Participatory Research and the Race to Save the Planet: Questions, Critique, and Lessons from the Field*

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ABSTRACT Participation has been widely touted as "the answer" to a number of problems facing sustainable development programs. It is not enough, however, to involve rural people as workers and informants in research and planning endeavors defined by outsiders. A truly collaborative approach will depend upon our ability to broaden our definitions of research and participation, to accommodate a wide spectrum of land users and local knowledge, and to expand our repertoire of research methods. This paper presents a critique of facile approaches to participation, outlines a more inclusive framework for who participates on what terms, and reviews a variety of methods that address the complex realities of rural livelihoods and landscapes. The final section of the paper suggests a multi-institutional model that combines the complementary strengths of several types of organizations in participatory field research and planning.

Introduction

"Sustainability" and "participation" have become the development watchwords of the decade, and with good reason, since both concepts were sorely lacking in development practice from the early 1960s well into the 1980s. To assail either of these trends in international development at this juncture is to risk feeding the new "green backlash" (*New York Times*, July 29, 1993), or worse, the resurgence of top down development and calls for a new custodial colonialism, as expressed by Johnston (*New York Times Magazine*, April 18, 1993). Yet a critique of these recent waves of development theory and practice might rest on the premise that such reforms only help to foster a kinder, gentler image of development-as-usual, which has been somewhat less than kind and gentle with many of the world's people over the past thirty years, as noted by Susan George (1992), Vandana Shiva (1988), Wolfgang Sachs (1992) and many others (Escobar, 1992; Esteva, 1992; Hancock, 1989; Marglin and Marglin, 1990; Mies, 1988; Wisner, 1989/1990; Wisner and Yapa, 1992).

Beyond the concerns over more-of-the-same, participation and sustainability might even serve as Trojan horses to bring a new level of global economic and environmental restructuring processes directly to rural communities, bypassing national institutional buffers and preempting critical review. These might include such diverse efforts as the negotiation of resource management plans for parks and reserves, the planning of "alternative" development strategies for people dependent on forest and wildlife utilization, the expansion of

rural services and infrastructure, and the promotion of more productive, environmentally sound agriculture, forestry, and water management. All of these stand to be affected by community-based planning, research, and extension efforts linked to environmental interests as well as to agents of "economic development". Rural communities may find themselves negotiating with banks, international NGOs, multinational corporations, church based organizations, bilateral aid agencies, and United Nations agencies. Moreover, they may be set upon by a combination of such agencies, sometimes working in concert or at cross-purposes, depending on the issues and the context.

Questions and critique of participatory approaches to sustainable development seem more than justified, since the consequences of "maldevelopment" (even in participatory clothing) are both real and serious (Mies and Shiva, 1993; Shiva, 1988). A careful critique, however, need not lead to rejection of either local participation or ecologically-based planning processes in rapidly changing landscapes and shifting economic contexts. An outright rejection of sustainability and participation from a critical perspective assumes that both concepts have been totally assimilated and already belong to the world of development-as-usual or "normal professionalism" (Chambers, 1993).

There is, however, the possibility for an alternative practice that seeks to promote broader social and ecological options, combining livelihoods and life support in local landscapes that are at once home, habitat, and workplace to those who live there. There is also ample opportunity for locally based initiatives to join together and to reach out across national boundaries (Perlman, 1990), taking advantage of the same flexibility and globalization (if not the financing) that facilitates direct access to local spaces worldwide by corporate interests and international bodies. There is scope to share a broad range of experience and expertise from the past, a wide array of evolving ecological and production sciences and a multiplicity of visions of the future, across the permeable boundaries defined by gender, class, race, culture, and nationality.

The discussion that follows is presented in the interest of furthering such a science and practice. It proceeds from a belief that for every assimilation there is a counter-assimilative opportunity, that is, a new space for exercising our social and ecological imaginations and our practical skills in the interest of a better world. Neither participation nor environmental criteria automatically guarantee just, equitable, and ecologically viable futures, but both constitute essential ingredients of a common future worth sharing.

Learning from Experience

As we[1] consider new initiatives in "sustainable development" we can learn much from both the successes and failures of local participation in the past thirty years of technology development and resource management as well as from socially focused rural development programs. In particular, the recent history of research and development in agriculture, forestry, and conservation illustrates the distinct approaches and converging experience of technical and social development programs in pursuit of broader participation and environmental objectives. The 1980s brought a profusion of research and extension programs in farming systems, sustainable agriculture, agroforestry, and social forestry. Over the last decade many of these programs have reached beyond the confines of professional scientific traditions. They have experimented with more direct collaboration with rural people and/or with rural development, social service, and relief agencies already well-established in rural communities. In turn, community development agencies of many types have also expanded their efforts to test and develop agricultural, forestry, and conservation technologies or have sought to collaborate with research organizations in the field.

The converging experience of participatory research initiatives in research and development institutions can provide a more advanced point of departure for the sustainable development initiatives of the 1990s and beyond. A decade of intensive documentation, research, and development in agriculture, agroforestry, social forestry, and conservation has taught us to look beyond our traditional research models. Experience suggests that the scientific establishment is too small and too specialized to generate fixed "packages" of production and resource management technologies for the multiplicity of diverse environments in the world. Fortunately, there is no need to do so, since farmers, pastoralists, and forest dwellers already have substantial knowledge as well as the ability to conduct both collaborative and independent research. Rural people often possess an inherent advantage over research institutions when dealing with trials of complex land use systems, as systems, *in situ* (Chambers, 1989). We have also found that there is no single best, fixed land use "package" for any given region or group of people, but rather a vast array of principles and components that can be constantly recombined, tested, and modified to suit changing social, economic, and ecological conditions for individuals, households, communities, and nation-states (Rocheleau, 1989a).

Participatory research represents one way to expand sustainable development research capabilities in the complex conditions faced by rural people (Uphoff, 1992). For some professional scientists, "participatory research" implies that "we" allow "them" (rural people) to participate in "our" research. For community organizers or rural communities it may mean that "they" allow outsiders (us) to take part in local land use experiments and their interpretation. What we all imply, but seldom discuss, is that we propose to join

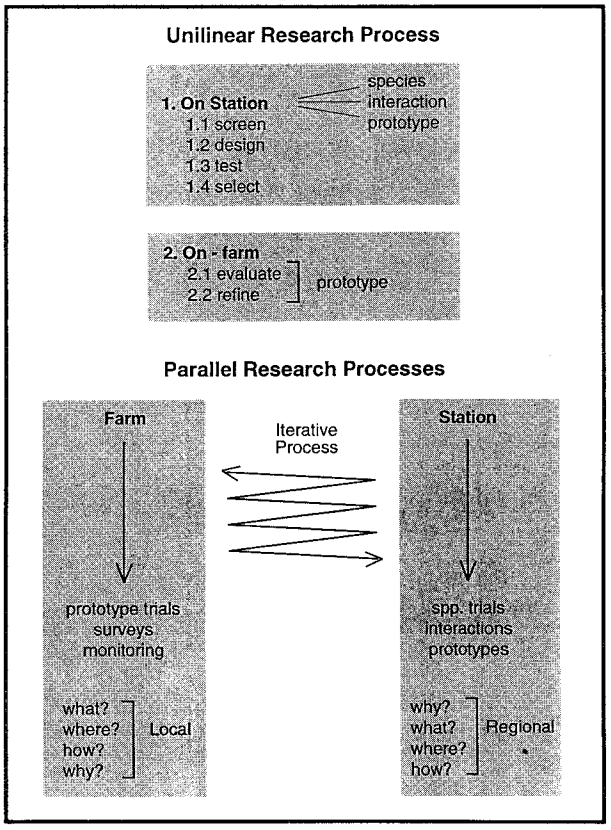
together people and institutions with very distinct traditions of acquiring and testing knowledge, in order to develop sustainable land use practices of interest to both.

We cannot expect to achieve this through simple addition of conventional research methods and a new interest in local participation. Many participatory research "recipes" suggest that we take one standard research trial, one part good will, one plot of land, add local participants, and stir. The results rarely meet the expectations of either outside researchers or participating communities, despite considerable effort on both sides. A truly honest joint effort will require everyone involved to stretch their imaginations, their skills, and their definitions of science. Although the question has many facets, this paper will focus on: (1) broadening the definition of research; (2) widening the scope for who participates, where, and on what terms; and (3) an expanded repertoire of practical research methods and flexible institutional arrangements.

Formal Research Models

Most agriculture and forestry research for the last decade has followed a *linear* model that tests species, interactions, and prototypes for new technologies first on-station, and then later evaluates and refines the "winners" on-farm or in-the-forest (Figure 1). We often ask the "basic" questions on-station and the "practical" questions on-site, though it might make more sense to address both types of questions in each place.

Figure 1.



Within this approach, we tend to assign "participation" to discrete steps within the research process, and we have defined the terms of participation and the participants rather narrowly. Farming systems approaches often relegate participation entirely to the first and final phases in the technology testing process, as "problem diagnosis" and "adaptive research", respectively. For example, researchers consult selected farmers about their production problems in a particular crop or livestock system. The research team designs a technology to address the problem(s) and on-station trials to test their ideas, as illustrated in the first part of Figure 1. Later, in "adaptive" on-farm research, participating farmers (usually male heads of household) contribute a plot, their own and family labor, and perhaps their opinions as to the performance of a particular tree species, or an entire agroforestry package. The research is deemed to be participatory by virtue of its response to farmer problems, its location in a farmer's field (off-station), the farmer's presence, or the farmer's judgment of the technology. This view of "participatory research" limits formally recognized scientific research and land users' knowledge to fixed times and places and diminishes their joint capacity as innovators and experimenters.

However, there is also some experience beyond the traditional linear research model (Hildebrand and Poey, 1985), with parallel lines of research on-station and on-farm (Figure 1). While researchers may pursue parallel, independent, non-participatory projects on-station and on-farm, they can also tie the activities at both sites into an interactive process. Farmers and researchers may exchange information, planting material, and evaluation of experiments at both sites. A farmer's exploratory trial on-farm may inspire an experiment on-station to monitor tree-pest-crop interactions, while a researcher's idea from a species screening trial on-station may lead to the introduction of an exotic tree into traditional home gardens on several farms. In such a case participation permeates all research activities and joins research station and on-farm endeavors (Biggs, 1988).

Likewise in cases of parks, reserves, and wildlife management, there is an opportunity to broaden the established linear model of research and planning and the limited scope for local participation. In most such cases rural people do not participate in problem definition, as they themselves are often already identified by outsiders as part (if not all) of the problem. Local residents are often brought into the picture to make a choice between predefined options or perhaps to help implement prearranged solutions to hunting, habitat destruction, and other threats to wildlife. The research in such cases may serve more to inform national and international environmental organizations about the "perceptions" of local people, their "receptivity" to

conservation initiatives, and their potential as allies and collaborators in a preset agenda than to incorporate local interests and priorities into conservation plans.

For example, in a "people-friendly" wildlife initiative, outside researchers might choose to establish a "buffer zone" of regulated land use around the periphery of a park, based on carefully documented needs assessments of wildlife populations. They might then involve local people in trials of various new land use practices to reduce stress on the park. A more fully participatory approach would require: 1) joint consideration of problems and opportunities in the *status quo*; 2) sharing of knowledge about economic, ecological, and social processes; 3) open negotiation of new land use options that address conflicts as well as shared objectives between distinct groups at the local level and between local, national, and international interests; and 4) joint development of technologies, management plans, and the performance criteria that research would seek to test. However, to develop a dynamic research program of this type we first need to broaden our definitions of research and participation.

The Broader Potentials of Research

"Scientific" research need not be synonymous with a randomized block design field trial or a multiple transect survey of plants and wildlife; nor must it imply a statistically analyzed survey questionnaire administered to a "random sample" of a population. While all of these research types are valid and obviously useful, none of them possesses an inherent advantage for all research questions and circumstances. In sustainable agriculture and forestry we can identify several categories of research topics and activities, as well as place, scale, timing, and methods of research (Chambers *et al., 1989;* Müller and Scherr, 1990; Rocheleau, 1991b) that are also valid for the broader concerns of sustainable development.

In fact, the range of choices is far wider than formal research publications suggest. Land use research on production and conservation technologies can include observation, measurement, description (qualitative or quantitative), data and sample collection, design, testing, analysis, and evaluation. Our mandate may be prediction, explanation, or technology development. Our analyses may be static or dynamic with respect to time, and they may focus on problems at varying scales, from nutrient uptake by plants to production processes in whole landscapes to the division of labor, land, and authority at the household and community levels. We may conduct controlled, semi-controlled, or uncontrolled experiments, or even transform a structured observation of existing processes into an "insinuated experiment".

Moreover, sustainable land use research should transcend our convenient dichotomy between on-station and on-site research; it may also take place in the laboratory, on a "model" farm, in a park, on open rangeland, in-the-forest, or at a combination of these sites. We can also refrain entirely from experimentation and conduct survey research, as in ecological sampling of tree species in a forest, a sociological questionnaire to determine community structure, or an ethnographic survey to explore and document local botanical science (both popular and specialized). In short, research not only extends beyond the research station; it encompasses substantially more than can be held within the confines of controlled experimental plots on any property.

The Varieties of Participation

Participation is likewise subject to a broad range of interpretation. It has been variously construed to catalyze, facilitate, assimilate, and suppress the initiative of rural people, depending upon the context and the players (Langley, 1986; Oakley, 1987). For the sake of simplicity Oakley (1987) reduces the varieties of participation to two basic forms: *mobilization* and *empowerment*. Where research is concerned we can also distinguish between *extractive* and *interactive* approaches.

Agricultural and environmental research programs often equate participation with mobilization and extract contributions of work, knowledge, and other resources from participants. Many scientists rely on rural people mainly to provide land and "authentic" labor for experiments and to indicate "consumer preferences". In fact, rural people are often well-placed to identify problems, formulate solutions, and devise tests of complex innovations *in situ*. They may participate in land use research in roles ranging from free labor on-farm to board members of research stations. We can identify several distinct roles of land users in the research process:

1) Labor (free, paid);
2) Hosts (to guests, to parasites);
3) Informants (representative, specialized);
4) Evaluators (of technology, of research process);
5) Collaborators (occasional, regular);
6) Partners (senior, equal, junior);
7) Advisors (informants with authority);
8) Board members (participants with power).

There is ample precedent for these roles and for interactive approaches in health, literacy, and agriculture (Bunch, 1985; Feuerstein, 1986; Jiggins, 1988).

Who Participates?

The quality of participation, by itself, does not guarantee that local participants represent all the diverse groups that have a stake in the results. For example, agricultural projects often limit participation to farm owners, managers, or heads of household. Yet, these actors are embedded in a social web of family and

community members, many of whom have a stake in the use and management of farm lands, although they do not own or manage a farm (Rocheleau, 1987b). Sustainable development ought, at least, to refrain from harming their livelihoods; at best, it should improve their lot, regardless of land rights, gender, or occupation.

A land user focus can accommodate all of the groupings that define privilege, power, and poverty in a given time and place. We may distinguish between land user groups based on activity, tenure (terms of access, use, and ownership), and social unit of organization (Table 1). For example we can determine which groups use specific land areas, plants, products, or services in a given place, and the importance of the resources to them, as an indicator of their stake in land use change. This, in turn, can help us to identify convergent, complementary, and conflicting interests of affected groups in the process and the eventual results of sustainable land use research and development. The diverse qualities, scales, and interests of user groups named in the table imply a flexible repertoire of methods for local participation.

Table 1. Subdivision of Land User Groups

Land Users...by activity
- A. Producers
  - Gatherers
  - Hunters
  - Herders
  - Farmers
    - Large
    - Small
  - Farmworkers
- B. Processors
- C. Market Vendors
- D. Consumers

Land Users...by rights of access and ownership (applies to trees, water, wildlife, and/or land)
- A. Owner (State, Group, Individual; *de jure* or *de facto)*
- B. Tenant (Rent paid)
- C. User by permission or exchange agreement
  - Continuous
  - Regular
  - Occasional
- D. Squatters, "Poachers" (illegal users)

Land Users...by management unit/unit of analysis
- A. Individuals or household subgroups
  - Men, women, children; age group
- B. Households
  - Managed by men, women; small/large; young/old; rich/poor
- C. Communities and community groups
  - Families, clans, self-help groups
- D. Companies or Cooperatives
- E. Administrative Units
  - States, districts, villages, *etc.*

Excerpted from Rocheleau, 1987b.

Participatory Research Expertise: Non-Existent or Just Invisible?

Most participatory field research in agriculture, forestry, and conservation has, to date, focused on rapid appraisals for research or development planning, or on surveys (quantitative, qualitative, and combined). We have much less collective experience with the design and management of on-site experiments or sampling and monitoring programs in partnership with rural people. Of the technology trials conducted on-farm most of the documented cases have involved farmers in controlled experiments designed by outside researchers. The more collaborative trials have often been *ad hoc* or have not been reported in the literature.

Similarly, little has been reported in the way of detailed documentation and analysis of locally initiated trials and experiments, with a few notable exceptions (Gumbo *et al.*, 1988; Juma, 1989; P. Richards, 1985; Scoones, 1988; Wilson, 1987, 1989). The combination of any sort of trial or experiment with historical documentation and analysis is even less common. Most reporting of rural people's production and conservation science has been limited to descriptions of existing and/or traditional practice as an accomplished fact. Within forest and wildlife management, rural people's knowledge has been increasingly recognized by outsiders, only to be cast as "timeless and unconscious ecological wisdom" or as remnants of "traditional" practice. There is, however, an emerging body of literature that treats local science and practice as the latest expression of a continuing process of learning and discovery (Anderson, 1990; Anderson *et al.*, 1991; Brokensha *et al.*, 1980; Chambers and Jiggins, 1986; Colfer *et al.*, 1989; Denevan *et al.*, 1985; Dewees, 1989; Flores Paitán, 1987; Roe and Fortmann, 1981; Gupta, 1989; Oldfield and Alcorn, 1991; Owusu-Bempah, 1988; Posey, 1985; Pretty, 1991; P. Richards, 1985, 1989; Rocheleau, 1991a; Scherr, 1990; Scoones and McCracken, 1989; Turnbull, 1992; Warren and Cashman, 1991; Warren *et al.*, 1994).

Does this mean that only a few researchers have addressed any of these points that seem so simple and based on "common sense"? A multitude of field workers continue to conduct isolated, undocumented research within forestry, agriculture, and conservation programs. Likewise, researchers often participate in community organization and institutional innovation to improve their research and attune it to local conditions. However, they are unlikely to report even the fact itself, let alone the process. This is particularly crucial in the rapidly growing number of wildlife management projects that address complex relationships between people and wildlife through separate

programs of biological research and public relations (local and international). Social research and management programs in this context are often couched in terms of social engineering to achieve conservation objectives. The ecology embedded in local society and the cultural threads that run through the surrounding ecosystems are seldom addressed formally and almost never documented.

Beyond the research and participation dichotomy we face a braided institutional divide along social-biological, production-conservation, and government-NGO lines that constitutes a substantial barrier to shared knowledge. The existing institutional structure encourages silence on work at the boundaries between research, development, and participation by those who actually know the territory best. As long as the more integrative work is submerged, it remains inaccessible to review, constructive criticism, and progressive improvement through collective learning and innovation.

Alternatively, we can make the most of opportunities to link these non-reinforcing cycles of research and development, social process, and technology innovation, to stop spinning our wheels and get somewhere. Some of our best data and insights are transmitted through stories, a professional oral tradition, and through the skills of our trades. The challenge will be to distinguish significant stories from mere anecdotes (Rocheleau, 1991a) and to combine them with classification and description of possible field methods. From these we need to build a coherent, larger body of shared knowledge and practice accessible (at least in part) to our various domains of science, practice, and critique, including those of rural people.

Expanding Our Repertoire

We can improve our capabilities for participatory research if we abandon fixed packages of research methodology and broaden our horizons to include a wide variety of principles, methods, and other people's field experience. The broad principles presented above, the "stories" of colleagues from the field, and the partial list of specific methods summarized below represent tools and raw materials. From these, individuals and institutions can develop appropriate participatory research programs for sustainable production and conservation within a multiplicity of local and national conditions.

Most of the methods or techniques listed below can be used in an *interactive* or *extractive* way and most of them could in fact help to describe, plan, test, monitor, or evaluate a technology, to document an existing system of resource use and management, or to facilitate the development of a new one. Some of the methods listed are actually labeled packages of methods, but need not be kept intact. The list is meant to convey a sense of the wide range of possibilities, a history of development and application for each, and an invitation to modify and combine these tools to suit the problem, the participants, and the institutional opportunities in a given case. Each entry carries a brief descriptive note and a selected list of references to facilitate access to the relevant literature.

Appraisal Methods

Rapid Rural Appraisal (RRA) consists of short, intensive, informal field surveys that focus on consultation between teams of outside "experts" and rural people to define research and development problems and solutions. Researchers, planners, administrators, or technical advisors travel to rural communities for a few days to a few weeks to meet individuals, households, and community groups. They discuss local views of social, economic, and technological problems and determine priorities for research, development, or policy intervention. The early versions of RRA were developed and widely used to identify household level problems and research priorities in farming systems (Collinson, 1981; Hildebrand, 1981) and agricultural development research (Chambers, 1981, 1983; Chambers and Ghildyal, 1985; Chambers and Jiggins, 1986). Several recent publications summarize the methods now commonly used in farming systems research and agroforestry research and extension (Chambers *et al.*, 1989; Feldstein and Jiggins, forthcoming; Khon Kaen University, 1987; Müller and Scherr, 1990; Rocheleau *et al.*, 1988).

While many people automatically equate RRA with popular participation, research and development workers may use it in an extractive or interactive spirit. Rural people definitely participate, but they may or may not ever see any concrete results. Moreover, where outside experts do take action, the results may or may not serve the interests of any (or all) of the land users in the community. Seeing is not necessarily believing, and hearing is not necessarily understanding. Even when outsiders do comprehend the problem, they may not translate that into appropriate solutions. If rural peoples' participation begins and ends with a single appraisal to identify problems, the larger effort will still bear the marks of a top-down approach. Fortunately, the tools and the practice of RRA have expanded to better meet the needs of researchers, development workers, and rural people (Chambers *et al.*, 1989; ILEIA, 1988a, 1988b; *RRA Notes Newsletter*, 1988 *et seq.*).

The spin-offs from this approach include research on farmers' prior knowledge and experience, as well as farmers' innovations and their modification of researcher-designed "packages" in agriculture (Fernandez, forthcoming; Jiggins, 1986a, 1986b; Rhoades, 1982, 1984, 1987, 1989; Rhoades and Booth, 1982), agroforestry (Rocheleau, 1987b; Rocheleau *et al.*, 1988; Scherr, 1990; Scoones, 1989; Wilson, 1987, 1989), pest ecology and control (Malaret and Ngoru,

1989) soil and water conservation (Jama *et al.*, 1992; Kiriro and Juma, 1991), and national park management (Abel and Blaikie, 1986; Berger, 1993; Dhyani Berger, personal communication, 1993; Drijver and Croll, 1992; Murphree, 1993; Parkipuny, 1991; Wells *et al.*, 1992). Field practice has extended the process within and beyond "the household", including specific techniques for gender analysis (Ashby, 1987; Feldstein and Jiggins, forthcoming; Poats *et al.*, 1988, 1989; Polestaco, 1993; Rocheleau, 1987a, 1989b; Thomas-Slayter *et al.*, 1993), and for group and community level interviews and workshops (Bruce, 1989; Fernandez and Salvatierra, 1989; Gupta and IDS Workshop, 1989; Jiggins, 1986a, 1986b, 1988; Kean, 1988; Lightfoot *et al.*, 1988, 1989; Norman *et al.*, 1988, 1989; Rocheleau *et al.*, 1988; Sutherland, 1987).

Field research and development workers have further stretched and reshaped this robust set of techniques to address issues of sustainability and the larger landscape beyond the farm boundaries. Agroecosystems Analysis (Conway, 1985, 1987) focuses on villages, communities, or watershed units and deals explicitly with long term ecological concerns and environmental management in rural farming systems. Researchers and local representatives walk along transects through the landscape and conduct interviews with individuals, households, and groups. The team maps whole communities, ecosystems, and specific plots with residents and key informants. This approach has been developed and applied primarily in studies of watershed management and water use within agricultural systems, from hillslope farms to lowland rice paddies. Another example is Total Catchment Management, and the Land Care movement as documented by the University of Western Sydney at Hawkesbury in Australia (Martin, 1991; Woodhill, 1990; Woodhill *et al.*, 1990). This approach begins with RRA, but then emphasizes action research and land user participation in resource management under complex, changing, and highly uncertain conditions, with constant readjustment and ongoing processes of information exchange, discussion, and conflict resolution/management.

Diagnosis and Design adapts farming systems approaches and RRA for agroforestry design and testing (Müller and Scherr, 1990; Raintree, 1987a, 1987b). Reconnaissance surveys, informal household level interviews, and alternating cycles of survey and technology testing allow for design of agroforestry technologies that address local problems and fit within the larger farming system (Raintree, 1983a, 1983b). This approach can be expanded to include land user groups at the community level (Rocheleau, 1985, 1987b, 1991a) or research and development interests at the national level (Scherr, 1987). Some researchers have combined Diagnosis and Design, Agroecosystems Analysis, and related approaches to fit the needs of community-based agroforestry research and extension programs (Abel *et al.*, 1989; Buck, 1988, 1989; Davis-Case, 1989; Feldstein *et al.*, 1989; Hoskins, 1982; Rocheleau *et al.*, 1988, 1989; Scherr, 1988a, 1988b, 1990; Scoones, 1988).

Community-based ecological research focuses initial appraisal on local knowledge systems, particularly knowledge that links livelihood to ecology. These approaches have special relevance for sustainable agriculture, forestry, and water management as well as wildlife and biodiversity programs. The science of everyday life in rural landscapes often involves the integration of wildlife, water sources, crops, livestock, and woody plants, within forests, rangeland, croplands, and gardens. It also encompasses the invisible food, fodder, and wood production systems in the "spaces between": roadsides, fences, fallows, gullies, and streambanks (Rocheleau *et al.*, 1988). Field researchers affiliated with ENDA Zimbabwe and the Zimbabwe Forestry Commission have developed participatory approaches to forestry and agricultural research that build on local science and practice (Clarke, 1990; Gumbo *et al.*, 1988; Matose, 1993; Scoones, 1989; Seitz, 1993; Wilson, 1988). The process begins with a fairly lengthy exploration by a resident action research team. From the outset, researchers and local participants compile written records of local ecological history and science, as well as a set of action research proposals.

Similar methods have been elaborated by Grandin (1988) in veterinary research with pastoralists in Kenya, by Cashman (1988) with women alley-cropping farmers in Nigeria, and by Fernandez and Salvatierra (1989) in livestock management and veterinary research with women's groups in Peru. Several researchers (Davis-Case, 1989; Gupta *et al.*, 1989; Rocheleau *et al.*, 1988) have combined group discussions and mapping exercises based on local knowledge of ecosystems and livelihoods. Carney (1988) has combined participant observation and ethnographic survey with appraisal of class and gender division of knowledge and resource use in an irrigation project in the Gambia.

In a creative synthesis of rapid appraisal, ethnobotany, and sociological survey techniques Calestous Juma (1989) conducted community-based surveys using a combination of community meetings, key informant interviews, and survey questionnaires. Locally nominated participants developed and refined the formal questionnaires in a workshop setting. The workshop served as an extended two-way key informant "interview" that shaped both the content and format of the subsequent survey. Representatives of the research project and local residents learned about each other as well as about indigenous plants, their uses, and their habitats. This process made the survey effective as a learning tool both for researchers and for the participating communities.

Research on local ecological science is richest if

we combine the study of both popular and specialized knowledge. Many researchers start from interviews with a broad base of representative community groups, to determine what is "common knowledge". They can then ask the groups to identify knowledgeable group members and other specialists in the community (Rocheleau *et al.*, 1988, 1989; Maslaret and Ngoru, 1989). Eventually, researchers learn enough about the topics at hand and about the identity of specialists to allow them to record the knowledge of the eldest or the most skilled members of the community.[2] They can also identify and record the emerging knowledge and practice of the rising generation or the distinct science and practice of particular groups, whether by gender, ethnicity, class, occupation, or locality.

If the work is applied within an action research approach, then this same understanding and information can be mobilized within the community's own research and development efforts (Bebbington, 1990; Thrupp, 1989). The involvement of local residents as researchers, recording their own community's knowledge, can also serve as a catalyst to organization and educational initiatives. When women, children, and the poor formally record their own experience the research effort can also strengthen their position within the larger community (Fortmann, 1993). This is arguably one of the most productive frontiers of research and action in sustainable development.

Participatory Rural Appraisal (PRA) has grown out of a synthesis of RRA, Agroecosystems Analysis, Diagnosis and Design, and other appraisal methods with action research and community organization techniques. It has coalesced from a number of centers of innovation, including: The International Institute for Environment and Development (MacCracken, 1988; MacCracken *et al.*, 1988; Mascarenhas *et al.*, 1991; Pretty and Chambers, 1992; Scoones and Thompson, 1992); The Institute for Development Studies at the University of Sussex (Chambers *et al.*, 1989); Clark University, World Resources Institute, the National Environment Secretariat of Kenya, and Egerton University (Ford *et al.*, 1993a, 1993b; Kabutha *et al.*, 1991; NES *et al.*, 1991; Thomas-Slayter *et al.*, 1991, forthcoming; Thrupp, 1989; Veit, 1993; Zazueta *et al.*, 1992); several NGO networks (Bunch, 1989; ILEIA, 1988a, 1988b); international agricultural centers (Feldstein and Jiggins, forthcoming; Lightfoot *et al.*, 1991; Rocheleau *et al.*, 1988); and United Nations organizations (Davis-Case, 1989; Project Reach, 1993). This approach, in its several versions, has enjoyed widespread application in resource management, conservation, and rural development programs.

Like other forms of rapid appraisal, PRA normally consists of a one- to three-week exercise based on collaboration between rural people from someplace and outside "experts" from somewhere else. The difference is in the structure and tone of interaction between them, and in the shift from researcher-subject to joint exploration as equals. In some cases, outside researchers function mainly as facilitators of a community-run process, and increasingly, as trainers of facilitators from rural communities (Chambers, 1992, forthcoming; Chambers and Conway, 1992). Overall, PRA relies more heavily on the judgment and analytical capabilities of rural people, rather than simply "tapping" their knowledge in bits and pieces to fill-in-the-blanks in the analytical frameworks of outsiders. The methods of inquiry are more explicitly interactive and tend to be more visual in orientation than earlier RRA approaches (Chambers, 1992, forthcoming; Chambers and Conway, 1992). In addition, PRA includes, by definition, leadership and technical expertise from local residents and sometimes public servants (Kabutha *et al.*, 1991).

The "steps" have been recorded and described by some practitioners as a discreet package of activities, with a given order (NES *et al.*, 1991). Others (Cornwall *et al.*, 1992; Pretty and Chambers, 1992; Scoones and Thompson, 1992) eschew any attempt to regularize the process and prefer to discuss principles, document specific techniques, and report on particular case studies in an effort to inform further work in a variety of contexts. One element that characterizes many versions of PRA is greater attention to history and to the possible futures of rural people (Chambers, 1992, forthcoming; Chambers and Conway, 1992; Rocheleau *et al.*, 1988, 1989). In general, PRA includes matrix ranking exercises, community histories, diagrams of organizations and institutions, maps of farms, landscapes or watersheds, and diagrams of production systems, ecosystems, and social processes. Often people will rank themselves and their neighbors with respect to wealth and well-being (Grandin, 1988), to clarify social structure and process and to situate their own knowledge and perspective for themselves and outsiders. They often also engage in several ranking exercises to clarify the use and relative importance of various water sources, soil types, land types, crops, livestock, trees, fodder sources, fuelwood, and other energy sources, insects, wild plants, and wild animals. They may discuss and rank these elements of livelihood and landscape as problems, as resources, or as desired characteristics of a possible future.

While PRA has often been used to mobilize community discussion, planning, and immediate action on resource management, it can also facilitate development of health, agricultural, or water supply programs, or longer term action research on a variety of topics from famine relief to migration and resettlement. In addition, there is ample scope for use of PRA in evaluation of ongoing projects and programs, whether large scale or local in nature. The emerging techniques of PRA could facilitate widespread adoption by national and international bodies of participatory methods

previously limited primarily to literacy, health, and community organization programs (See methodological works by Feuerstein, 1986; Freire, 1968, 1973; H. Richards, 1985).

All of these appraisal methods can help to describe a particular place and situation, and to direct research and development plans that fit rural people's realities and aspirations. There is some danger that single rapid appraisals or surveys may not be adequate for long term planning or may simply raise expectations and leave residents (as in many clinics) with a free "diagnosis" and a prescription for "medicine" that is not locally available. To be effective, appraisal must lead to action, with continuing participation by rural people. Several of these approaches, in fact, work best within a recurring cycle of surveys and trials of various types, including some of the experimental approaches listed below.

Field Experiments and Trials

Much of the literature on on-farm agricultural research discusses "how to" reconcile statistically valid experimental designs with field conditions (Collinson, 1981; Hildebrand, 1986; Shaner *et al.*, 1982; Tripp, 1984). The most frequently used methods are those that allow for control plots, some variation in treatment, and statistical analysis of variable performance by different treatments within or between farms.

Farmer and researcher preferences for different research designs may differ substantially. While outside researchers can gain substantial information by varying treatment between farms, farmers may gain, and subsequently share, more insights by having controls and/or a range of treatments on their own farms to compare close-up (Robert Hart, personal communication, 1984). However, farmers may not appreciate the placement of these various treatments within a randomized block design. This is especially impractical for forestry, water management, wildlife management, and conservation practices, which are not divisible into small fractions of a single plot. Group-focused trials at multiple sites provide an alternative, by combining different real-scale treatments on various members' lands with regular group meetings to observe and compare all treatments in the multi-site experiment.

Herders and farmers of the Aramachay Women's Production Committee in Peru requested a similar research design in a collaborative livestock and cropping research project. In veterinary experiments based on local and outsiders' science, they separated blocks and treatments by family herds, rather than mix treatments across herds. Likewise, farmers took an active role in the design and evaluation of the cropping systems research p*rocess*, as well as participating in technology evaluation. As a result, the project team developed a robust, statistically valid research design that was convenient for farmers and herders (Fernandez, forthcoming).

Researchers can also use informal trials to explore technology design prior to more formal, elaborate trials (Attah-Krah and Francis, 1987; Sumberg and Okali, 1989; Rocheleau, 1985) or simply as a way to learn more about the detail of farming practice (Edwards, 1987a, 1987b, 1987c) before committing local residents and research institutions to a substantial research effort. It is also possible (though professionally risky) to pursue formal but not controlled experiments on complex land use systems with farmers (Flores Paitán, 1987). This applies particularly to technology innovations for home gardens and similarly complex systems both on-farm and in the larger landscape. Robert Chambers and Janice Jiggins (1986) have explicitly challenged researchers to go beyond the confines of "normal professionalism" in order to address complex and changing rural realities. They document the limitations of disciplinary paradigms and call for a "new professionalism" supported by institutional reform. This is particularly crucial for both social and ecological innovations in complex rural ecosystems characterized by a high diversity of land cover, land use, and species.

A few sources also treat the issue of farmer participation and the quality of interaction between outside researchers and farmers, as well as research designs that fit the needs of both (Hildebrand and Poey, 1985; Scoones, 1989). The possible terms of collaboration on research trials range from researcher-designed trials on research stations and in parks to rural peoples' own experiments that are "discovered" and documented by research institutions (Rocheleau *et al.*, 1989). The following typology (Poats *et al.*, 1989; Rocheleau and Malaret, 1987) presents a spectrum of collaborative arrangements between local science and practice and "the scientific establishment":

(1) Researcher designed and managed trials, (usually on station or special plots). Land users are consulted and their problems are addressed, but their resources, management practices, and evaluation are not part of the research design.

(2) Researcher designed and managed trials, on site, in local peoples' work and production sites, whether individual or shared space. Land users are consulted, their problems are addressed and they evaluate the results. There is little involvement of land users' management, since all labor and material inputs are planned and paid for by the research institution.

(3) Researcher-designed and user-managed trials, on site. This is the same as case 2, above, with the difference that land users' resources and management are included in the trial, their evaluation and feedback are continuous, and land users' performance and judgment are part of the trial.

(4) Joint design and management of on-site

trials by researcher and land users. Local people and outside researcher(s) collaborate in the design of the trial and confer on management decisions. Land users' management and decision-making are explicitly treated as experimental variables, their feedback and evaluation are high priorities in the research endeavor, and they consciously evaluate their own and researchers' decisions.

(5) Trials designed and managed by land users, with outside researcher(s) consulting. Outside researcher(s) enter into on-going trials as occasional consultants or regular collaborators, and document results and/or process. Researchers may or may not alter trial design.

(6) Trials designed and managed by land users. Outside researchers observe and document existing trials, experiments, and ongoing innovation. Outsiders may also produce documents for local review, revision, and use.

The choice of trial types will also depend on the type of question, the variability of social, economic, and ecological conditions in the region, and the time, space, and precision required to produce useful answers to the questions. For example, farmers in southern Zimbabwe have participated in agroforestry projects that include species trials in community experimental plots, farm trials of tree establishment techniques, and resource management trials in shared and private lands. Trials have combined controlled experiments (types 2, 3, and 4) with more informal observation plots (types 5 and 6) and "perturbation experiments" (a kind of before and after comparison of a whole system with a particular treatment introduced). In trials on-farm, on-station, and in-the-commons, farmers have participated in roles ranging from advisor to employee (Clarke, 1990; Gumbo *et al.*, 1988; Matose, 1993; Scoones, 1988; Seitz, 1993; Wilson, 1987). In such cases, the entire project can become an experiment, if researchers carefully document the process and the effects of "work in progress".

In contrast, some projects have emphasized farmer participation in formal research station experiments. Researchers in Rwanda have reported major advances in potato and bean varietal selection and breeding research through surveys of farmer knowledge (Haugerud, 1986) and involvement of farmer "experts" in on-station research (Sperling, forthcoming). This approach recognizes that farmers develop their knowledge and skills over long time periods and across a wide range of microenvironments. It couples the richness of farmer experience and judgment with the precision and control of research station experimental regimes.

If rural people are to use production and conservation research results under a wide range of conditions, then the experiments and the larger research program must be robust enough to accommodate the broad spectrum of situations that they may encounter. They may well benefit over the long term from replicated experimental testing of agroforestry innovations. They may also contribute key questions and performance standards to narrowly focused species selection and plant interaction trials (types 1, 2, or 3), on station or on-site. However, non-replicable experience may also be extremely instructive. Farmers, herders, and forest dwellers may benefit substantially from a combination of historical analysis, consideration of possible futures, and qualitative comparison of existing practice (Hope and Timmel, 1984).

Experience as Experiment

Beyond the terms of cooperation in specific experimental activities lies the question of how to reconcile our own experimental inclinations with the "science of survival". When we (outside researchers) recognize rural people as independent innovators and co-researchers we may reconstruct them in our own image. However, we need to recognize that they may be scientific without subscribing to the norms of industrial science. Their process of experimentation may be more like that of a concert pianist than an industrial chemist (Richards, 1989).

In his discussion of agriculture as a performance, Paul Richards (1989) notes that farmers must integrate all of their past experience at critical moments (such as drought, flood, pest outbreak, or market fluctuations). They must make binding decisions that will affect the season's harvest or even their very survival as farmers (Richards, 1989; Watts, 1983). Long-term learning and innovation are likewise accelerated during times of rapid and dramatic change such as land tenure reform, large scale migration, an exodus of part of the work force, or the introduction of new technology (plows, tractors). Farmers react much as a concert violinist on stage might improvise on a piece of music to avoid a broken or out of tune string. The outcome influences future decisions of a similar nature, but the same situation (same song, same string, same audience) might never repeat itself. Like the violinist, farmers might not have the luxury of designing controlled experiments to solve pressing problems, nor would they gain much from highly precise results that would apply only to a repetition of the same conditions. Unlike the violinist, farmers might face more than a bad review if they fail at a crucial time. However, their process of learning and innovation clearly has more in common with the acknowledged immediacy of the stage performance than with the purported control and replicability of the laboratory experiment.

Some types of research directly address the science of survival under uncertain conditions. Techniques from industrial psychology and marketing have proven useful to identify successful strategies for coping with change or stress or for reducing vulnerability

to economic and environmental stress (Jiggins, 1986a, 1986b, 1988). For example, aerospace industry researchers developed critical incident analysis to identify early indicators of trouble and to document the decisions taken by pilots who survived potentially fatal crashes. Janice Jiggins adapted this to learn from poor and "average" rural people who survived drought, famine, and public health crises in farming communities of Africa and Asia.[3] The study of survivors and "success" stories (stratified by class, gender, age, ethnic group, and locality) can better inform people from the place about their own options in similar future events. This technique consists of applying an experimental frame of mind to the documentation and interpretation of remembered events. It lends itself well to studies of wildlife management, watershed management, deforestation, reforestation, and agricultural intensification.

Rural people can also reverse the time sequence to conduct "what if" simulations, applying an experimental mindset to visions of the future as well as to memories of the past. Extrapolating from current trends, it is possible to imagine a range of possible futures (Davis-Case, 1989; Martin, 1991; Rocheleau *et al.*, 1988; Woodhill, 1990) based on a combination of conscious choices and chance occurrences. Choices could include national wildlife, forest, and land tenure policy, community resource management strategies, landscape design, household migration decisions, and introduction of trees as cash crops. Externally determined events might include drought, plant and animal diseases, groundwater depletion, and price fluctuation or market collapse for particular commodities.

Sampling and Monitoring

Although scientists often make controlled laboratory conditions conform to the demands of particular statistical analyses, it is also possible to fit multivariate and time series analyses to complex field conditions. Oceanographers, meteorologists, geologists, and field ecologists are all accustomed to working with "experiments" designed by "nature". This differs from survey research in that researchers may gather detailed data on complex systems over time, within an experimental framework that embraces variability. They can monitor and test relationships between specific practices, processes, species, site characteristics, landholding types, and land user groups. They can sample and monitor land use systems or trees-in-the-landscape according to maps of existing variation in practice or in vegetation. Such "inferred" or "insinuated experiments" can explain the economic and ecological significance of these patterns in the landscape. Researchers may also use monitoring data to develop models that can simulate potential changes in land use systems. For example, researchers could use farmers' records and their own field observations to model an existing land use system and to predict the likely outcome of a prolonged drought or a new settlement program.

In most cases, rural people can be part of the system as well as active observers, recorders, analysts, evaluators, and independent experimenters. They may monitor and evaluate projects and research process as well as specific technologies (Davis-Case, 1989). They can also conduct their own "perturbation experiments" with "real world" models to observe the response of local landscapes, livelihoods, and ecosystems to specific changes. The "control" is in their memory. This type of experiment may well prove more coherent from their point of view than a replicated experiment laid out according to a randomized block design.

Group Methods Applicable Throughout the Research Cycle

Farmer panels (Sperling, forthcoming), focus groups (Feldstein and Jiggins, forthcoming), group interviews (Buck, 1988; Rocheleau *et al.*, 1988), group ranking exercises (Grandin, 1988; Scoones, 1989), and participant observation (Ashby, 1987; Ashby *et al.*, 1989) can all provide information about the substance and the distribution of knowledge, practice, resources, opinions, and interests on a particular issue within a given community (Davis-Case, 1989). While individuals may provide detailed information in intensive interviews, their responses often represent one position on a larger spectrum that remains unknown or must be inferred by the researcher from a large random sample.

For any of these methods, researchers may choose a group at random, or select groups systematically to represent a range of characteristics present in the community. Alternatively, participant groups may be selected by the larger membership in a preexisting group, they may volunteer according to researcher criteria, or key informants may nominate groups. Both the origin and the composition of groups have strong implications for the substance, the style of interaction, and the locus of control within research activities. Researchers who collaborate with groups may work with: (1) preexisting groups that take on research tasks as a group, (2) preexisting groups that facilitate the participation of a subgroup of members as a special optional activity, or (3) groups created by and for researchers for the explicit purpose of research collaboration.

In the case of preexisting groups, there are several key questions: whether they are formal or informal (as in legally registered vs. family and friends); whether membership and contributions are voluntary or coerced; whether the group represents the community as a whole or specific segments thereof (by gender, class, ethnicity, religion, occupation, location); whether they are traditional or recently initiated; whether they are

internally or externally organized; and whether they are perennial, multipurpose organizations or were formed to accomplish a specific task. If researchers misunderstand the purpose or composition of a participating group it can bias the research results and distort the quality and distribution of participation within the community.

Preexisting groups can apply their own usual terms of leadership and participation to research activities (Fernandez and Salvatierra, 1989). These may not be egalitarian nor are they likely to reward research aptitude and performance, but they have the advantages of familiarity, local control, and credibility. Special research groups formed from preexisting groups retain the advantage of group and community linkages and credibility, yet can provide freedom for group members and researchers to choose leaders and follow procedures that facilitate the research task. They can also remain accountable to the larger group and respect the spirit of its organization in research activities.

When researchers form new groups from the larger community, based on open enrollment, direct selection, or "conscription", then the control of group process and activities is far more likely to reside with the outside researchers. The form and substance of the research may differ substantially as a result. Such groups make convenient participants in quantitative research designs. They lend themselves readily to controlled experiments, test panels for prepackaged products, or as representative qualified informants (Norman, et *al.*, 1988, 1989; Baker, forthcoming). However, they are less likely to promote continuing local innovation, research, or information exchange. Groups of this type may make significant contributions to formal research efforts (Sperling, forthcoming), but they should not be confused with self-sustaining groups that participate in research efforts as part of their own long-term agenda.

Individual, Household, or Group Data Collection and Record-Keeping

Record keeping, measurements, diaries, plant collections, oral histories, maps, and sketches may be limited to "just the facts" or may include a substantial dose of rural people's judgment, skill, and worldview. While all of these can be very labor intensive and are sometimes used in an exploitative fashion, these methods can allow for accurate data collection, analysis, and interpretation by and for rural people.

Records might include only qualitative observations such as time and labor allocation within the household, or simple quantitative notes on nursery operation, such as records of seeds planted, plants germinated, seedling survival, number distributed, to whom, number planted, damage, growth, and survival (Buck, 1989; Davis-Case, 1989). Records could also include measurements of tree growth, insect damage to leaves or stems of seedlings, and volume and/or weight of fuelwood harvested. Records might also provide substantial insight into seasonal and periodic price fluctuations of local products and purchased items.

Individual, household, or group diaries provide scope for sharing judgments and reflections about changing conditions or new activities in a rural community. For example, a women's group might keep a long term narrative record of significant events and peoples' interpretations of these occurrences, including suggested solutions to land use and environmental problems. A diary could also focus on a specific technical topic such as tree seedling condition and survival. Entries could emphasize pest attacks on planted seedlings, with comments about when, where, and why pest attacks occur, as well as a description of the pests. A diary of tree use and management might also provide comments about which trees are harvested, whether there is adequate supply, about the quality of products, the potential uses and users, and the decisions about who will use what tree and what product. Alternatively, diaries could focus on sightings and observations of wildlife, including rare or endangered species sighted at home, at work sites, on regular trails, or on extended journeys.

Individual, household, or group plant or insect collections may serve several purposes, some a bit more "participatory" than others. A collection may be for the collector's own use, for outside researchers according to specific lists, or for shared use from jointly compiled lists of plant and insect types and sampling sites. The use may be as general as "basic research" or as practical as a reference guide to identify medicinal herbs for local preparation and use. Public participation in collecting work can also facilitate discussions of ecological history, ecosystem structure and function, and the future landscape. This, in turn, may affect planning, management, and improvement of land use systems, including domestication or protection of wild plants and forest or range ecosystems.

Oral history, while less tangible than some of the data collection methods described above may well prove crucial to subsequent planning efforts to shape the landscape and livelihood systems of the future. The objectives may range across a broad spectrum from: 1) the postmodern project of liberating (apparently) subjugated knowledges (Foucault, 1980; Stamp, 1989); to 2) empowerment of local communities and organizations (Fortmann, 1993; Rocheleau et *al.*, 1994; Ross, 1994); to 3) supplementing written and photographic records of soil erosion, water supply development, deforestation, reforestation, technology adoption, or land use and land cover change (Malaret and Rocheleau, 1994; Rocheleau *et al.*, forthcoming; Tiffen *et al.*, 1994). Oral history has recently gained formal recognition as a tool of environmental and land use research

(Showers, 1989; Showers and Malahlela, 1992) and enjoys increasing use within research on environment, development, and agricultural technology generation. The applications include personal life histories, which are now widely used by feminist scholars to portray the diversity and depth of experience among women and to illuminate the political and the sublime embedded within the personal and the everyday. Life history approaches can be extrapolated to discussions of community and regional history, and can be specifically focused on landscape, land use, land degradation, biodiversity, and ecological processes (Rocheleau, 1983b). Likewise, researchers and local residents can construct matrices and diagrams describing inputs and outputs for a given area, or documenting energy flows and material cycles in a local ecosystem and its linkages to larger economic and ecological systems (Rocheleau, 1993a).

Mapping of past, present, and possible future landscapes is yet another way that research programs can collaborate with rural people to document, analyze, and predict ecological and land use changes. Maps and sketches facilitate discussions of topics ranging from biodiversity to food production to water management. The spatial configuration of landscapes is changing swiftly and dramatically in many agrarian, rangeland, and forest landscapes, and this method allows for an integrative and rapid portrayal of the range of microenvironments available to plants, animals, and people in rural communities. The approach is particularly useful for botanical research as well as land use planning and resource management programs that transcend single plots and landholdings (Chambers *et al.*, 1989; Rocheleau *et al.*, 1988).

Visual aids for discussion and graphic representation can include a wide range of media and approaches. Researchers have recorded a number of techniques in recent field exercises: landscape drawings with pens and ink markers drawn by researchers and local residents (Rocheleau *et al.*, 1994); chalk sketches and maps on blackboards drawn by groups and individuals (McConnell, 1992); clay models, sand paintings, and stick-drawings on the ground (Chambers, 1993; Fortmann, 1993; MacCracken, 1988; MacCracken *et al.*, 1988; Mascarenhas *et al.*, 1991); felt board landscapes with plants, animals, people, landscape features, and infrastructure for iterative construction of alternative scenarios by groups and individuals (Rocheleau *et al.*, 1994); flow diagrams and systems diagrams of various types (Lightfoot *et al.*, 1991); and computer mapping simulations of farms, watersheds, and larger landscapes on portable computers. Most of these techniques have been employed in planning research and action on land use issues at the farm and community levels, with some larger scale applications.

Beyond the local scale, some programs based in forest communities have also begun community-based mapping exercises to delineate established terrains of resource use and rights to particular places as territory, using survey maps (Chambers, 1992, forthcoming; Chambers and Conway, 1992; Colchester and Alcorn, 1993; Herlihy, 1993). Members of the Rubber Tappers Union and farmers' associations in the Brazilian Amazon have undertaken training to read and utilize aerial photographs and remotely sensed satellite imagery so as to locate their communities within larger regions and to conduct land use research in coordination with other communities. They have also mapped their lands at community and regional scales for use in surveys and legal proceedings against government and private sector encroachment on their resources (Anderson, 1993). The Land Care groups in Australia (Martin, 1991) also depend on mapping and mapped information at multiple scales to facilitate participatory planning for resource management. The Arusha Diocesan Development Office (ADDO) has assisted Maasai communities in Tanzania to map their customary grazing lands, water sources, and current settlements in response to increasing conflicts over land use and access (Fr. Ben Ole Nangore, personal communication, 1989). In Sri Lanka, researchers have joined rural communities in the use of geographic information systems (GIS) for collaborative planning approaches with government (Batuwitage, 1992) and NGOs (Yapa, 1991). This may well become a major tool of action research on natural resource allocation and management in communities throughout the world.

What Institutions Can and Will Do Participatory Research?

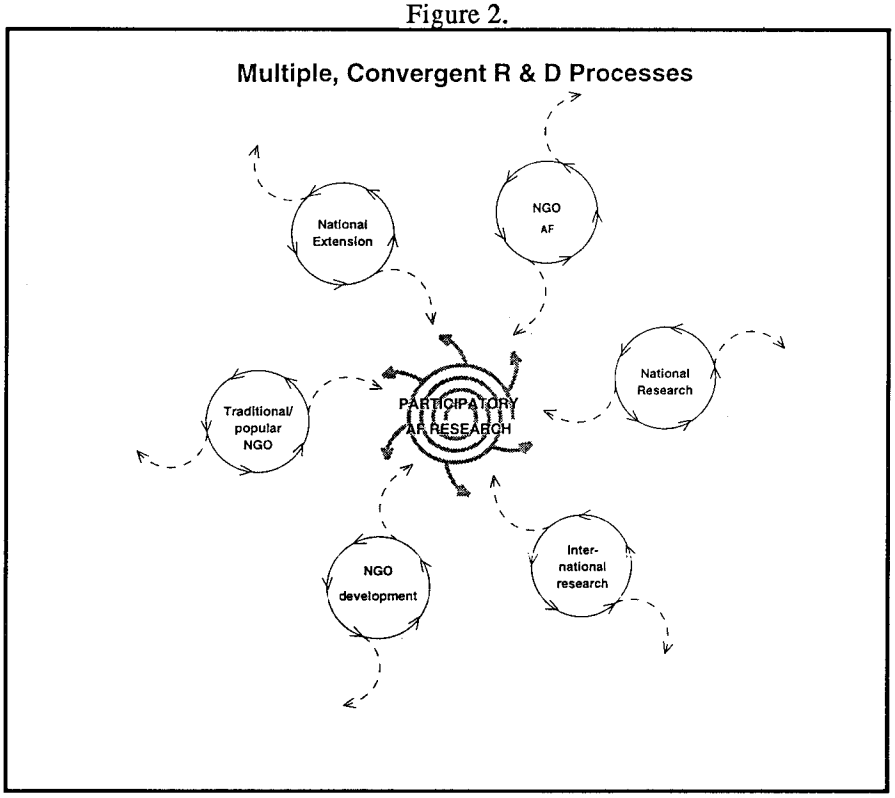
Most national and international agricultural research institutions already provide some scope for participatory survey research, adaptive technology trials, and land user evaluation of new technologies and land use plans. Enterprising field researchers, from anthropologists to ecologists, have seized upon or created opportunities to inform mainstream technology research from local science and practice. They have incorporated rural peoples' contributions to formal and "informal" surveys, trials, and research planning. Instances of such "injections" of local participation have been reported for several of the international agricultural research centers (see above) as well as in several international environment and development research institutions (Bruce, 1989; Kiriro and Juma, 1991; McCabe, 1990; Murphree, 1993; Thrupp, 1989; Veit, 1993; Zazueta *et al.*, 1992). Rapid Rural Appraisal is now widely used to identify problems and to inform technology design and research planning. Several major international and national research programs have incorporated participant observation, ethnobotanical surveys, and "directed" participation, as in the case of farmer panels, focus groups, and key informants, both

group and individual.

During the last five years a parallel stream of reports has issued from the field through new channels sharpened their skills in participation.

These programs have already accomplished much independently. However, they constitute a potentially

Figure 2.



explicitly created to give voice to participatory research experience in NGO and national government programs (Buck, 1989; Bond-Stewart, 1986; Bunch, 1985, 1989; ILEIA, 1988a, 1988b; Martin, 1991; Maundu Munyao, 1992; Ngugi and Buck, 1989). The case studies, methodological summaries, and field trial results include applications of Rapid Rural Appraisal, Agroecosystem Analysis, Participatory Rural Appraisal, and a host of untitled but no less valid approaches. They all include rural peoples' skills, concerns, and judgment in survey and monitoring activities.

The key message this conveys for sustainable development researchers and planners is simple. Several kinds of organizations, from the local to the international in scale, and from basic research to local empowerment in mandate, have successfully entered into participatory research activities in forestry, agriculture, conservation, and related fields (Korten, 1990; Uphoff, 1992). While the mainstream research and policy communities have not yet incorporated these approaches as a whole into their explicit mandates, they have already (in some cases unwittingly) integrated many methods and principles of participatory research into daily field practice. Conversely, many development agencies and NGOs have integrated an increasing number of research activities into participatory development programs and have more powerful mix of complementary skill, experience, and institutional strengths. The optimal combination in any one case might vary, but overall this approach would join organizations with different sectoral expertise and mandates (water, soil, crop production, forestry, wildlife, employment, education, and culture). At the same time, the mix of participating organizations would combine distinct types of institutions: popular NGOs, technical NGOs, universities, national extension agencies, national research agencies, and international research, development, relief, and environmental agencies.

The "spinning wheel" model of collaborating institutions (Figure 2) suggests that each institution could spin on its own internal axis, yet contribute to a broader, shared circulation of participatory research for sustainable development. Each institution would also continue to contribute to specialized networks of like organizations. The work within the wheel would take place at a single site or a series of shared sites.

Depending on local and national circumstances, the institutions and their activities would vary substantially. For example, in an agroforestry and rural livelihoods program the linked activities might include the following:

1) an ethnobotanical survey;

2) a series of formal trials to determine the best

placement of a favorite local tree within a new settlement pattern;

3) exploratory trials with different types and sizes of tree nurseries;

4) management and tenure experiments to test alternative rules of use and access on farm, along forest margins, and in the forest;

5) ecological and social baseline surveys using local criteria to stratify the sample by environments and social groups;

6) documentation of prior and ongoing experiments by farmers;

7) participant observation by researchers in group agricultural and conservation work;

8) a seed evaluation, selection, and collection program for favorite local and exotic plants;

9) a marketing study on existing and potential local tree products;

10) a local board to oversee all project work at the site; and

11) a farmer advisory group to collaborate on research station experiments of interest to the community.

A different agency might carry out each task, and the participants might include an international church-based NGO; a national forestry research agency; a national agricultural extension program; local self-help groups; district officials; a national university research team of ecologists and social scientists; an association of local teachers; and an international conservation organization. Common interest in viable agroforestry systems and "livable landscapes" would drive the wheel, along with the cost savings of linking several activities in one place (a spatial economy of shared focus). The result could be one successful process, easy to multiply (not clone), rather than several specialized, incompatible environment and development successes that don't add up.

Throughout the world there are partial examples of the "spinning wheel" already turning. For example, the herbarium of the National Museums of Kenya has combined with Kenya Freedom From Hunger and Worldview International to conduct research and extension on indigenous wild food plants (Maundu Munyao, 1992). Their complementary skills have allowed them to link several distinct activities into a single coherent effort. They have been able to survey the use and knowledge of edible wild plants, to prepare and disseminate planting and cooking information on the best known plants, to promote domestication in community fruit and vegetable gardens, and to establish seed multiplication plots. In other cases "working groups" (networks that emphasize "work") have coordinated national research and extension agencies, economic planning, energy research, grassroots tree planting efforts, and rural development agencies to promote social forestry within a single district, as in Indonesia (Mark Poffenberger and Fran Korten, personal communication, 1988) and Kenya (Bradley, 1991; Buck, 1989; Kerkoff, 1990; Ngugi and Buck, 1989; Scherr, 1990). The Total Catchment Management and Land Care groups in the Hunter Valley of Australia represent yet another example of multi-institutional and interdisciplinary research and action on environment and development issues (Martin, 1991; Woodhill *et al.*, 1990).

There is ample precedent within the international and grassroots NGO community[4] for long-standing action research programs and collaboration with popular organizations in technology innovation and development (Korten, 1990; Uphoff, 1992). These experienced groups are well-placed to inform and mediate the convergence of environment and development institutions with both research and action mandates to play complementary roles in participatory land use research (Woods, 1983). We need not reinvent this particular wheel (Figure 2) from agriculture, forestry, and conservation, but merely need to balance it for easy and effective use in a variety of sustainable land use initiatives. Lest we become complacent about the ease of this task, we need only remind ourselves how a careless neglect of the relations of power can threaten such a carefully balanced process. This will surely prove to be another necessary focus of participatory research over the coming decade (Cohen, 1993; Cornwall *et al.*, 1992; Fraser, 1989; Watts, 1993).

Conclusion

The last decade of experience in forestry, agriculture, and conservation research has taught us what we can and cannot do alone as scientists and planners working within national and international institutions. Many of us have explored the soft edges of our own science and the regions of overlap with local science and practice in isolated rural communities throughout the world. We have also discovered a wealth of experience and information in the larger scientific and development community, often in institutions previously invisible to us, from our respective perches. We can use the decade ahead to employ our new-found collective skills in sustainable development and to demonstrate what is possible when we combine our efforts and our insights with those of rural people. Participatory methods cannot guarantee socially just sustainable development. They can facilitate democratic or self-determined programs to protect, create, and maintain sustainable livelihoods and living landscapes for a multiplicity of unfolding futures.

Notes

* Portions of this article have previously appeared in Rocheleau, 1991b and are reprinted with the permission of *Agroforestry Systems*.

1. "We" refers here primarily to fieldworkers and

researchers engaged in critical exploration, review, and revision of participatory methods for ecological, social, and economic research and action in "sustainable development". This does not seek to exclude the people directly affected or those who reject the possibility of any positive "development". The designation of "we" simply acknowledges the major audience as the group referred to above.

2. It is important to keep in mind that "tradition" also changes. The body of "traditional" knowledge and practice is constantly revised and redefined and may become a contested point between land user groups (Carney, 1988).
3. While there may be an ethical question raised about the advisability of outsiders reaping advantage from disaster, this type of study can be either extractive or interactive. It can help to prepare rural communities to avoid or survive future disasters of the same or similar type.
4. This includes such groups as Intermediate Technology Development Group (ITDG), Oxfam, Oxfam America, World Neighbors, Care International, SOS Sahel, Save the Children, Catholic Relief Services, Lutheran World Services, Mennonite Central Committee, Quaker Peace and Service; American Friends Service Committee, Carinas, CEBEMO, Gandhian development organizations, International Institute for Rural Reconstruction (IIRR), IRED, International Organization of Consumer Unions (IOCU), Environment Development Action (ENDA), and many other numerous relief and development organizations.

References

Abel, N. O. J. and Piers Blaikie. 1986. "Elephants, People, Parks and Development: The Case of the Luwanga Valley, Zambia," *Environmental Management*, 10 (6):735-751.

Abel, N. O. J., M. Drinkwater, J. Ingram, J. Okafor, and R. T. Prinsley. 1989. *Guidelines for Training in Rapid Appraisal for Agroforestry Research and Extension*. London and Harare, Commonwealth Science Council and Forestry Commission.

Anderson, Suely. 1993. "Participatory Research and Mapping with Peasant Organizations and Forest Peoples." A paper presented at the Sixth International Forum of the Association for Women in Development, October 21-24, 1993, Washington, DC.

Anderson, Anthony, ed. 1990. *Alternatives to Deforestation: Steps toward Sustainable Use of the Amazon Rainforest*. New York: Columbia University Press.

Anderson, Anthony, Peter May, and Michael Balick. 1991. *Subsidy from Nature: Palm Forest Peasantry and Development on an Amazon Frontier*. New York, Columbia University Press.

Ashby, Jacqueline. 1987. "The Effects of Different Types of Farmer Participation on the Management of On-Farm Trials," *Agricultural Administration and Extension*, 24:235-252.

Ashby, Jacqueline, Carlos Cuiros, and Yolanda Rivers. 1989. "Farmer Participation in Technology Development: Work with Crop Varieties." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 115-122.

Atta-Krah, A. N. and P. A. Francis. 1987. "The Role of On-Farm Trials in the Evaluation of Composite Technologies: The Case of Alley Farming in Southern Nigeria," *Agroforestry Systems*, 23:133-152.

Baker, Doyle. Forthcoming. "Women and Trials Management in Botswana: Experience with Farmer Groups." In *Methodologies Handbook: Intra-household Dynamics and Farming Systems Research and Extension* (Hilary Feldstein and Janice Jiggens, eds.), New York: Population Council.

Batuwitage, Gamini. 1992. Effectiveness of Collaborative Planning as a Strategy for Sustainable, Integrated Area Development. Ph.D. Dissertation Proposal. Worcester, MA, Graduate School of Geography, Clark University.

Bebbington, Anthony. 1990. "Farmer Knowledge, Institutional Resources and Sustainable Agricultural Strategies: A Case Study from the Eastern Slopes of the Peruvian Andes," *Bulletin of Latin American Research*, 9 (2).

Berger, Dhyani. 1993. *Wildlife Extension: Participatory Conservation by the Maasai of Kenya*. Nairobi: ACTS Press.

Biggs, Stephen. 1988. *Resource-Poor Farmer Participation in Research: A Synthesis of Experiences from Nine National Agricultural Research Systems*. The Hague: ISNAR.

Bond-Stewart, Kathy. 1986. *Land*. Harare: Mambo Press.

Bradley, Phillip. 1991. Woodfuel, Women, and Woodlots, Vol. 1. London: MacMillan.

Brokensha, David, D. Michael Warren, and Oswald Werner, eds. 1980. *Indigenous Knowledge Systems and Development*. Lanham, MD: University Press of America.

Bruce, John. 1989. *Community Forestry: Rapid Appraisal of Tree and Land Tenure*. Rome: FAO.

Buck, Louise. 1989. "Planning Agroforestry Extension Projects: The CARE International Approaches in Kenya. In *Planning for Agroforestry* (William Budd, ed.), Amsterdam: Elsevier, pp. 101-131.

Buck, Louise. 1988. *Agroforestry Extension Training Source Book*. New York, CARE International.

Bunch, Roland. 1989. "Encouraging Farmers' Experiments." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 55-61.

Bunch, Roland. 1985. *Two Ears of Corn: A Guide to People-Centered Agricultural Improvement*. Oklahoma City: World Neighbors.

Carney, Judith. 1988. "Struggles Over Land and Crops in an Irrigated Rice Scheme: The Gambia." *In Agriculture,*

Women, and Land: The African Experience (Jean Davison, ed.), Boulder: Westview.

Cashman, Kristin. 1988. "Promoting the Fertilizer Bush Among Nigerian Farmers," *VITA News*, July/October: 7-10.

Chambers, Robert. Forthcoming. "Participatory Rural Appraisal: Analysis of Experience," *World Development.*

Chambers, Robert. 1993. *Challenging the Professions: Frontiers for Rural Development.* London: Intermediate Technology Publications.

Chambers, Robert. 1992. "Methods for Analysis by Farmers: The Professional Challenge." A paper presented at the 1991-1992 Symposium of the Association for Farming Systems Research/Extension, September 11, 1991, Michigan State University, East Lansing, MI.

Chambers, Robert. 1989. "Farmer-First: A Practical Paradigm for the Third Agriculture. In *Agroecology and Small Farm Development* (Miguel Altieri and Susanna Hecht, eds.), Florida: CRC Press.

Chambers, Robert. 1983. *Rural Development: Putting the Last First.* London: Longman.

Chambers, Robert. 1981. "Rapid Rural Appraisal: Rationale and Repertoire," *Public Administration and Development*, 1(2).

Chambers, Robert and Gordon Conway. 1992. "Sustainable Rural Livelihoods: Practical Concepts for the 21st Century." IDS Discussion Paper No. 296. Brighton, Institute for Development Studies, University of Sussex.

Chambers, Robert and B. P. Ghildyal. 1985. "Agricultural Research for Resource-Poor Farmers: The Farmer-First-and-Last Model," *Agricultural Administration and Extension* 20:1-30.

Chambers, Robert and Janice Jiggins. 1986. "Agricultural Research for Resource-Poor Farmers: A Parsimonious Paradigm." IDS Discussion Paper No. 220, Brighton, Institute for Development Studies, University of Sussex.

Chambers, Robert, Arnold Pacey, and Lori Ann Thrupp, eds. 1989. *Farmer First: Farmer Innovation and Agricultural Research.* London: Intermediate Technology Publications.

Clarke, J. 1990. "On-Farm Agroforestry Research Lessons and Innovations from a Pilot Project in Zimbabwe." A paper presented at ICRAF workshop on participatory methods for on-farm agroforestry research, February 19-23, 1990, Nairobi.

Cohen, A. P. 1993. "Segmentary Knowledge: A Whalsay Sketch." In Z(Mark Hobart, ed.), London: Routledge.

Colchester, A. and Janis Alcorn. 1993. Indigenous Territories and Resource Use Mapping Project: South East Asia Region. Second draft of project proposal. Chadlington, England and Washington, DC: World Rainforest Movement and World Wildlife Fund.

Colfer, Carol J. Pierce with Fahmuddin Agus, Dan Gill, M. Sudjadi, Gofo Ueharu, and M. K. Wade. 1989. "Two Complementary Approaches to Farmer Involvement: An Experience from Indonesia." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 151-157.

Collinson, Michael. 1981. "A Low-Cost Approach to Understanding Small Farmers," *Agricultural Administration and Extension*, 8:433- 450.

Conway, Gordon. 1987. "The Properties of Agroecosystems," *Agricultural Systems*, 24: 95-117.

Conway, Gordon. 1985. "Agroecosystem Analysis," *Agricultural Administration*, 20:31-55.

Cornwall, Andrea, Irene Guijt, and Alice Welbourn. 1992. "Acknowledging Process: Challenges for Agricultural Research and Extension Methodology." Overview paper No. 2 prepared for IIED/IDS Beyond Farmer First Workshop, October 27-29, 1992, Brighton, Institute for Development Studies, University of Sussex.

Davis-Case, D'Arcy. 1989. *Community Forestry Participatory Assessment, Monitoring and Evaluation.* Rome: FAO.

Denevan, William, John Treacy, Janis Alcorn, Christine Padoch, Julie Denslow, and Salvador Flores Paitán. 1985. "Indigenous Agroforestry in the Peruvian Amazon: Bora Indian Management of Swidden Fallows." In *Change in the Amazon Basin, Volume 1: Man's Impact on Forests and Rivers* (John Hemming, ed.), Manchester: Manchester University Press, pp. 137-155.

Dewees, Peter. 1989. "The Woodfuel Crisis Reconsidered: Observations on the Dynamics of Abundance and Scarcity," *World Development* 17(8):1159-1172.

Drijver C. A. and Elizabeth Croll. 1992. "People's Participation in Environmental Projects. In *Bush Base, Forest Farm. Culture, Environment, and Development* (Elizabeth Croll and David Parkin, eds.), London: Routledge, pp. 131-145.

Edwards, R. J. A. 1987a. "Farmers' Knowledge: Utilization of Farmers' Soil and Land Classification." A paper presented at the IDS Workshop on Farmers and Agricultural Research: Complementary Methods, July 26-31, 1987, Brighton, Institute of Development Studies, University of Sussex.

Edwards, R. J. A. 1987b. "Farmers' Groups and Panels." A paper presented at the IDS Workshop on Farmers and Agricultural Research: Complementary Methods, July 26-31, 1987, Brighton, Institute of Development Studies, University of Sussex.

Edwards, R. J. A. 1987c. "Mapping and Informal Experimentation by Farmers: Agronomic Monitoring of Farmers' Cropping Systems." A paper presented at the IDS Workshop on Farmers and Agricultural Research: Complementary Methods, July 26-31, 1987, Brighton, Institute of Development Studies, University of Sussex.

Escobar, Arturo. 1992. "Culture, Economics and Politics in Latin American Social Movements Theory and Research." In *The Making of Social Movements in Latin America* (Arturo Escobar and Sonia Alvarez, eds.), Boulder: Westview Press, pp. 62-85.

Esteva, Gustavo. 1992. "Development." In *The Development*

Dictionary: A Guide to Knowledge as Power (Wolfgang Sachs, ed.), London, Zed Press, pp. 6-25.

Feldstein, Hilary and Janice Jiggins. Forthcoming. *Methodologies Handbook: Intra-household Dynamics and Farming Systems Research and Extension*, New York: Population Council.

Feldstein, Hilary, Dianne Rocheleau, and Louise Buck. 1989. "The Siaya Agroforestry Project in Kenya." In *Working Together: Gender Analysis in Agricultural Research, Vol. 1.* (Hilary Feldstein and Susan Poats, eds.), West Hartford: Kumarian Press.

Fernandez, Maria. Forthcoming. "The Influence of the Aranachay Women's Production Committee on Planning the Research Agenda and Trial Design." In *Methodologies Handbook: Intra-household Dynamics and Farming Systems Research and Extension* (Hilary Feldstein and Janice Jiggens, eds.), New York: Population Council.

Fernandez, Maria and Hugo Salvatierra. 1989. "Participatory Technology Validation in Highland Communities in Peru. In Z (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 146-150.

Feuerstein, Marie-Therese. 1986. *Partners in Evaluation: Evaluating Development and Community Programmes with Participants.* London: MacMillan.

Flores Paitán, S. 1987. "Agroforestry Systems in Iquitos." ICRAF Working Paper, Nairobi: ICRAF.

Ford, Richard, Charity Kabutha, and Barbara Thomas-Slayter. 1993a. "Erosion Control in Machakos, Kenya." In *Working with Farmers for Better Land Husbandry* (Norman Hudson and Rodney Cheatle, eds.), London: Intermediate Technology Publications.

Ford, Richard, Charity Kabutha, and Barbara Thomas-Slayter. 1993b. "Participatory Rural Appraisal: A Case Study from Kenya." In *Rapid Appraisal Methods* (Krishna Kumar, ed.), Washington, DC, The World Bank.

Fortmann, Louise. 1993. "Learning from People, Learning with People, Empowering People with Research." A paper presented at the Annual Meeting of the Rural Sociological Society, August 9, 1993, Orlando, FL.

Foucault, Michel. 1980. *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977.* New York: Pantheon Books.

Fraser, Nancy. 1989. *Unruly Practices: Power, Discourse, and Gender in Contemporary Social Theory.* Minneapolis: University of Minnesota Press.

Freire, Paulo. 1973. "Research Methods." In *Studies in Adult Education.* Dar es Salaam: Institute of Adult Education.

Freire, Paulo. 1968. *Pedagogy of the Oppressed.* London: Penguin Books.

George, Susan. 1992. *The Debt Boomerang: How Third World Debt Harms Us All. Boulder:* Westview Press.

Grandin, Barbara. 1988. *Wealth Ranking.* London, Intermediate Technology Publications.

Gumbo, D., B. Mukamuri, M. Makondo, and I. Scoones. 1988. "Indigenous and Exotic Fruit Trees: Why Do People Want to Grow Them?" A paper presented at the Commonwealth Science Council Conference on Economics of Agroforestry, April 23-27, 1988, Mbabane, Swaziland.

Gupta, Anil. 1989. "Scientists' Views of Farmers' Practices in India: Barriers to Effective Interaction." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 24-31.

Gupta, Anil and IDS Workshop. 1989. Maps Drawn by Farmers and Extensionists. In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 86-92.

Hancock, Graham. 1989. *Lords of Poverty.* New York, Atlantic Monthly Press.

Haugerud, Angelique. 1986. "An Anthropologist in an African Research Institute: An Informal Essay," *Bulletin of the Institute for Development Anthropology*, 4: 2.

Herlihy, Peter. 1993. *Indigenous Mapping of the Honduran Mosquitia: The Design and Methodology of a Participatory Project. Draft Document*, Washington, DC: World Wildlife Fund.

Hildebrand, Peter, ed. 1986. *Perspectives on Farming Systems Research and Extension.* Boulder, Lynne Reiner Publishers.

Hildebrand, Peter. 1981. "Combining Disciplines in Rapid Appraisal: The Sondeo Approach," *Agricultural Administration 8:423-432.*

Hildebrand, Peter and Federico Poey. 1985. *On-Farm Agronomic Trials in Farming Systems Research and Extension. Boulder*: Lynne Reiner Publishers.

Hope, Anne and Sally Timmel. 1984. *Training for Transformation, Vols. 1-3,* Harare: Mambo Press.

Hoskins, Marilyn. 1982. "Social Forestry in West Africa: Myths and Realities." A Paper presented at the annual meeting of the American Association for the Advancement of Science, Washington, DC.

ILEIA. 1988a. "Towards Sustainable Agriculture (Parts 1 and 2)," *ILEIA Newsletter*, 4 (1).

ILEIA. 1988b. "Participative Technology Development," *ILEIA Newsletter* 4 (3).

Jama, M., L. Malaret, D. Rocheleau, and I. O. Jondiko with B. M. Wanjohi. 1992. *Farmer/Researcher Collaborative Approach to Rural Development. A report to the IDRC.* Nairobi: Institute for Development Studies, University of Nairobi.

Jiggins, Janice. 1988. "Farmer Participatory Research and Technology Development," Occasional Papers in Rural Extension No. 5. Guelph, Canada, Department of Rural Extension Studies, University of Guelph.

Jiggins, Janice. 1986a. "Problems of Understanding and Communication at the Interface of Knowledge Systems." In *Gender Issues in Farming Systems Research and Extension* (Susan Poats, Marianne Schmink, and Anita Spring, eds.), Boulder: Westview Press.

Jiggins, Janice. 1986b. "Women and Seasonality: Coping with Crisis and Calamity," *IDS Bulletin*, 17 (3): 9-18.

Juma, Calestous. 1989. *Biological Diversity and Innovation: Conserving and Utilizing Genetic Resources in Kenya.* Nairobi: African Centre for Technology Studies.

Kabutha, Charity, Barbara Thomas-Slayter, and Richard Ford. 1991. *Assessing Mbusyani: Using Participatory Rural Appraisal for Sustainable Resource Management.* Worcester, MA: Clark University.

Kean, Stuart. 1988. "Developing a Partnership between Farmers and Scientists: The Example of Zambia's Adaptive Research Planning Team," *Experimental Agriculture*, 24 (3):289-299.

Kerkoff, Paul. 1990. *Agroforestry in Africa: A Survey of Project Experience.* London: Panos.

Khon Kaen University. 1987. *Proceedings of the 1985 International Conference on Rapid Rural Appraisal. Khon Kaen, Thailand,* Faculty of Agriculture. Khon Kaen University.

Kiriro, Amos and Calestous Juma, eds. 1991. *Gaining Ground: Institutional Innovations in Land Use Management in Kenya.* Nairobi: African Centre for Technology Studies.

Korten, David. 1990. *Getting to the 21st Century: Voluntary Action and the Global Agenda.* West Hartford: Kumarian Press.

Langely, Phillip. 1986. "Popular Participation as a Cargo Cult?" ENDA African Environment Occasional Paper Series No. 95-86.

Lightfoot, Clive, Nancy Axinn, K. C. Joh, Robert Chambers, R. K. Singh, Dennis Garrity, V. P. Singh, P. Mishra, and Ahmad Salman. 1991. *Training Resource Book for Participatory Experimental Design.* India and Manila: NDUAT, ICLARM, and IRRI.

Lightfoot Clive, Olimpio de Guia, Jr, Aniceto Aliman, and Francisco Ocado. 1989. "Appraisal by Group Trek." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 93-100.

Lightfoot, Clive, Olimpio de Guia, Jr., and Francisco Ocado. 1988. "A Participatory Method for Systems-Problem Research Rehabilitating Marginal Uplands in the Philippines," *Experimental Agriculture*, 24 (3): 301-309.

MacCracken, Jennifer. 1988. *Participatory Rapid Appraisal in Gujarat: A Trial Model for the Aga Khan Rural Support Programme.* London: International Institute for Environment and Development.

MacCracken Jennifer, Jules Pretty, and Gordon Conway. 1988. *An Introduction to Rapid Rural Appraisal for Agricultural Development.* London: International Institute for Environment and Development.

Malaret, Luís and Francis Ngoru. 1989. "Ethnoecology as a Tool for Community Based Pest Management: Farmer Knowledge of Termites in Machakos District, Kenya," *Sociobiology* 15 (2): 197-211.

Malaret, Luis and Dianne Rocheleau. 1994. Landscape Pattern, Land Use Change and Biodiversity in Forest/Farm Mosaics. A proposal submitted to the National Science Foundation. Worcester, MA: New England Science Center and Clark University.

Marglin, Frederique and Stephen Marglin, eds. 1990. *Dominating Knowledge: Development Culture, Resistance.* Oxford: Clarendon Press.

Martin, Peter. 1991. "Environmental Care in Agricultural Catchments: Toward the Communicative Catchment," *Environmental Management*, 15(6):773-783.

Mascarenhas, James, Parmesh Shah, Sam Joseph, Ravi Jayakaran, John Devavaram, Vidya Ramachandran, Aloysius Fernandez, Robert Chambers, and Jules Pretty. 1991. *Participatory Rural Appraisal: Proceedings of the February 1991 Bangalore PRA Trainers Workshop.* RRA Notes Number 13. London: International Institute for Environment and Development.

Matose, Frank. 1993. "Gender and Local Knowledge of Trees and Crops in a Pilot Project in Zimbabwe." A paper presented at the Sixth International Forum of the Association for Women in Development, October 21-24, 1993, Washington, DC.

Maundu Munyao (1992) Biodiversity and Wild Foods. Manuscript. Nairobi, Indigenous Food Plants Programme, National Museum of Kenya.

McCabe, J. Terrence. 1990. "Turkana Pastoralism: A Case Against the Tragedy of the Commons," *Human Ecology*, 18 (1): 81-104.

McConnell, William. 1992. Local Ecological Knowledge and Environmental Management in the Republic of Mali, West Africa. M. A. thesis. Worcester, MA, Program in International Development and Social Change, Clark University.

Mies, Maria. 1988. *Patriarchy and Accumulation on a World Scale.* London: Zed Press.

Mies, Maria and Vandana Shiva. 1993. *Ecofeminism.* London, Zed Press.

Müller, E. U. and S. K. Scherr. 1990. "Planning Technical Interventions in Agroforestry Projects," *Agroforestry Systems*, 12: 23-44.

Murphree, Marshall. 1993. "Decentralizing the Proprietorship of Wildlife Reserves in Zimbabwe's Communal Lands. In *Voices from Africa: Local Perspectives on Conservation* (Dale Lewis and Nick Carter, eds.), Washington, DC: World Wildlife Fund.

National Environment Secretariat, Egerton University, Clark University and Center for International Development and Environment of World Resources Institute. (NES) 1991. *Participatory Rural Appraisal Handbook: Conducting PRAs in Kenya.* Washington, DC: World Resources Institute.

Ngugi, A and L. Buck. 1989. *Proceedings of the Agroforestry Monitoring and Evaluation Methodology Project Regional Workshop.* Nairobi: CARE International.

Norman D, D. Baker, G. Heinrich, C. Jonas, S. Maskiara, and F. Worman. 1989. "Farmer Groups for Technology

Development: Experiences from Botswana. In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 136-146.

Norman, D., D. Baker, G. Heinrich, and F. Worman. 1988. "Technology Development and Farmer Groups: Experiences from Botswana," *Experimental Agriculture*, 24 (3): 321-331.

Oakley, P. 1987. "State or Process, Means or End? The Concept of Participation in Rural Development Ideas," *RRDC Bulletin*, March.

Oldfield, Margery and Janis Alcorn. 1991. "Conservation of Traditional Agroecosystems." In *Biodiversity: Culture, Conservation and Ecodevelopment* (Margery Oldfield and Janis Alcorn, eds.), Boulder: Westview Press, pp. 37-58. Reprinted from *Bioscience*, 37 (3).

Owusu-Bempah, Kofi. 1988. "The Role of Women Farmers in Choosing Species for Agroforestry Farming Systems in Rural Areas of Ghana." In *Gender Issues in Farming Systems Research and Extension* (Susan Poats, Marianne Schmink, and Anita Spring, eds.), Boulder: Westview Press, pp. 427-443.

Parkipuny, M. S. 1991. "Pastoralism, Conservation and Development in the Greater Serengeti Region." IIED Issues Paper No. 26. London, International Institute for Environment and Development.

Perlman, Janice. 1990. "Introduction: A Dual Strategy for Deliberate Social Change in Cities," *Cities*, 1990 (February): 3-15.

Poats, Susan, Hilary Feldstein, and Dianne Rocheleau. 1989. "Gender and Intra-Household Analysis in On-Farm Research and Experimentation." In *The Household Economy: Reconsidering the Domestic Mode of Production* (Richard Wilk, ed.), Boulder: Westview Press.

Poats, Susan, Marianne Schmink, and Anita Spring, eds. 1988. *Gender Issues in Farming Systems Research and Extension*. Boulder: Westview Press.

Polestico, Rachel. 1993. "Participatory Research: Its Application to Development, Gender, Sexuality, and Reproductive Health." In *Gender, Sexuality, and Reproductive Health in the Philippines* (Pilar Ramos Jimenez and Patricia Monina P. Yadao, eds.), Manila: Social Development Research Center, De la Salle University, pp. 3-28.

Posey, Daryl. 1985. "Indigenous Management of Tropical Forest Ecosystems: The Case of the Kayapo Indians of the Brazilian Amazon," *Agroforestry Systems*, 3 (2): 139-158.

Pretty, Jules. 1991. "Farmers' Extension Practice and Technology Adaptation: Agricultural Revolution in 17-19th Century Britain," *Agriculture and Human Values*, 8 (1-2): 132-148.

Pretty, Jules and Robert Chambers. 1992. "Turning the New Leaf: New Professionalism, Institutions and Policies for Agriculture." Overview paper prepared for IIED/IDS Beyond Farmer First Workshop, October 27-29, 1992, Brighton, Institute for Development Studies, University of Sussex.

Project Reach. 1993. "Gender Concerns in Sustainable Development: The Case of Katheka, Kenya." Draft Paper. Nairobi, Project Reach.

Raintree, J. B., ed. 1987a. *D&D User's Manual: An Introduction to Agroforestry Diagnosis and Design*. Nairobi: ICRAF.

Raintree J. B. 1987b. "The State of the Art of Agroforestry Diagnosis and Design," *Agroforestry Systems*, 5 (3): 219-250.

Raintree, J. B., ed. 1983a. "Resources for Agroforestry Diagnosis and Design." ICRAF Working Paper No. 7. Nairobi, ICRAF.

Raintree, J. B. 1983b. "Strategies for Enhancing the Adoptability of Agroforestry Innovations," *Agroforestry Systems*, 1 (3): 173-188.

Rhoades, Robert. 1989. "The Role of Farmers in the Creation of Agricultural Technology." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 3-9.

Rhoades, Robert. 1987. "Basic Field Techniques for Rapid Rural Appraisal." In *Proceedings of the 1985 International Conference on Rapid Rural Appraisal, Khon Kaen, Thailand*, Faculty of Agriculture, Khon Kaen University.

Rhoades, Robert. 1984. *Breaking New Ground: Agricultural Anthropology*, Lima, International Potato Centre.

Rhoades, Robert. 1982. *The Art of the Informal Agricultural Survey. Training Document*. Lima: International Potato Centre.

Rhoades, R. E. and R. H. Booth. 1982. "Farmer-Back-to-Farmer: A Model for Generating Acceptable Agricultural Technology," *Agricultural Administration*, 11: 127-137.

Richards, Howard. 1985. *The Evaluation of Cultural Action*, Ottawa, International Development Research Centre.

Richards, Paul. 1989. "Agriculture as Performance." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 39-43.

Richards, Paul. 1985. *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa*. London: Hutchinson.

Rocheleau, Dianne. 1991a. "Gender, Ecology and the Science of Survival: Stories and Lessons from Kenya," *Agriculture and Human Values*, 8 (1): 156-165.

Rocheleau, Dianne. 1991b. "Participatory Research in Agroforestry: Learning from Experience and Expanding our Repertoire," *Agroforestry Systems*, 9 (1).

Rocheleau, Dianne. 1989a. "Agroforestry as Popular Science: A Land User Perspective for Research and Design in Rural Landscapes." A paper presented at the Annual Meeting of the American Association for the Advancement of Science, January 14-19, 1989, San

Francisco.

Rocheleau, Dianne. 1989b. "The Gender Division of Work, Resources and Rewards in Agroforestry Systems." In *Agroforestry Development in Kenya* (A. E. Kilewe, K. M. Kealey, and K. K. Kebaara, eds.), Nairobi: ICRAF, pp. 228-245.

Rocheleau, Dianne. 1987a. "Gender, Resource Management and the Rural Landscape: Implications for Agroforestry and Farming Systems Research." In *Gender Issues in Farming Systems Research and Extension* (Susan Poats, Marianne Schmink, and Anita Spring, eds.), Boulder: Westview Press, pp. 149-169.

Rocheleau, Dianne. 1987b. "The User Perspective and the Agroforestry Research and Action Agenda." In *Agroforestry: Realities, Possibilities and Potentials* (Henry Gholz, ed.), Dordrecht: Martinus Nijhoff, pp. 59-87.

Rocheleau, Dianne. 1985. "Criteria for Re-Appraisal and Re-Design: Intra-Household and Between-Household Aspects of FSRE in Three Kenyan Agroforestry Projects." ICRAF Working Paper No. 37. Nairobi, ICRAF.

Rocheleau, Dianne. 1983a. "Appendix A-5: Ecosystems Analysis in D&D Applications." In *Resources for Agroforestry Diagnosis and Design* (ICRAF Working Paper No. 7), Nairobi, ICRAF, pp. 137-155.

Rocheleau, Dianne. 1983b. "Appendix A-8; Watershed Evaluation Guidelines." In *Resources for Agroforestry Diagnosis and Design* (ICRAF Working Paper No. 7), Nairobi: ICRAF, pp. 165-171.

Rocheleau, Dianne, Patricia Benjamin, Alison Field-Juma, and Philip Steinberg, with Ana Nzisa and Peter Ondiege. Forthcoming. *History, Ecology and Environmental Change in East Africa: The Case of Ukambani.* Tokyo: United Nations University Press.

Rocheleau, Dianne and Luis Malaret. 1987. "Use of Ethnoecology in Agroforestry Systems Research." In *How Systems Work. Selected proceedings of the Farming Systems Research Symposium*, Fayetteville: University of Arkansas and Winrock International.

Rocheleau, D., L. Ross, J. Morrobel, R. Hernandez, C. Brito, and C. Amparo. 1994. "Farming the Forest, Gardening with Trees: Gendered Landscapes and Livelihood in Zambrana-Chacuey, Dominican Republic." Working paper. Worcester, MA, Clark University.

Rocheleau, Dianne, Kamoji Wachira, Luis Malaret, and Bernard Muchiri Wanjohi. 1989. "Ethnoecological Methods to Complement Local Knowledge and Farmer Innovations in Agroforestry. In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 14-24.

Rocheleau, Dianne, Fred Weber and Alison Field. 1988. *Agroforestry in Dryland Africa. Science and Practice of Agroforestry Series, Vol. 3.* Nairobi: ICRAF.

Roe, Emery and Louise Fortmann. 1981. *Season and Strategy: The Changing Organization of the Rural Water Sector in Botswana.* Ithaca, NY, Rural Development Committee, Cornell University.

Ross, Laurie. 1994. The Partnership Between Grassroots Social Movements and Development Organizations: Identity Reinforcement and Reinvention in Zambrana-Chacuey, Dominican Republic. M. A. thesis. Worcester, MA, Program in International Development and Social Change, Clark University.

RRA Notes Newsletter. 1988 *et seq.* London, Sustainable Agriculture Program. International Institute for Environment and Development.

Sachs, Wolfgang, ed. 1992. *The Development Dictionary: A Guide to Knowledge as Power.* London: Zed Press.

Scherr, Sara. 1990. "The Diagnosis and Design Approach to Agroforestry Project Planning and Implementation: Examples from Western Kenya." In *Planning for Agroforestry* (William Budd, ed.), Amsterdam: Elsevier, pp. 132-160.

Scherr, Sara. 1988a. *Current Agroforestry Practices and Extension Recommendations of the CARE Agroforestry Extension Project. ICRAF-CARE Project Report No. 8.* Nairobi: ICRAF.

Scherr, Sara. 1988b. *Pilot Survey of Adopted Agroforestry Practices in the CARE Agroforestry Extension Project. ICRAF-CARE Project Report No. 6.* Nairobi: ICRAF.

Scherr, Sara. 1987. "Planning National Agroforestry Research: Guidelines for Land Use System Description." ICRAF Working Paper No. 48. Nairobi, ICRAF.

Scoones, Ian, ed. 1989. *Participatory Research for Rural Development in Zimbabwe: A Report of a Training Workshop for ENDA-Zimbabwe Trees Project.* London: International Institute for Environment and Development.

Scoones, Ian. 1988. Community Management of Indigenous Woodland Project. A series of unpublished reports (Nos. 1-9). Harare, ENDA-Zimbabwe.

Scoones, Ian and Jennifer MacCracken, eds. 1989. *Participatory Rapid Rural Appraisal in Wollo: Peasant Association Planning for Natural Resource Management.* London: IIED and Ethiopian Red Cross Society.

Scoones, Ian and John Thompson. 1992. "Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice: Towards a Theoretical Framework." Overview paper No. 1 prepared for IIED/IDS Beyond Farmer First Workshop, October 27-29, 1992, Brighton, Institute for Development Studies, University of Sussex.

Seitz, Virginia. 1993. "Gender and Rural Organization in a Pilot Project in Zimbabwe." A paper presented at the Sixth International Forum of the Association for Women in Development, October 21-24, 1993, Washington, DC.

Shaner, W. W., P. F. Philipp, and W. R. Schmehl. 1982. *Farming Systems Research and Development: Guidelines for Developing Countries.* Boulder: Westview Press.

Shiva, Vandana. 1988. *Staying Alive: Women, Ecology and Survival.* London: Zed Press.

Showers, Kate. 1989. "Soil Erosion in the Kingdom of Lesotho: Origins and Colonial Response, 1830s-1950s,"

Journal of Southern African Studies, 15 (2): 263-286.

Showers, Kate and Gwendolyn Malahleha. 1992. "Oral Evidence in Historical Environmental Impact Assessment: Soil Conservation in Lesotho in the 1930s and 1940s," *Journal of Southern African Studies*, 18(2):276-296.

Sperling, L. Forthcoming. "Methods for Integrating Farmer Experts into On-Station Research." In *Methodologies Handbook for Gender Analysis in Farming Systems Research* (Hilary Feldstein and Janice Jiggins, eds.), New York: Population Council.

Stamp, Patricia. 1989. *Technology, Gender and Power in Africa*. Ottawa and West Hartford: International Development Research Centre and Kumarian Press.

Sumberg, J. and C. Okali. 1989. "Farmers, On-Farm Research, and New Technology." In *Farmer First: Farmer Innovation and Agricultural Research* (Robert Chambers, Arnold Pacey, and Lori Ann Thrupp, eds.), London: Intermediate Technology Publications, pp. 109-114.

Sutherland, A. J. 1987. "The Benefits of Adopting a Community Approach to Farmer Selection." A Paper presented at the Workshop on Household Issues in Farming Systems Research. April 27-30, 1987. Lusaka, CIMMYT.

Thomas-Slayter, Barbara, Andrea Esser, and M. Dale Shields. 1993. *Tools of Gender Analysis*. Worcester, MA: Clark University.

Thomas-Slayter, Barbara, Charity Kabutha, and Richard Ford. Forthcoming. "Participatory Rural Appraisal: An Innovative Methodology for Improved Community Development." In *Participatory Methodologies in Development* (K. Kumar, ed.).

Thomas-Slayter, Barbara, Charity Kabutha, and Richard Ford. 1991. *Traditional Village Institutions in Environmental Management. From the Ground Up Case Study Series, No. 1*. Washington, DC and Nairobi, The Center for International Development and Environment, World Resources Institute and the African Centre for Technology Studies.

Thrupp, Lori Ann. 1989. "Legitimizing Local Knowledge: From Displacement to Empowerment for Third World People," *Agriculture and Human Values*, 6 (3): 13-24.

Tiffen Mary, Michael Mortimore, and F. Gichuki. 1994. *More People, Less Erosion: Environmental Recovery in Kenya*. Chichester: John Wiley and Sons.

Tripp, Robert. 1984. "On-Farm Research and Applied Nutrition: Some Suggestions for Collaboration Between National Institutes of Nutrition and Agricultural Research," *Food and Nutrition Bulletin*, 6 (3).

Turnbull, David. 1992. Local Knowledge and Comparative Scientific Traditions. Manuscript. Victoria, Australia, School of Social Inquiry, Deakin University.

Uphoff, Norman. 1992. "Local Organization for Supporting People-Based Agricultural Research and Extension." A paper presented at IIED/IDS Beyond Farmer First Workshop, October 27-29, 1992, Brighton, Institute for Development Studies, University of Sussex.

Veit, Peter. 1993. Local Level Natural Resource Management: Lessons from the Ground Up. Draft manuscript. Washington, DC: World Resource Institute.

Warren, D. Michael, L. Jan Slikkerveer, and David Brokensha, eds. 1994. *Indigenous Knowledge Systems: The Cultural Dimension of Development*. London: Intermediate Technology Publications.

Warren, D. Michael and Kristin Cashman. 1991. *Indigenous Knowledge for Agriculture and Rural Development: Some Practical Applications*. London, International Institute for Environment and Development.

Watts, Michael. 1993. "Development I: Power, Knowledge, Discursive Practice," *Progress in Human Geography*, 17 (2): 257-272.

Watts, Michael. 1983. *Silent Violence: Food, Famine, and Peasantry in Northern Nigeria*. Berkeley: University of California Press.

Wells, Michael, Katrina Brandon, and Lee Hannah. 1992. *People and Parks: Linking Protected Area Management with Local Communities*. Washington, DC, World Bank.

Wilson, Ken. 1989. "Trees in Fields in Southern Zimbabwe," *Journal of Southern African Studies*, 15 (2): 369-383.

Wilson, Ken. 1988. *Community Management of Indigenous Woodland Project*. Unpublished report. Harare, ENDA.

Wilson, Ken. 1987. *Research on Trees in the Mazvihwa and Surrounding Areas*. Unpublished report. Harare, ENDA.

Wisner, Ben. 1989/1990. *Power and Need in Africa*. London and Trenton, NJ: Earthscan and Africa World Press.

Wisner, Ben and Lakshman Yapa. 1992. *Building a Case Against Economic Development*. Manuscript. Hampshire College and Pennsylvania State University.

Woodhill, J. 1990. "Landcare — Who Cares? Current Issues and Future Directions for Landcare in NSW." A discussion paper from the 1990 review of Landcare in New South Wales. Hawkesbury, Australia, Landcare and Environment Program, Centre for Rural Development, University of Western Sydney.

Woodhill, J, J. McKenzie, and A. M. Wilson. 1990. "Post Course Report." A paper prepared following the Landcare and Total Catchment Management Coordinators Workshop, July 1990. Hawkesbury, Australia, Faculty of Agriculture and Rural Development, University of Western Sydney.

Woods, B. 1983. "Altering the Present Paradigm: A Different Path to Sustainable Development in the Rural Sector." Unpublished paper. Washington, DC: The World Bank.

Yapa, Lakshman. 1991. "Is GIS Appropriate Technology?" *International Journal of Geographic Information Systems*, 5 (1): 41-58.

Zazueta Aaron, Bruce Cabarle, and Lori Ann Thrupp. 1992. *Linking Participatory Methods with Policy Dialogue and Planning Processes: Multi-Interest Resource Management in Latin America*. A paper presented at IIED/IDS Beyond Farmer First Workshop, October 27-29, 1992, Brighton, Institute for Development Studies, University of Sussex.