could be considered. On the policy side, this could include the introduction of incentive policies, which encourage investments in soil fertility improvement. In this context, subsidies on phosphate fertilizer or planting of trees and taxation of those villages/groups who do not plant trees or control erosion, together with the provision of matching grants for those who do, could be considered. On the social side, research needs to improve the analytical tools of the socio-anthropologists, allowing them to better incorporate the views of target populations in development planning, advice on which social grouping(s) would provide the maximum social cohesion for different tasks and to better anticipate the institution building effort necessary to induce individual herders or groups to invest in resource conservation. On the technology side, research should cover the integration of livestock, crops and forestry, rather than focus exclusively on range improvement. That needs to include moisture conservation techniques, the search for higher yielding drought resistant cereals, with particular attention to their crop residues, nitrogen-fixing legumes for dry areas, and fast growing trees to cover fuel wood needs, and for SSA, the use of animal traction and manure in the development of sites of higher potential. On the institutional side, we need to strengthen government services in research and extension, improving especially their inter-disciplinary skills. On the pastoral/village organization side, we need to continue what has been started, strengthening grass root efforts, and -- very importantly -- developing the grass root organizations into national organizations, to act as partners to government services in the policy dialogue. More than anything, perseverance and consistency on what has been started seems crucial in this institution building exercise. Specific attention requires also drought relief strategies. Inter-annual variability and drought are intrinsic aspects of rangeland development, and very little research has been carried out on how to cope with bad years, i.e. how to achieve in a short time at reasonable prices a significant reduction in livestock numbers so that stocking rates are adapted to the reduced carrying capacity. Adequate tools (i.e. internal saving and taxation mechanisms) to achieve those objectives are essential to sustainable rangeland production.

CONCLUSION

In this paper, I have tried to summarize recent trends in range development in World Bank-funded projects. I hope, that I made it clear that we are evolving a new strategy, and that we are in a state of transition from range development to resource management and from a project approach to a more comprehensive national institution building program approach. Encouraging results are forth coming, although we are only in the initial phase, and many questions remain to be answered. However, this approach seems the most logical way to go, and might well be one of the last opportunities to promote sustainable rangeland development.

REFERENCES

Breman, H and C.T. de Wit (1983). Rangeland Productivity and Exploitation in the Sahel. Science, Vol 221,pp 1341-1347.

de Ridder, N. and K.T. Wagenaar (1984). A comparison between the Productivity of Traditional Livestock Systems and Ranching in Eastern Botswana. Proceedings of the 2nd International Rangeland Congress. Adelaide.

Glenn, J., (1988). Livestock production in North Africa and the Middle East. Problems and Perspectives. World Bank Discussion Paper no. 39. Washington D.C.

Gorse, J., and D. Steeds (1984). Desertification in the Sahelian and Sudanian Zones of West Africa. World Bank Technical Paper no. 61, Washington D.C.

Grimshaw, R. (1989). A review of Existing Soil Conservation Technologies, and a Proposed Method of Soil Conservation Using Contour Farming Practices backed by Vetiver Grass Hedge Barriers. Internal memo. World Bank, Washington D.C.

Lewis, J., (1989). Resource management in the Sahel. Internal memo. World Bank, Washington D.C.

Nelson, R., (1988). Desertification. Inter-agency Working Group on desertification. The World Bank, Washington D.C.

OED (1985). The Smallholder Dimension of Livestock Development: A Review of Bank Experience. Internal World Bank report. Washington, D.C.

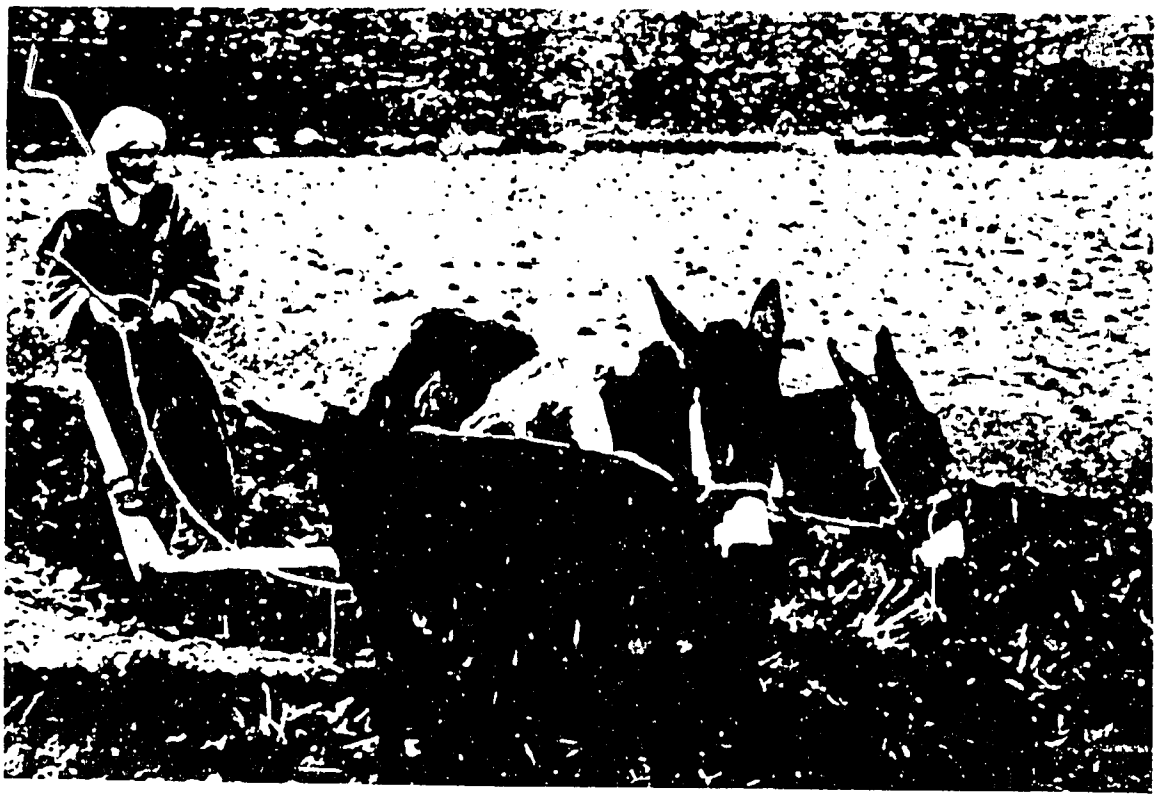
Sandford, S., (1981). Review of World Bank Livestock Activities in Dry Tropical Areas. World Bank Internal Report. Washington, D.C.

Sandford, S., (1983). Management of Pastoral Development in the Third World. Riley and Son. London.

Savory. A., (1988). Holistic Resource Management. Island Press. Covelo, CA.

Schramm, G. and J.J. Warford, (1988). Environmental Management and Economic Development. John Hopkins University Press. Baltimore, Md.

Gittinger, J. Price. (1982). Economic Analysis of Agricultural Projects. 2nd edition. John Hopkins University Press. Baltimore, Md.



Low Input Sustained Yield Systems

LOW INPUT AGRICULTURE AND SUSTAINABLE YIELD SYSTEMS FOR THE UNITED STATES

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ABSTRACT

The United States of America developed upon the strength of its natural resources. We have the ability to apply broadly adaptable technologies,ie, irrigation, chemicals, and mechanization that can dominate natural components hindering agricultural productivity (Hildebrand 1989). Historically our agricultural economy, institutions, and research have been built upon the foundation of maximization of yields. The results of our agricultural advancements have contributed greatly to raising of the standard of living and to the alleviation of hunger. However, with this focus on yield maximization environmental costs such as contamination and depletion of ground water, soil erosion and loss of wildlife habitat has occurred. Both the AG and Non-AG sectors of the public are voicing concern over these environmental issues. LISA is an example of this concern. The Soil Conservation Service recognizes the value of LISA and has made it one of its high priority items for 1990. Grassland agriculture is an excellent example of LISA concepts at work. It allows livestock producers the opportunity to sustain production of cost effective food and fiber while providing benefits to water quality and quantity, wildlife habitat and recreational experiences.

INTRODUCTION

The USDA - Soil Conservation Service (SCS) recognizes the inherent values of Low Input Sustainable Agriculture (LISA). Introduction of LISA principles into farm and ranch management regimes may offer direct benefits to the agricultural producer as well as to the environmental health of the nation and its soil and water resources. SCS's policy on LISA is to provide alternative conservation systems to accomplish farm and ranch management goals while emphasizing SUSTAINABLE production, profit, environmental quality, and food safety. SCS does not treat LISA as a separate program, but plans to integrate the principles of LISA into its on-going resource conservation and technical assistance program.

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What is LISA?

LISA means different things to different people. When one discusses LISA, one generally will discuss commodities crop production and alternative cropping systems. In some arenas LISA has been linked to "limited resource farmers" based upon "Low Input" being apart of its name. "Low Input" carries connotations that it is a throwback to the days before the use of widespread technology in agriculture. SCS has focused on the "sustainable" aspects of LISA.

SCS does not recognize LISA as an effort to "throwback" or anyway impede the use of advanced technology in agriculture. Organic agriculture is not the central theme of the LISA programs as we view it, however we do recognize that it does have a place in sustainable agriculture. We see LISA concepts, principles and application requiring a high degree of integration of managerial decision making, state-of-the-art implementation of research and development in effective agricultural production, as well as a blending of many forms of conservation that may have been discontinued due to a "low tech" image. LISA is applicable to a wide spectrum of agriculture operations including conventional-till, low-till, and minimum-till cropping systems. Livestock production systems with emphasis placed upon optimizing sustained versus maximizing pounds of food and fiber per acre is well within the LISA philosophy. SCS technical assistance to district cooperators is to provide LISA concepts, principles and application alternatives in such a manner that benefits to environmental quality, water quality and quantity, and economics of resource conservation can be realized.

Why is LISA an issue?

Non-point source water pollution from agriculture chemicals (ie, herbicides, pesticides and fertilizers), and soil erosion are environmental issues facing the nations farmers and ranchers. Todays agriculturalist must be environmentally alert and understand the dynamic nature of AG chemicals applied on the farm and ranch. As producers begin to recognize off-site impacts and the application technology to address these concerns, implementation of LISA type management programs will accelerate. Alternative tillage methods, integrated pest management, new conservation practices, diversification of farm enterprises and skillful management can lead to reduced purchased inputs. LISA programs make good environmental sense and should be applied in such a manner to achieve economic benefits to the producer and community.

The Soil Conservation Service is a technology transfer agency, whereby we translate research and other knowledge into information that can be applied by farmers and ranchers. Our principle clientele are private-sector agricultural producers.

The four major technology priorities for Ecological Sciences Division in 1990 are;

1. UPGRADE FIELD OFFICE TECHNICAL GUIDES
2. GROUND WATER AND SURFACE WATER QUALITY INITIATIVE
3. LOW INPUT SUSTAINABLE AGRICULTURE INITIATIVE
4. WETLANDS DEVELOPMENT INITIATIVE

Thus, Low Input Sustainable Agriculture, LISA, is a high technology priority for SCS. Dr. Marc Safley, Assistant Director of ECS, is our SCS national coordinator on LISA and sustainable agriculture. Three principle goals have been defined to address LISA within SCS. These goals are provide policy direction, develop technical materials, and provide training.

GOALS FOR FY 1990

Goal 1. Policy Direction.

SCS's policy on LISA and sustainable agriculture is as follows:

Sustainable agriculture is achieved through management strategies which help the producer select hybrids and varieties, soil conserving cultural practices, soil fertility programs, and pest management programs which reduce costs and amounts of purchased inputs. Sustainable agriculture minimizes adverse impacts to the immediate and off-farm environments and provides a sustainable level of production and profit. Sound resource conservation is an integral part of the means to achieve sustainable agriculture.

The Soil Conservation Service will, through its programs of resource conservation technical assistance, continue to provide producers with choices to accomplish their goals while providing for sustainable production, profit, environmental quality, and food safety. As such, SCS will not treat sustainable agriculture as a separate program, but will integrate its principles into existing technical materials and training programs.

At all levels within SCS, cooperation with the research community and with forward-thinking producers will continue to be the means by which our technical capability is kept ready to meet the challenges of sustainable agriculture.

Goal 2. Provide Technical Materials.

Plant Nutrient/Pesticide Management Specifications, demonstration farms, plant materials development for nutrient harvesting, and expanding the Field Office Technical Guide to fit a wider range of agricultural systems is the main focus on new technical materials.

GOAL 3. PROVIDE TRAINING:

Training will be provided with a hands on approach. Demonstration farms where examples of sustainable agriculture can be observed and discussed will be used. Exposure of employees the Rodale Institute, Land Institute and other similar type sustainable agricultural systems groups in our training approach where such things as ridge-till cropping, grassland management and perennial/native cereal grain systems can be discussed.

What has SCS done in the short term to integrate LISA?

Recently the Engineering Division released the first of a series of technical materials about low initial cost structures for soil and water conservation. The Ecological Sciences Division has added an agri-chemicals specialist to its staff to augment both LISA and water quality efforts through more effective use of AG chemicals and related conservation systems. Development under the guidance of the Economics and Social Science Division, methods to help display effects of conservation planning with emphasis on sustainable agriculture from an economic and social point of view will be addressed.

What has SCS done to address LISA in the Range Program?

In SCS our attempt to increase range conditions and trends on private-sector rangeland, have been and will continue to be within the framework of low dollar investment per acre expenditure to maintain acceptable cost effective systems. Low stock densities even in the highest of ecological range condition class simply do not permit any other feasible approach.

The SCS range program started making changes several years ago such as changing the practice Brush Control to Brush Management. Total eradication of brush was being promoted in the former, now is approached as a balanced brush control effort. A year ago last September in Ft. Worth, Texas ranchers were invited from all over the country to share their experiences with non-traditional enterprises on their ranching operations. SCS has also sent range conservationists back to school to help us integrate new

concepts with emphasis in alternative uses on rangeland for incorporation into our conservation planning environment.

Of particular interest to me is where the SCS range program is going in computer assisted decision aids for conservation planning. SCS has just concluded national training to the states on Phase I of the Grazing Lands Application module (GLA), a computer driven decision aid. GLA is a product developed for SCS by the Texas A&M University Ranching Systems Management Group. GLA will allow the field office conservationist to automate the ranch planning process in such a manner that projections can be analyzed for the producer. With the use of the computer, conservationists and producers can look at alternatives and the economic feasibility of conservation and cultural treatments of range, pasture, grazeable woodlands, forages on cropland and haylands.

Phase II of GLA, to be released next fall, will extend our current version to include a annual grazing plan scheduler and a forage quality balance sheet for livestock. Phase III of GLA, about 2 years down the road, will provide the ultimate in computer assisted ranch planning with a Geographic Information System (GIS) embedded into the software.

Tomorrows ranch planning from SCS will be geared more and more to personal computer assisted conservation planning. Information generated will be of extremely high quality, detailed to the level required by the farmer and rancher needs and delivered in a timely manner. Outputs will be the ultimate in decision making opportunities for the rancher and from this decision making will be the opportunity to apply LISA principles into everyday ranching decisions.

The SCS range discipline has the technical responsibility for pasture and haylands. Now we are in a better position to instill the concepts and principles of Agro-Ecology into SCS conservation planning on grazinglands. We feel this will have a positive influence in the reduction of purchased fossil fuels, increase net returns and encourage farmers and ranchers to implement a sustainable forage system on their farms and ranches.

CONCLUSION

Every since I heard the term. LISA, being a range conservationist, I felt you could not get any more low input and sustainable than range management. After all range management is based on ecological principles to achieve optimum sustained productivity of range sites. From my formal education and experience in the field, working within the ecological limits of the range resource with low inputs from fossil fuel products to obtain long term sustainable ecosystems was and still is my principle mission. Range

Management is based on "least cost" economic principles. We should not be defensive about trying to maintain low over head in our agricultural enterprises derived from rangeland resources. Every successful business in America strives to optimize and achieve better management to keep them on the cutting edge everyday. Researchers, ranchers, and technical experts in the field of range management need to stress the intellectual, the mental exercisers, the MANAGEMENT part of our disciplines name. We need to emphasize the importance of management and look toward innovative methods to build on this principle to promote sustainable ecosystems on rangelands.

When you talk LISA, your talking range management. As Wilson Scaling, Chief of the Soil Conservation Service told the State Conservationists at their last annual meeting, "Range Management is the original LISA". We in the range field have a leg up on other disciplines who are trying to integrate LISA principles into their area of agriculture. We must be prepared to share our success stories to any and all who will listen and look for new avenues and approaches to educate the AG and Non-AG public of the benefits of LISA and range management to our society. I would like to conclude with a challenge. I challenge all of the range profession to come to the fore front with the ecological principles so important for the sustainable ecosystems of rangelands and help make sustainable agriculture a success story.

ACKNOWLEDGMENTS

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REFERENCES

Hildebrand, Peter E., Agronomy's Role in Sustainable Agriculture: Integrated Farming Systems, Presented at the American Society of Agronomy meeting in Las Vegas, NV, Oct., 16, 1989.

THE ROLE OF TITLE XII UNIVERSITIES IN SUSTAINABLE YIELD PROGRAMS

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No concept has swept through international development circles and the halls of Congress as rapidly and with such force as the concept of "Sustainable Agriculture." This concept has universal appeal because it implies both a consideration of the immediate needs for food, fiber, and wood production as well as adequate attention to long term environmental issues. It forces cooperation between the traditional producer and the so-called environmentalist. It raises new questions for scientists involved in research and development projects at home and abroad.

I have been asked to speak to the role of universities as we move toward sustainable approaches to international development. My focus therefore, will be on the Title XII amendment to the Foreign Assistance Act and its implications. It is too early to make a judgement as to the changes under consideration by Congress which may replace Title XII. I hope the new legislation will strengthen and dilute university involvement in international development.

The Title XII amendment to the U.S. Foreign Assistance Act provides a mechanism to involve the major agricultural universities in all aspects of international development. Under this act, the Board for International Food and Agricultural Development (BIFAD) has taken the lead for USAID and the university community to examine approaches to sustainable agricultural production and natural resource conservation in the Third World countries.

It was my privilege to Chair a BIFAD Task Force on the subject of sustainable agriculture in 1988. Based upon some recommendations from this first task force BIFAD named a follow-up committee last year, which I co-chaired with Ambassador Robert Blake. This second committee last year, which I co-chaired with Ambassador Robert Blake. This second committee, composed of representatives of the environmental community, universities, USAID, the World Bank, and certain congressional interests, was charged with the development of a common agenda for jointly addressing environmental issues in the agricultural sector. BIFAD reports have been released from both of these committees. (Thomas 1985 and USAID 1989).

Neither of these BIFAD task forces spent a great deal of time on the definition of sustainable agriculture. We felt that the numerous papers and recent books on the subject were ample for reference purposes. Rather, we tried to move into an action agenda by accepting the concept of **sustainability as a way of examining and evaluating all aspects of development to be certain that objectives are realistic and that results will meet the needs of this and future generations.** We considered sustainability as applicable to both ecologic and economic systems and agreed that sustainability as applicable to both ecologic and economic systems

and agreed that sustainable agriculture is **not** synonymous with low-input agriculture or organic farming. Sustainable agriculture as reported by the National Research Council (NRC 1989). Low input, alternative agriculture and organic farming have an important place in our future, but it would be unrealistic to assume that these approaches could possibly provide for the world's future food and fiber needs in the next several decades. Our dependency on inorganic fertilizers, agricultural chemicals and depletable energy resources will continue into the indefinite future unless some significant and unanticipated research break-throughs come about.

It is important to note that the major challenge to sustainable yield programs, both for rangelands and for croplands is to balance economic and ecological constraints. I call this the battle of the two great "Ecos." The world-wide trend toward capitalism and private enterprise has clearly demonstrated that countries can increase production by providing an economic "incentive to produce". The challenge now is to find techniques to create a corresponding "incentive to conserve".

The greatest challenge to sustainability is population growth. The World Bank's latest global projections indicate a possible leveling of the world population of the year 2100 at 10.4 billion people--nearly double the present number of 5.2 billion. Most of this growth will take place in the less developed countries. Whether or not levelling will occur by the year 2100 will depend upon education and economic development-both precursors to numbers reduction.

The challenge for sustainable development is not only to keep the status quo as population increases, but to meet the needs for a better quality of life. The world average GNP (Gross National Product) per capita in 1987 was $3330. Twenty-six countries have average incomes below $300 per year. At the time of this survey the US stood at $18,430 per capita GNP. (PRB 1989). A worthy goal would be to bring the four billion people in the less-developed countries from the present $670 per capita GNP to the world average-five times their present level. From an environmental impact standpoint, four billion poor people are one problem, but four billion wealthy or middle-class people are another. To close the GNP gap would also require an annual economic growth rate for the developing countries of at least 5-10 percent per year. This will be difficult if not impossible for most countries. We cannot sustain this performance even in the U.S. Education for family planning remains the most logical approach to the population problem and thereby to the eventual attainment of sustainable resource use.

No country in the world can reach ultimate "sustainability" until we find an alternative to fossil fuel. We have not dedicated sufficient resources to research on this problem. Several observations about energy use in the agricultural sector bear repeating:

1. More refined and processed foods, greater consumption at distant points from the source of production, and a more variable, but perhaps better balanced, diet is expensive from the standpoint of photosynthetic biomass utilization.

2. The trend toward mechanization in the agricultural sector is continuing worldwide in spite of the emphasis on appropriate technology and the underdeveloped manpower available in most countries. This trend creates a greater negative balance in the ratio of renewable-to-depletable energy sources.

3. Total world biomass energy is probably going down with the destruction of many forested areas and with increased desertification, although this reduction is partially offset by increased crop yields. If worldwide biomass production is decreasing we are losing some of our ability to utilize surplus carbon dioxide.

4. Mankind is consuming a higher percentage of the total biomass as population increases, leaving less and less available to all other biological populations. We do not know the impact of this transfer on the total ecosystem.

5. Much of the original biomass produced by photosynthesis is lot to the consumer by processing and distribution before it reaches the consumer.

I still recall a revealing statement made by Dr. Van Dyne before his untimely death: In a grassland biome under livestock grazing in the U.S.: "Of the total energy captured by the vegetarian, only .0003 percent reached the consumer as meat--a small, but tasty percentage."

There is, however, one area relating to energy where we have made significant progress; that is, in our understanding of the impact of fossil fuel burning on the climate and air environment. Awareness so far has **not** led to many changes in our approach to energy use, but perhaps this will come with time. At least the scientific community has pointed out the dangers associated with increased carbon dioxide levels, problems with acid rain, depletion of the ozone layer, and the adverse impacts of atmospheric trace grasses.

THE SITE-SPECIFIC APPROACH

In the numerous meeting that I have had with environmental groups, I found that the most effective technique to force a "focus on the solution" to the issue of sustainability and resource conservation was to emphasize the site-specific nature of the problem. This is particularly important for rangelands. Even though environmental degradation may be reflected as a regional, national, or

international concern, any change in direction must be made at the farm or pastoralist level. This site-specific focus tends to bring everyone out of the clouds of emotion, evangelism, and proclamation, down to the solid earth, where the problem lies.

A site-specific approach to the problem will require two types of analysis:

1. A comprehensive study of the soils, vegetation, climate and the other physical resources of the site. What is the resource potential? What are the limitations? What land-use practices are leading to resource deterioration?

2. Secondly, an evaluation must be made of the social, cultural and political pressures under which the individual farmer or pastoralist must work. Why is he doing what he is doing? There are probably valid reasons for the present practices. What is the nature of decision-making process? What will be required to motivate the individual to change? This second task, obviously, will require social scientists as a part of the multidisciplinary team. An excellent book on The Social Sciences in International Agricultural Research has just been released by the Missouri team associated with the SR-CRSP. (McCorkle 1989).

MECHANISMS FOR CHANGING DIRECTION

The charge before us is clear. We must move toward more sustainable yield systems without further delay. To do so will require better utilization of the mechanisms for change:

1. First, we must **target the educational process** to reach the most critical publics, ranging from the farmer to the politician. This educational process must be based upon facts and not emotions.

2. Secondly, additional research will be required to examine and recommend alternatives.

3. Third, there is a role for **technical assistance** with conservation practices at the farm level. The programs of the U.S. Soil Conservation Service still serve as a good worldwide model for technical assistance. PVO's have assumed part of this role in some developing countries.

4. Fourth, **legislation and regulation may be necessary**. Many groups move rapidly into the legal arena because they are frustrated with the research and education process. I caution **against** this approach without the careful site-specific analysis I mentioned earlier.

5. My last point, is probably the most important mechanism for bringing about change. That is, **we need to build conservation and environmental improvement "incentives" into the economic and political system**. This will not be easy as the U.S. experience has indicated. Some conservation practices increase income at the farm level, even in the short run. Many, however, are costly to the individual farmer or pastoralist in terms of increased labor, or management and sometimes reduced yields. This means that society as a whole will have to pay the increased costs as we move toward sustainable systems.

THE RESEARCH AND EDUCATION IMPERATIVE

Let me conclude with a few comments about the research and education imperative. This responsibility will rest heavily on cooperative efforts between the Universities and Development agencies.

1. The first priority should be USAID and the World Bank to **add a resource conservation and environmental objective to all ongoing and anticipated agricultural research and development projects**. This will ease the pressure on Congress to earmark funds for so-called environmental projects. Earmarking removes flexibility for Agency response. Virtually every program these agencies support has environmental impacts which should be addressed.

2. **Adding an environmental dimension to agricultural development programs will require a much longer time-frame for research and education projects.** This is basic to all other recommendations. A number of institutional factors within the USAID funding mechanism and World Bank loans as well as policies of host countries tend to encourage short-term approach. A minimum funding horizon of ten years is needed for sustainable agricultural development.

3. We must improve the measures of progress for the environmental dimension. How do we quantify environmental change? The most commonly used indicators of progress in agricultural development projects have been increased production and/or changes in income. While **these economic measures are important, they are not adequate indicators of sustainability, environmental degradation, or resource conservation.**

4. **More research is needed on policy alternatives.** One of the key challenges in every country is to establish policies which reward conservation efforts, policies which rate an "incentive to conserve", as well as an "incentive to produce." Economists must find a better way to place an economic value on the resource base and assist with the contrasting choices between individual short-run gains as opposed to (or complimenting) the longer-term contributions to society as a whole by proper conservation approaches.

5. **New technologies and approaches are needed for the fragile environments.** While the major increases in food production may continue to come from the better soils with supplemental irrigation, the challenge of sustainability is also critical on marginal lands with low productivity.

6. Additional **research is needed on the role of livestock**, particularly small ruminants, in food production systems. We need to know more about the **interactions among crops, forest products and livestock**. The design of proper livestock management strategies and forest management is critical to issues such as biological diversity and desertification.

7. The science of ecology can contribute substantially to the evaluation process, particularly through the examination of ecosystems. **The challenge, however, is to involve all scientific disciplines in a collaborative research approach to sustainable development."** I repeat, the challenge is for a wide range of disciplines.

In a recent policy paper prepared by the Science and Technology Bureau of USAID, the statement is made that, **"The major topic that will dominate discussion, resource allocation, and evaluation of agricultural development programs during the decades ahead will be that of "sustainable" agricultural development."** I concur with this statement. Both USAID and the World Bank are charged by congressional mandates to "prepare a comprehensive strategy for maximizing the use of foreign assistance provided by the United States through multi-lateral and bilateral development agencies to address natural resource wetlands, soil conservation, preservation of wildlife and biological diversity, estuaries and fisheries, croplands and grasslands."

It should be obvious that the emphasis on sustainable agricultural systems will call for increased involvement by the university community. As a part of that effort range scientists will move into a more critical and strategic role.

REFERENCES

McCorkle, C. 1989, The Social Sciences in International Agricultural Research: Lynne Rienner Publishers.

NRC Committee on the Role of Alternative Farming Methods in Modern Production Agriculture. 1989, Alternative Agriculture: National Academy of Sciences.

Population Reference Bureau. 1989, World Population Data Sheet, Washington, D.C.

Thomas, G.W., et al 1985, Environment and Natural Resources: Strategies for Sustainable Agriculture. BIFAD Occasional Paper No. 12. USAID, Washington, D.C.

USAID. 1989. BIFAD Joint Panel on Sustainable Agriculture. Washington, D.C.

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