Training Programme on Revitalization of Rainfed Agriculture (RRA) with special reference to Natural Resource Management

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Revitalization of Rainfed Agriculture (RRA) with special reference to Natural Resource Management

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1.. REVITALIZATION OF RAINFED AGRICULTUE - NATURAL RESOURCE MANAGEMENT

Introduction:

Rainfed India has been languishing in the rain shadow of the Green Revolution for close to four decades. The skewed public investment paradigm towards perennially irrigated areas has led to the exclusion of close to 68% of Indian farmlands. Similar has been the status of low input animal husbandry and inland fisheries. The livelihood and incomes of more than half of India's workforce depend crucially on this triad of agriculture-livestock and fisheries. Yet, there is no relevant paradigm for revitalizing these sectors. Rainfed India straddles a wide range of agro-ecological and agro-climatic zones thereby making a universal policy prescription unviable. The need of the hour is to make policy a function of typologies so as to be able to deliver the required results. Research questions suited to this end also need to be evolved so as to provide a foundation for effective revitalization.

Rainfed India has been left out of mainstream development in agriculture due to the government's emphasis on generating food surplus from intensively irrigated areas to meet food security needs of the nation. Substantial public investments have been made in irrigation, with a focus on mainly rice and wheat. These investments have gone into promoting intensive use of fertilizers, seeds and other inputs, and price support systems. The extension of policies evolved in the context of the Green Revolution to rainfed regions has only deepened the crisis in Rainfed India. Falling groundwater levels, declining soil productivity, degradation of commons and increasing costs of inputs have led to stagnant incomes and entrenched poverty in rainfed areas.

The potential for higher growth in crop productivity, incomes from livestock - in particular, goats, sheep and fisheries has not been realized for lack of relevant public investments. Therefore, there must be distinctive policy focus and substantial investments to revitalize the diverse and integrated production systems in rainfed areas. If there were parity in investment with irrigated areas, rainfed regions would have high potential for growth. If rainfed farmers received regular public investment of the magnitude that goes into per hectare of irrigated land, they would be able to improve soil productivity by regularly adding organic matter, ensure higher moisture retention and make their crop systems resilient to climate variability. The productivity gains would then be substantial.

The Revitalizing Rainfed Agriculture (RRA) Network aims to evolve appropriate policies

rooted in the realities of rainfed areas. It advocates for increased and appropriate public investments to strengthen Rainfed Agricuture.The RRA Network is a growing network of over 6civil society organizations, research institutions, policy makers, donor agencies and individuals advocating for a differentiated agricultural policy and support system for rainfed areas in India. Based on the vast experience on the ground of its member organizations, RRA Network proposes a series of specific measures on seeds, soils, water, millets, fisheries, credit, markets and institutions. These have taken the shape of thematic nodes, anchored by organizations with years of experience in the field.

Need:

- Differentiated policies for rainfed agriculture (including livestock and fisheries)
- Substantial scaling up of public investments for revitalizing rainfed areas
- Appropriate framework for public investments - rooted in a paradigm relevant for rainfed areas.

The natural resources base of a region includes the elements of climate, land, water, soil and biodiversity. Degradation and erosion of natural resources – those parts of the natural world that are used to produce food and other valued goods and services and which are essential for our survival and prosperity, are one of root causes of the agrarian crisis. No current or intended use of natural resources should condemn our children to endless toil or deprivation. Land, water, soil, forest, livestock, fish, biodiversity (plant, animal and microbial genetic resources), along with air and sunlight, are our natural resource upon which human life is dependent.

The natural resources are interlinked as producers and service providers to maintain environmental health, augment agriculture production and ensure economic development. One of the major concerns in this endeavor is to rehabilitate the degraded and vulnerable land and water resources suffering from soil erosion, soil acidity, salinity, alkalinity, water logging, water depletion, water pollution etc and to ensure livelihood support to the rural population in the country. Soil and water conservation practices through engineering and vegetative measures need to be more indigenous, innovative and eco-friendly and those which are maintainable by farming community. The existing soil and water conservation practices to arrest soil erosion and reclamation measures for other soil degradation processes also need to be re-looked. Soil buffering system and land use policy are also vital components of NRM to attain sustainability that needs to be activated.

The NRM-specific policy and action challenges notwithstanding, equally formidable other challenges directly impacting sustainability and productivity of natural resources are: technology fatigue, huge technology transfer/adoption gaps, collapse of the extension system and serious knowledge deficits and gaps, poor institutional credit and insurance supports, non-remunerative prices and highly inadequate marketing infrastructure and regulations, huge post-harvest losses and negligible value addition, worsening input-risk-output imbalance, non-existent and/or ineffective enabling mechanisms and regulatory frameworks, and capital stock depletion and inadequate investment.

The 12th Five Year Plan working group on Natural Resource Management (NRM) and Rainfed Farming recommended for a special focus on evolving a policy and program framework for revitalizing rainfed agriculture (RRA) by integrating Natural Resource Management, Production systems and livelihoods as the core strategy of rainfed areas development. RRA Comprehensive Pilot (RRA-CP) Program has been initiated to strengthen diverse rainfed farming systems integrating and converging all the available mainstream agriculture, rural development other programs at the Mandal level.

Objectives

The main objectives of the training program are to orient participants on the following:

- To Overall evolution, strategy, approach and expectations of the RRA Program
- To Critical convergent interventions to be made under Natural Resource Management in the Comprehensive Pilots (CP)
- To evolve institutional arrangements for convergence on Natural Resource Management theme at Block level
- To evolve convergent strategic plan and annual action plan for Natural Resource Management at Block level under the identified CP

2. NATIONAL MISSION FOR SUSTAINABLE AGRICULTURE (NMSA) OPERATIONAL GUIDELINES

Introduction

Sustaining agricultural productivity depends on quality and availability of natural resources like soil and water. Agricultural growth can be sustained by promoting conservation and sustainable use of these scarce natural resources through appropriate location specific measures. Indian agriculture remains predominantly rainfed covering about 60% of the country's net sown area and accounts for 40% of the total food production. Thus, conservation of natural resources in conjunction with development of rainfed agriculture holds the key to meet burgeoning demands for foodgrain in the country. Towards this end, National Mission for Sustainable Agriculture (NMSA) has been formulated for enhancing agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation.

NMSA derives its mandate from Sustainable Agriculture Mission which is one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC). The strategies and program of actions (POA) outlined in the Mission Document, that was accorded 'in principle' approval by Prime Minister's Council on Climate Change (PMCCC) on 23.09.2010,aim at promoting sustainable agriculture through a series of adaptation measures focusing on ten key dimensions encompassing Indian agriculture namely; 'Improved crop seeds, livestock and fish cultures', 'Water Use Efficiency', 'Pest Management', 'Improved Farm Practices', 'Nutrient Management', 'Agricultural insurance', 'Credit support', 'Markets', 'Access to Information' and 'Livelihood diversification'. During XII Five Year Plan, these measures are being embedded and mainstreamed onto ongoing/proposed Missions/ Progammes/ Schemes of Dept. of Agriculture & Cooperation (DAC) through a process of restructuring and convergence. NMSA architecture has been designed by converging, consolidating and subsuming all ongoing as well as newly proposed activities/programmes related to sustainable agriculture with a special emphasis on soil & water conservation, water use efficiency, soil health management and rainfed area development. The focus of NMSA will be to infuse the judicious utilization of resources of commons through community based approach.

NMSA will cater to key dimensions of 'Water use efficiency', 'Nutrient Management' and 'Livelihood diversification' through adoption of sustainable development pathway by progressively shifting to environmental friendly technologies, adoption of energy efficient equipment's, conservation of natural resources, integrated farming, etc. Besides, NMSA aims at promoting location specific improved agronomic practices through soil health management, enhanced water use efficiency, judicious use of chemicals, crop diversification, progressive adoption of crop-livestock farming systems and integrated approaches like crop-sericulture, agro-forestry, fish farming, etc.

Mission Objectives:

NMSA will have following objectives:

- To make agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific Integrated/Composite Farming Systems;
- To conserve natural resources through appropriate soil and moisture conservation measures;
- To adopt comprehensive soil health management practices based on soil fertility maps, soil test based application of macro & micro nutrients, judicious use of fertilizers etc.;
- To optimize utilization of water resources through efficient water management to expand coverage for achieving 'more crop per drop;
- To develop capacity of farmers & stakeholders, in conjunction with other on-going Missions e.g. National Mission on Agriculture Extension & Technology, National Food Security Mission, National Initiative for Climate Resilient Agriculture (NICRA) etc., in the domain of climate change adaptation and mitigation measures;
- To pilot models in select blocks for improving productivity of rainfed farming by mainstreaming rainfed technologies refined through NICRA and by leveraging resources from other schemes/Missions like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Integrated Watershed Management Program (IWMP), RKVY etc.; and
- To establish an effective inter and intra Departmental/Ministerial co-ordination for accomplishing key deliverables of National Mission for Sustainable Agriculture under the aegis of NAPCC.

Mission Strategy:

To achieve these objectives, NMSA will have following multi-pronged strategy:

- Promoting integrated farming system covering crops, livestock & fishery, plantation and pasture based composite farming for enhancing livelihood opportunities, ensuring food security and minimizing risks from crop failure through supplementary/ residual production systems;
- Popularizing resource conservation technologies (both on-farm and off-farm) and introducing practices that will support mitigation efforts in times of extreme climatic events or disasters like prolonged dry spells, floods etc.
- Promoting effective management of available water resources and enhancing water use efficiency through application of technologies coupled with demand and supply side management solutions;
- Encouraging improved agronomic practices for higher farm productivity, improved soil treatment, increased water holding capacity, judicious use of chemicals/ energy and enhanced soil carbon storage;
- Creating database on soil resources through land use survey, soil profile study and soil analysis on GIS platform to facilitate adoption of location and soil-specific crop management practices& optimize fertilizer use;
- Promoting location and crop specific integrated nutrient management practices for improving soil health, enhancing crop productivity and maintaining quality of land and water resources; Involving knowledge institutions and professionals in developing climate change adaptation and mitigation strategies .
- State Government may engage reputed NGOs for implementation of cluster/village development plan in case of limited govt. infrastructure is available in that area through a transparent system of selection and defined process of supervision and monitoring through a line department.
- Strong technical monitoring and feedback systems on climate change mitigation and adaptation issues to the National Advisory council for regular updates on technical feasibility of various components and their effectiveness in bringing about the climate resilience.
- Establishing platform to liaison, review and coordinate implementation of interventions outlined in Mission Document of NMSA under aegis of National Action Plan on Climate Change.

Mission Interventions

NMSA has following four (4) major program components or activities:

Rainfed Area Development (RAD):

RAD will adopt an area-based approach for development and conservation of natural resources along with farming systems. This component has been formulated in a 'watershed plus framework', i.e., to explore potential utilization of natural resources base/assets available/created through watershed development and soil conservation activities /interventions under MGNREGS, NWDPRA, RVP&FPR, RKVY, IWMP etc..

This component will introduce appropriate farming systems by integrating multiple components of agriculture such as crops, horticulture, livestock, fishery, forestry with agro based income generating activities and value addition. Besides, soil test/soil health card based nutrient management practices, farmland development, resource conservation and crop selection conducive to local agro climatic condition will also be promoted under this component. A cluster based approach of 100 hectare or more (contiguous or noncontiguous in difficult terrain with close proximity in a village/adjoining villages) may be adopted to derive noticeable impact of convergence and encourage local participation and for future replication of the model in larger areas. Supplementary support from this component will be admissible for gap-filling resource conservation activities under converging programmes.

RAD clusters should have soil analysis/soil health card/soil survey maps to justify the interventions proposed and at least 25% of the farming system area will have to be covered under On Farm Water Management. Farming Systems recommended by ICAR's Contingency Plans and successful findings of NICRA projects shall also be considered in development of integrated project plan. Besides, creation and development of common property resources/assets/utilities like grain bank, biomass shredders, fodder bank, group marketing etc. will be encouraged under this component.

On Farm Water Management (OFWM): OFWM will focus primarily on enhancing water use efficiency by promoting efficient on-farm water management technologies and equipment. This will not only focus on application efficiency but, in conjunction with RAD component, also will emphasize on effective harvesting & management of rainwater. Assistance will be extended for adopting water conservation technologies, efficient delivery and distribution systems etc. Emphasis will also be given to manage and equitably

distribute the resources of commons by involving the water users associations, etc.. To conserve water on farm itself, farm ponds may be dug using MGNREGA funds and earth moving machinery (to the extent manual digging under MGNREGA is not feasible).

Soil Health Management (SHM):

SHM will aim at promoting location as well as crop specific sustainable soil health management including residue management, organic farming practices by way of creating and linking soil fertility maps with macro-micro nutrient management, appropriate land use based on land capability, judicious application of fertilizers and minimizing the soil erosion/degradation. Assistance will be provided for various improved package of practices based on land use and soil characteristics, generated through geographical information system (GIS) based thematic maps and database on land and soil characteristics through extensive field level scientific surveys. Besides, this component will also provide support to reclamation of problem soils (acid/alkaline/saline). This component will be implemented by State Govt., National Centre of Organic Farming (NCOF), Central Fertilizer Quality Control & Training Institute (CFQC&TI) and Soil and Land Use Survey of India (SLUSI). Given the limitations, such as staff and infrastructure, faced by the department of agriculture at the field level, a Public Private Partnership Model may be adopted by states depending upon the private partner's strength in the field to ensure that the soil testing is done in time and in the numbers required. The private parties can be encouraged to set up soil testing labs in selected areas in the district.

Climate Change and Sustainable Agriculture:

Monitoring, Modeling and Networking (CCSAMMN): CCSAMMN will provide creation and bidirectional (land/farmers to research/scientific establishments and vice versa) dissemination of climate change related information and knowledge by way of piloting climate change adaptation/mitigation research/model projects in the domain of climate smart sustainable management practices and integrated farming system suitable to local agro-climatic conditions. The dedicated expert teams of technical personnel will be institutionalized within NMSA to rigorously monitor and evaluate the mission activities thrice in a year and will inform the National Committee. Comprehensive pilot blocks will be supported to illustrate functional mechanism for dissemination of rainfed technologies, planning, convergence and coordination with flagship schemes/Missions like

MGNREGS, IWMP, Accelerated Irrigation Benefit Programme (AIBP), RKVY, NFSM, NHM, NMAET etc. Such an integrated action of input and output flows across agriculture, livestock and other production systems will harness the growth potential of the rainfed production systems, imparting sustainability of local production systems while negotiating climate change risks. A consortium approach will be evolved with various stake holders including knowledge partners like State Agricultural Universities (SAUs), Krishi Vigyan Kendras (KVKs), Indian Council of Agricultural Research (ICAR) Institutes etc. by the State Government to provide single window service/knowledge provider system for the benefit of farming community. Financial support may be provided through States to institutionalize the concept and meeting supplementary developmental activities. Climate change related monitoring, feedback, knowledge networking and skill development will also be supported under this component through State Agricultural Universities, ICAR Institutes National/International Institutes, KVKs, Public / Private R&D Organizations etc. Awarding of Studies, Documentation & Publication, Domestic and Foreign Training, Workshops/ Conferences etc. will be supported under this component.

Planning & Implementation

Component Specific Planning (CSP)

NMSA has four major program components e.g. 'Rainfed Area Development', 'Soil Health Management', 'On Farm Water Management' and 'Climate Change and Sustainable Agriculture Modeling and Networking'. An illustrative approach for component specific planning is outlined below:

Rainfed Area Development (RAD)

i. RAD aims at promoting integrated farming system(IFS) with emphasis on multi-cropping, rotational cropping, inter-cropping, mixed-cropping practices with allied activities like horticulture, livestock, fishery, agro-forestry, apiculture, conservation/ promotion of NTFPs etc. to enable farmers not only in maximizing the farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extreme weather events;

ii. Depending on the type and extent of natural resources/assets/commodities already developed or supported, location-specific crops, fruits, vegetables, spices, flowers, feed & fodder, livestock, fisheries, apiculture, mushroom, medicinal & aromatic plantation and related income generating activities would be supported. Activities like construction of ponds, land treatment, wells, supply of pumps, micro-irrigation/other water saving

devices, seed and sapling Support etc. would be converged/supplemented to promote value addition through a sustainable farming system;

iii. Adoption of a cluster approach in a village or an area of not less than 100 Ha (contiguous or non-contiguous in difficult terrain with close proximity, in a village/ adjoining villages) may be preferred for injecting investments to utilize the potential of available/ created common resources;

iv. Selected clusters will have soil analysis/soil health card as mandatory and at least 25% of the farming system area will have to be covered under On Farm Water Management.

v. Support will be given to those who wish to add other compatible farming component(s) to their existing crops/ system. It should have the potential to introduce/merge at least one or more major components/activities apart from cropping system and water harvesting of the farming systems to qualify for the support. Support for only cropping system will be not be allowed under this component unless it is diversified from the regular practice to a farming system suitable to that particular ecological conditions through effective on-farm water management and soil health care. Farmers would have the option to choose one or combination of farming systems suitable to the specific eco-system supported through local KVK, SAU, ICAR Centre, ICRISAT, ATMA etc., for maximizing agricultural productivity from the existing natural resource assets;

vi. Support to each farm family under RAD component will be restricted to a farm size of 2 Ha and financial assistance will be limited to Rs. 1 lakh. However, construction/renovation of farm ponds, storage/processing unit and / or construction of poly house etc., are excluded from these limits. Credit support, if required, may be arranged to meet the balance;

vii. Farmland development through location specific interventions e.g. resource conservation, rainwater harvesting, land development in river valley project and flood prone river areas, last mile connectivity etc. Farmers' Companies, Farmers' Producer Companies/ Organizations, Registered Farmers' Societies, Farmers' Cooperatives would also be eligible for developing a cluster. The support for the activities would be restricted to the eligible limits for members. The FPOs are also eligible to get support from NMSA, but as per the Policy and Process.

viii. Guidelines for Farmer Producer Organizations issued by Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India. Due consideration should also be given to ensure that farmers rights and ownership issues are not violated;

ix. Converging the upgraded utilities developed through watershed development programmes/NREGA in terms of water harvesting and micro water storages through effective application and distribution systems like improved conveyance, field channels, pressurized irrigation, water-lifting devices etc. to enhance the potential of farming systems.

x. The farmers' producer companies may be set up to grow organic products. These farmers can come from a group of villages, preferably contiguous, forming a cluster and should be supported to achieve organic certification over a period of three years. These producer companies should be given financial support as per provisions for FPOs and subsidies for eligible components under NMSA for marketing of the organic product so that it fetches better prices and encourages others to take up organic farming. Marketing Federations existing at the state level should enter into agreement with the producer companies to market their organic product in the niche markets.

xi. Resource Conservation Technologies (RCT) and rainwater harvesting have been kept under the basket of eligible activities of RAD to fulfill specific requirement of farmers/localities to supplement the works undertaken under National Watershed Development Program for Rainfed Areas (NWDPRA) and Soil Conservation in the Catchments of River valley Projects & Flood Prone Rivers (RVP&FPR) which have not been developed to their full potential due to limitation of resources and in some cases not completed due to discontinuation of funding.

xii. RCT activities will not be taken up in any developed/ongoing /proposed IWMP watershed project areas unless specifically recommended by the State Level Nodal Agency of IWMP.

xiii. Reclamation of problem soils (Acidic/alkaline/saline) through appropriate soil amendments, land development including bio-drainage, on-farm water management including secondary storage as may be required in the cluster, may be proposed under RAD Component adopting the norms and specifications given under SHM /OFWM components.

xiv. Convergence of relevant developmental programmes in project areas to be ensured for optimal utilization of resources by establishing an integrated and coordinated system involving different sectors and institutions. The upgraded utilities developed through watershed development programmes/MGNREGA in terms of water harvesting and micro water storages can be made use through effective application and distribution systems

like improved conveyance, field channels, pressurized irrigation, water lifting devices etc. to enhance the potential of farming systems. Areas/Commodities developed/being developed under National Food Security Mission (NFSM), National Mission on Oilseed & Oil Palm (NMOOP), National Mission on Horticulture (NHM), National Livestock Mission (NLM) can be supplemented with other productions systems from NMSA to make it an Integrated Farming System facilitating additional livelihood opportunities to farmers. Similarly the interventions of National Mission for Agriculture Extension & Technology (NAMET) to appropriately made use for capacity building, awareness generation, information support, farm mechanization, availability of seeds/planting materials etc.

xv. Suitable linkage for agro-processing and Marketing may be established for the cluster. Possibilities of building post-harvest and market linkage under PPP model may be explored. Funds from schemes like NADP, National Mission for Food Processing may be dovetailed for this purpose.

Soil Health Management (SHM):

Guidelines for Implementation of Mission Intervention on Soil Health Management (SHM):

Out of the 4 interventions under NMSA, Soil Health Management (SHM) is one of the most important intervention: SHM will aim at promoting location as well as crop specific sustainable soil health management including residue management, organic farming practices by way of creating and linking soil fertility maps with macro-micro nutrient management, appropriate land use based on land capability, judicious application of fertilizers and minimizing the soil erosion. Assistance will be provided for various improved package of practices based on land use and soil characteristics, generated through geographical information system (GIS) based thematic maps and database on land and soil characteristics through extensive field level scientific surveys. This component will be implemented by State Govt., National Centre of Organic Farming (NCOF), Central Fertilizer Quality Control & Training Institute (CFQC&TI) and sanctioned by INM division. Besides, this component will also provide support to reclamation of problem soils (acid/alkaline/saline) and promote appropriate land uses through State Governments, Soil and Land Use Survey of India (SLUSI)/NRM Division.

It will have following approach for component specific planning.

- SHM will support various types of soil and land resource surveys for creating a comprehensive soil database for the planning and implementation of programmes;
- Ensure quality control requirements of fertilizers, bio-fertilizers and organic fertilizers under the Fertilizer (Control) Order (FCO), 1985, including revision of standards and testing protocols keeping in view the advances in research and technology and covering organic inputs under quality control regime;
- Promote Integrated Nutrient Management (INM) through judicious use of chemical fertilizers, including secondary and micro nutrients, in conjunction with organic manures and bio-fertilizers, for improving soil health and its productivity;
- Support augmentation and strengthening of soil and fertilizer testing facilities and provide soil test based recommendations to farmers for improving soil fertility and enhancing economic return to farmers. It will also support up-gradation of skill and knowledge of Soil Testing Laboratories (STL)/extension staff and farmers and their capacity building through training and demonstration including demonstration on farmers' fields on soil health care;
- Training on appropriate measures on soil nutrient management and judicious distribution of fertilizers as per soil/crop need for enhanced productivity with reduced cost of cultivation.
- Reclamation of problem soils (Acidic/alkaline/saline) through appropriate soil amendments and land development.
- It is to be noted the reclamation and land use survey and planning will be implemented by SLUSI through NRM division

On Farm Water Management (OFWM):

i. OFWM will focus on enhancing water use efficiency by promoting appropriate technological interventions like drip & sprinkler technologies, efficient water application & distribution system, secondary storage and drainage development.

ii. The unit cost of Drip Irrigation system varies with respect to plant spacing and location of the water source. Moreover, the cost of the drip system varies from state to state depending upon the volume of demand, marketing network, etc. Accordingly, the states have been categorized into three categories, viz. Category 'A', 'B' and 'C'. States where more than 20,000 hectares have been brought under drip irrigation would come under 'A' Category. This would include the States of Andhra

Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Punjab and Tamil Nadu. All the States except those covered under Category 'A' and those falling in the Himalayan belt would come under Category 'B'. All the North Eastern States, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand and Darjeeling District of West Bengal would come under Category 'C'. Keeping in view the level of awareness, proximity to the manufacturing units, distance involved in transportation, potential for drip irrigation, the cost of drip system in Category 'B' States is estimated to be 15% higher than Category 'A' States while for Category 'C' States it is estimated to be 25% higher than Category 'A' State.

iii. Location and crop specific technologically appropriate irrigation systems will be propagated ensuring least cost burden to the farmers/beneficiaries;

iv. It may be ensured that at least 25% of the micro irrigation fund allocated to the State is used for crop sector.

v. Support to each farm family under OFWM component will be restricted to a farm size of 5 Ha. However, beneficiaries who have already availed the benefit of central support for micro irrigation cannot avail further assistance for the same land for the next 10 years

vi. Support for creating secondary storage at tail end of canal system to store water when available in abundance (rainy season) or from perennial sources like streams for use during dry periods through effective on-farm water management; Support for drainage development through surface/sub-surface/bio-drainage system;

vii. Training on appropriate water management technologies, judicious use of water and agronomic & land development measures for effective water management; and

Implementing Agency at the District level should follow uniform procedures and assure transparency in selecting beneficiaries and releasing assistance expeditiously. PRIs need to be consulted in selection of beneficiaries. The water resources developed through watershed development programmes/ NGNREGA in the demonstration area should invariably be linked with the activities of OFWM component for its potential use. Project areas under National Food Security Mission (NFSM), National Mission on Oilseed & Oil Palm (NMOOP), National Mission on Horticulture (NHM), National Livestock Mission (NLM) may also take the advantage of this component for improving water use efficiency, if this component has not been utilized from the parent scheme.

3. TOWARDS A PARADIGM SHIFT IN INDIA'S RAINFED AGRICULTURE

Introduction

Cross-country comparisons show that the impact of GDP growth originating in agriculture on poverty reduction is twice as much as that of GDP growth originating outside. In India, rainfed agriculture (including animal husbandry) is emerging as a major constraint in raising overall agricultural growth. Rainfed areas in India are spread over in some 200 million hectares and constitute 62 percent of the total geographical area of the country. Spanning several agro-ecological regions, the rainfed areas represent the geography with the largest concentration of poverty and backwardness. The key thrust in agricultural policy until now has been to indiscriminately extend the water-intensive Green Revolution technology to these areas that have a significantly different natural resource configuration. This has led to several catastrophic ecological consequences, such as loss of soil fertility, groundwater depletion, loss of bio-diversity and an increase in climate change vulnerability. At the same time, lack of inadequate support for rainfed agriculture in terms of support price, availability of inputs, credit, market access and agricultural research has caused widespread desperation.

The most visible aspects of this desperation are farmer suicides on the one hand, and the rising tide of left wing extremism on the other. In rainfed agriculture, we need a radical shift away from the current paradigm derived from the experience of the Green Revolution. Even with this policy neglect, the contribution of rainfed agriculture to the national economy is by no means small. Rainfed agriculture accounts for 56 percent of total cropped area, 48 percent of the area under food crops and 68 percent of that under non-food crops. In terms of crop groups, 77 percent of pulses, 66 percent of oilseeds and 45 percent of cereals are grown under rainfed conditions. Food grain production in India grew at a rate of 1.26 percent per annum between 1990–1993 and 2003–2006.

Meeting the future demand for food grains (estimated at 280 million tones by 2020) would require a step up in the rate of growth of food production where rainfed agriculture has to play an important role. As estimated by the Technical Committee on Watershed Development (2006), even in the best possible scenario of irrigation development, about 40

percent of the additional supply of food grains needed to match future rise in demand will have to come from rainfed agriculture. Therefore, a breakthrough in rainfed agriculture is an imperative for poverty alleviation, livelihood promotion and food security in India. Watershed development has been one of the important vehicles for directing public investment to rainfed agriculture. However, to be effective, the rainfed agriculture package needs to move beyond watershed development and integrate several other components. Samaj Pragati Sahayog (SPS) has been engaged in the implementation of such an integrated watershed and rainfed agriculture package by bringing together different stakeholders in the tribal drylands of central India for the last 20 years. This work has enhanced drinking water availability, sustained employment generation and livelihood security in several villages. Decentralised water harvesting provides vital life-saving irrigation support to farmers and ensures drought-proofing of the rainfed crop.

As a result, the value of agricultural production has doubled. The immediate impact is observed on distressed out-migration from the villages, which has shown a decline of about 80 percent. There has also been a significant decline in the level of indebtedness of these households to traders and moneylenders who charge usurious rates of interest. While the experience of SPS and other civil society organizations working in similar contexts have shown the strength of this approach at a micro-level, the overall impact of the rainfed agriculture package need to be demonstrated at a scale. It is in this context that SPS joined a group of civil society organizations, researchers and policy-makers who have come together to form the Revitalizing Rainfed Agriculture (RRA) Network.

The RRA network currently has 109 members spread across rainfed areas of the country, and is emerging as an important platform articulating the issues of rainfed agriculture at the national level. The RRA network is attempting to generate large scale and field-based evidence through implementation of comprehensive rainfed agriculture pilots in different bio-physical and socio-economic contexts and typologies within rainfed India, and to develop policy advocacy on the basis of that evidence.

The network is currently putting together available experiences across rainfed typologies on various themes such as water, soil fertility, seeds, inputs, land use, livestock, marketing, credit, etc. An important aspect of the pilot efforts of the RRA network is an

attempt to leverage resources from ongoing public investment programmes for grassroots implementation. Generation of such evidence will provide an opportunity to test the effectiveness of specific interventions, evolve operational strategies for scaling up, develop systems of monitoring and documentation of results, and garner important lessons for public policy that identifies the crucial agents of change in rainfed agriculture.

4. STATUS AND MANAGEMENT SCENARIO OF NATURAL RESOURCES: OVERVIEW

Natural resources (land, water, biodiversity and genetic resources, biomass resources, forests, livestock and fisheries) – the very foundation of human survival, progress and prosperity, have been degrading fast, and the unprecedented pace of their erosion is one of the root causes of the agrarian crisis that the country is facing. The demographic and socio-economic pressures notwithstanding, the unmindful agricultural intensification, over use of marginal lands, imbalanced use of fertilizers, organic matter depletion and deteriorating soil health, extensive diversion of prime agricultural lands to non-agricultural uses, misuse and inefficient use of irrigation water, depleting aquifers, salinization of fertile lands and water logging, deforestation, biodiversity loss and genetic erosion, and climate change are the main underlying causes.

The stipulated overall GDP growth rate of 9 per cent and agricultural growth rate of 4.1 per cent during the XI Plan cannot be achieved with the ongoing shrinking and degradation of the country's natural resources. Interlinked as producers and service providers, the resources must be judiciously conserved, developed and harnessed.

Specific Resources and their Management Prospects:

Land

Of the country's total 142 m ha cultivated land, 57 m ha, 40 per cent of the total, is irrigated and the remaining 85 m ha is rainfed. Of the total geographical area of 329 m ha, about 146 m ha is classified as degraded, although varying estimates have been provided by different agencies. As generally agreed, the resources have been degrading fast, costing 11 to 26 per cent of the GDP during the 1980s and 1990s. Land distribution is highly skewed, more than 80 per cent of the farmers are small, marginal

and sub-marginal and together own about 40 per cent of the total cultivated land, and increasing proportions of the holdings are becoming uneconomical. The soil health has been deteriorating, especially widespread micro-nutrient deficiencies (hidden hunger) and fast depleting carbon content, resulting in low and decelerated TFP growth rates.

Efforts of different Ministries/Departments/Organizations should be integrated to harmonize the delineation, codification and land capability classification. Detailed soil data (physical, biological, chemical and microbial) based on effective soil testing are prerequisites for all lands under both rainfed and irrigated agriculture to address the issues related to soil health *vis a vis* agriculture production. Such soil data will be vital for setting up Village Resource Centres for benefit of the farming community. Necessary financial and human resources should thus be assigned for the purpose.

Central and State Land Use Boards should be reorganized and empowered to lead this work. Further, we must implement the unimplemented agenda of land reform with particular reference to tenancy laws, land leasing, distribution of ceiling surplus land and wasteland, providing adequate access to common property and wasteland resources. Following the conferment of land rights to women under the Hindu Succession Amendment Act (2005), the provision of appropriate support services to women farmers has become urgent. Moreover, as far as possible, agricultural land should not be diverted to non-agricultural use.

Water

Water availability at the National level is reaching close to 1700 cubic meter (cu m) per capita – the threshold line, and if things do not improve, it will drop to water scarcity line by 2025. India annually receives about 350 million hectare meter (m h m) rain water, but almost half of it finds its way back to the sea, whereas the per capita water storage in India is only 210 cu m against 1110 cu m in China and 3145 cu m in Brazil.

With nearly 60 m ha of net irrigated area and irrigation using over 80 per cent of all fresh water, India ranks first in the world in irrigated acreage. There is huge gap of 14 m ha between irrigation potential created and utilized, and the irrigation intensity is only 135 per cent which should be raised to 175 per cent or more. Besides low water use efficiency, there is high inequity in water use and irrigation development, let alone the fast receding aquifers and blocks after blocks turning "dark" and "grey" in certain parts of the country.

The XI Plan aims to give thrust to irrigation expansion. Accounting for the 7 m ha through the trend scenario, the additional 10 m ha irrigated area under Bharat Nirman by the year 2009 and the stipulated additional 14 m ha to be brought under pressurized irrigation, by the end of the XI Plan, the country would have an additional 27 m ha under irrigation. The Planning Commission should urgently firm up these figures and, in consultation with the concerned Ministries, should delineate the areas to be brought under additional irrigation. Considering that 70 per cent of the groundwater in the East Zone is unexploited, and the region has high poverty intensity, larger allocations and technical support should be provided by the Centre to this zone for judiciously developing and utilizing water resources towards increased, sustained and inclusive agricultural growth.

The following water management strategies and actions are recommended:

- Undertake scientific and comprehensive assessment of water resources, monitor and evaluate water extraction, storage and use, and enhance income per unit of water consumed.
- Prevent/ discourage unsustainable use of groundwater resources in critical zones, develop the resources in unexploited zones, and increase awareness of farmers and other stakeholders about the value and scarcity of water and negative fallouts of improper use.

- Develop and adopt water use efficient cost-effective and eco-friendly crops, cropping patterns, farming systems and technologies.
- Integrate rain, surface and ground waters and promote conjunctive use of poor quality and polluted waters.
- Institutionalize participatory management of water (Water Users Associations, including proactive women's participation), rationalize water pricing and operational and maintenance charges and distribution of irrigation water and equitable access to water as a common resource.

Biodiversity and agricultural genetic resources

Rampant loss of biodiversity and agricultural genetic resources has greatly enhanced genetic vulnerability of our agricultural systems besides losing invaluable gene pools, such as Tharparker in Western Rajasthan. The two recent National initiatives in this field, namely, National Biodiversity Board and Plant Variety Protection and Farmer's Rights Authority are supposed to address this issue, but there is little coordination between the two. Participatory breeding, integrated germplasm and indigenous knowledge conservation and benefit sharing, particularly involving women and tribals, should be promoted through transparent modes of accessing the National Gene Fund and increasing gene and IPR literacy. Establishment of living heritage of livestock germplasm (mostly at State Farms), village gene banks, offshore quarantine centres for germplasm screening against serious diseases and pests and maintenance and trade of pedigreed animals and elite medicinal and aromatic plant landraces by farm science graduates should be strongly supported.

Forests

Forests, the green cover, are the natural resource infrastructure for agriculture/primary production and rural economic growth. India, harbouring 16 major forest types – tropical, temperate, alpine etc., is one of the 17 mega diversity centres

and two biodiversity hot spots of the world. Per capita forest area in the country (0.064 ha) is one-tenth of that of the world's average, and 41 per cent of the country's forest cover is degraded. Despite the high importance of forests as source of food, fuel, fodder and fibre, and of linking conservation with community based forestry, allocation to the forestry subsector has rather been meager, less than 1 per cent of the Plan size. Moreover, most of the budget has to come from the State Governments which seldom meet their commitments and the forests continue to suffer. The share of the Central Government should be increased to at least 50 per cent of the total requirement, and the Tribal Bill, 2005 should be fully implemented and linked with the NREGA.

Through the watershed system, the Joint Forest Management (JFM) should be changed to Community Forest Management (CFM) and the concerned Committees, in collaboration with Watershed Committees, should ensure maintenance of the forest profile through large scale tree plantations deploying the nearly 140 thousand frontline staff trained in natural resource management. State Forest Departments should serve as the Project Implementing Agencies and Village Panchayats should play the coordinating role. MoRD, MoEF and MoA should jointly invest in agroforestry and bio-energy and biomass plantations covering degraded forest lands, wastelands and common property resources, duly supported with producer-friendly regulations for harvesting, processing, and value addition, grazing and marketing.

Livestock

Livestock accounts for about 27 per cent of the Agricultural GDP and is positively egalitarian in its distribution and in ownership by women, and is a major pillar of income, food and employment security. Possessing the world's largest livestock population, India ranks first in milk production, fifth in egg production and seventh in meat production. Total livestock output has been growing at a much faster rate of 3.6 per cent per annum against only 1.1 per cent registered for the crops sub-sector during the past decade. The targeted overall agricultural annual growth rate of 4.1 per cent

during the XI Plan is stipulated to be achieved through a growth rate of about 8 per cent in the livestock subsector. In order to double the current growth rate to achieve the XI Plan target, constraints to increased livestock production and productivity (which is one-third of that of the world average) must be properly identified and addressed. Institutional supports and policy actions such as livestock insurance, market and price support, Livestock Feed and Fodder Corporation, Fodder Banks, Small Holder's Poultry Estates, etc. are needed towards achieving the rapid and inclusive growth.

Fisheries

Fisheries (53 per cent of the production from aquaculture) contribute significantly to food, nutrition, economic and employment securities, and fortunately are one of the fastest growing agricultural sub-sectors during the last three decades. Currently, fisheries contribute 4.6 per cent of the agricultural GDP, provide employment security to about 11 million people and annually earn foreign exchange worth Rs. 7,300 crore – about one-fifth of the value of the National agricultural export. The overall growth rate of fish production could be doubled to about 8 per cent towards achieving the overall agricultural growth rate of 4.1 per cent during the XI Plan. The following constraints should, however, be addressed to harness the potential: siltation and pollution of water bodies, poor management of production-processing-distribution chain, poor quality control of fish seed and feed, under-exploitation of available species such as cold water fishes like trout and Mahseer and air-breathing fishes like Mangur. Weak infrastructure for landing and marketing and inadequate access to water bodies/tanks, multi-user conflicts and inappropriate leasing policies are other important constraints. Suitable leasing policies, reduced duties on feed and lower power tariffs can help accelerate production of scampi (prawn) in inland saline waterlogged areas, brackish water areas and other aquaculture systems, thus greatly contributing to employment, income and food security.

The newly established National Fisheries Development Board, among other things, should strongly support Integrated Coastal Zone Management and Aquarian Reforms, as also suggested by NCF.

Major Strengths and Weaknesses of the Past NRM Programmes

During the last two decades, primarily through the watershed programmes, considerable emphasis has been placed on natural resources management. Up to the X Plan, nearly 51 m ha has been developed through integrated approach (i.e. simultaneous development of multiple natural resources on watershed basis) with an investment of Rs. 19,251 crore. Besides, 1.6 million ha has been developed through situation specific approach (i.e. development of one type of natural resource at one time) with an investment of Rs. 9,500 crore. The Ministry of Rural Development accounted for 63 per cent of the "treated" area spending nearly 50 per cent of the total funds and the Ministry of Agriculture "developed" the remaining 37 per cent of the area, but used slightly more than 50 per cent of the total funds. The Ministry of Forest and Environment and the National Planning Commission had only limited involvement.

Often, the treated areas have reverted back to the original status and the impact of the development on productivity, equity and sustainability is generally invisible at larger scales. This was ascribed primarily to the lack of focus on productivity enhancement and on livelihood component under the watershed programmes. Sustaining people and their interest in conserving the natural resources for their livelihood, and not merely in land and water conservation, is a necessary precondition for management of natural resources, particularly in rainfed areas.

Participatory approach has been promoted through JFM, PIM and PWM etc. for the last 10 to 15 years, but more than 30 per cent of NRM programmes continue to be under top-down approach even at this stage. Institutionalization of participatory approach has thus not yet taken place on large scale even in programmes where

participatory guidelines are used. This has resulted not only in continued over exploitation of the natural resources due to low emphasis on proper management of the resources, but also in non-inclusive growth and greater inequity.

Post project sustainability continues to be a challenge. This appears to be mainly due to: (i) inadequate delivery mechanism at National, State and District levels, (ii) low capacity building at Community level, (iii) lack of sustainability of CBOs, (iv) low attention towards allocation of users' right over CPR, (v) lack of payment of genuine contribution by actual users, (vi) delay in fund flow particularly under those programmes which are funded by MoA and (vii) lack of proper modality for carrying out repair and maintenance of CPR, etc.

Development of farm production systems as well as off-farm livelihoods continue to receive low attention under natural resource development programmes. Likewise, convergence between inter-related schemes of different development departments could not take place due to various reasons. Poor implementation of the watershed programme at field level may partly be ascribed to the differences in guidelines of different Ministries/ Departments.

The scientific concept of watershed based development could not be properly adopted in majority of cases due to scattering of 500 ha micro-watershed units over the entire block / district. It is now being recognized that though a unit of 500 ha may be adequate for development of land resources, it is quite inadequate for development of water resources as well as management of common lands / forest department lands.

The space for NGOs has been gradually reducing (particularly in govt. funded watershed programmes) inspite of the fact that good results have been obtained by several of them. Likewise many of the innovative experiences generated under the externally funded projects could not be up-scaled even in the concerned States. These maladies must be remedied towards sustained and humanistic development of natural resources.

5. CHALLENGES OF ADOPTION AND ADAPTATION OF LAND AND WATER MANAGEMENT OPTIONS IN SMALLHOLDER AGRICULTURE: SYNTHESIS OF LESSONS AND EXPERIENCES

Introduction

Conservation and management of land and water resources for sustainable intensification of agriculture and poverty reduction in many developing regions has remained one of the most challenging policy issues for a long time. The increasing degradation of agroecosystems gradually deprives the poor of key productive resources and affects communities whose livelihoods heavily rely on utilization of these resources. Degradation of land and water resources gradually diminishes the capacity of individual farmers and communities to undertake critical investments needed to reverse the situation. This in turn reduces opportunities for addressing nutritional and other necessities and depletes the ability to buffer shocks, thereby increasing vulnerability of livelihoods.

The potential nexus between worsening poverty and degradation of natural resources also raises fundamental questions on strategies for poverty reduction, equitable distribution of income and intergenerational equity. These challenges are highest in many developing regions representing the intersection of hotspots of widespread poverty and fragile ecosystems (e.g. arid and semi-arid areas, highland regions) (Pender and Hazell, 2000; IFAD, 2001; Shiferaw and Bantilan, 2004).

In recognition of these challenges, governments, donors and development partners in many developing countries have devoted substantial resources to develop and promote soil and water conservation practices and technologies for sustainable intensification of agriculture. These technologies are generally very diverse and vary from one region to another but include a mix of indigenous and introduced structural (or mechanical) and agronomic practices for combating soil erosion and nutrient depletion, improving water conservation, and enhancing soil and water productivity. Some examples include structural methods for soil conservation such as soil and stone bunding and terracing; agronomic practices for soil and water conservation and management such as minimum tillage, organic and inorganic fertilizers, grass strips

and agroforestry techniques; and water-harvesting options such as tied-ridges, planting basins, check-dams, ponds, tanks and wells used in many rainfed systems (Wani et al., 2006; Chapters 1 and 9, this volume). The structural methods have been promoted through donor funded projects (e.g. food for work programmes) in many parts of Africa and Asia, primarily for arresting soil erosion and productivity decline. Agronomic methods and agroforestry technologies, in particular alley cropping, aim to reduce soil erosion while also enhancing soil organic matter and have been shown to replenish soil nitrogen through nitrogen inputs. Water harvesting technologies provide farmers with the opportunity to plant early and help reduce reliance on unpredictable rains (Baidu-Forson, 1999).

Despite the increasing efforts made and the growing policy interest, spontaneous and widespread adoption and adaptation of technologies and innovations for sustainable management of land and water resources by smallholder farmers outside of intensively supported project locations has generally been limited (Fujisaka 1994; Pender and Kerr, 1998; Barrett et al., 2002). Smallholder farmers and resource users continue to face difficulties in adoption and adaptation of soil and water conservation technologies. The diagnosis of these changes and lessons from different examples show that several factors have indeed contributed to the continuing challenges facing smallholder farmers in adoption and adaptation of sustainable land and water management interventions – ranging from the poor performance of the technologies themselves to policy and institutional deficiencies at different levels (Joshietal., 2005).

In an effort to address these problems, the basic paradigm and approach to soil and water conservation has itself evolved over time. In recent years more holistic and landscape-wide approaches that go beyond resource conservation towards improved land husbandry and water management for beneficial conservation have been promoted (Wani et al., 2006). Taking a broader view, this chapter reviews African and Asian experiences in promoting soil and water conservation and sustainable land management technologies. It synthesizes lessons from various case studies and offers new insights on approaches and strategies that accelerate widespread adoption and adaptation of such interventions.

The chapter is organized as follows. The next section provides a brief description of the evolution of approaches to soil and water conservation in agriculture. The third section provides a broad conceptual framework for analyses of investment opportunities and challenges to smallholder farmers in adoption and adaptation of natural resource management (NRM) interventions. The fourth section builds on the conceptual framework and presents a review of factors that condition the adoption and adaptation of sustainable land and water management interventions. The fifth section presents the conclusions and implications for policy and future research.

Evolution of Approaches for Sustainable Land and Water Management

Concern with land and water degradation in smallholder agriculture is not a new issue. It has been around for a long time and farmers are involved in a constant struggle to adopt and adapt mitigation and conservation strategies under changing climatic and socio-economic conditions. Many countries have also tried to complement farmers' efforts by developing and promoting strategies that reduce the problem of soil erosion (and nutrient depletion) and that counter on-site productivity decline associated with degradation of agricultural land. In some cases, soil erosion and deforestation of hilly slopes also imposed significant off-site effects (e.g. siltation of dams and waterways), thereby adding another justification for government intervention. But the strategies adopted and technological solutions to the problem of land degradation varied over time and space. In many sloping areas with undulating topographies, the traditional emphasis has been on arresting soil erosion and reducing run-off. In semi-arid regions where rainfall is either unreliable or insufficient, the focus has been on technological solutions for capturing and utilizing surface and groundwater.

As indicated above, stimulating widespread adoption and adaptation of land and water management innovations has seen limited success, especially in marginal and vulnerable environments with limited socio-economic infrastructure. In an effort to redress the problem and improve actual livelihood and environmental outcomes, the approach to soil and water conservation has evolved through several phases. These different approaches may be grouped into three major types: top-down interventions, populist or farmer-first, and neoliberal approaches. Most of the early soil and water

conservation approaches focused on top down interventions, mainly using structural methods for arresting the physical process of soil erosion (Wani et al., 2006). This approach is also characterized by lack of farmer participation in technology design and use of command-and-control type policies for implementation of externally developed structural measures. In the pre-independence era, colonial governments, following concerns with the rapid rate of land degradation in marginal areas (i.e. the reserves), instituted policies that aimed at checking the rate of soil and water degradation. These policies included forced adoption of soil erosion control, planting of trees on hillsides, and protection of water/river catchments. However, the policies were largely driven by fear of future consequences of inaction. Similar top-down approaches also continued in several countries (especially in Africa) until the mid1980s (e.g. see Shiferaw and Holden, 1998; Pandey, 2001). As we show later, the command-and-control approach has imposed its own challenges on the farmers' ability to innovate and adopt and adapt improved land and water management practices.

Based on the experiences gained from the failed command-and-control policies, a new paradigm – referred to as 'populist' – that upturned the process and made the farmer central to program design and implementation of soil and water conservation activities has emerged. This view appeared in the late 1980s and was marked by the publication of Farmer First – a book that embodies many of the ideas behind the 'populist' approach (Chambers et al., 1989). This approach stressed small-scale and bottom-up participatory interventions, often using indigenous technologies (Reij, 1991) and largely rejected the traditional transfer of technology model in the process of technology development and extension. The difficulties of implementing such farmer-led participatory approaches has prompted some researchers to reject this model in favour of a broader approach, in which farmer innovation is driven by the economic, institutional and policy environment. The neo-liberal approach advocates the need to understand the present structure of incentives that prevents resource users from adopting and adapting existing land and water management technologies. This approach recognizes the appropriate roles for farmer innovation but brings to the centre stage the critical role of markets, policies and institutions to stimulate and induce farmer innovation, adoption and adaptation of suitable options.

The critical importance of making conservation attractive and economically rewarding to farmers through productive technologies and improved access to markets

is regarded as the driving force for igniting farmer investments in sustainable land and water management options.

The growing understanding and recognition of the public goods characteristics of soil and water conservation and the non-technical factors that condition individual technology choice and adaptation has also prompted strategies that address institutional and organizational constraints and internalize local externalities to induce proper action at the community and landscape level (Shiferaw et al., 2006). An example of this is the integrated watershed management (IWM) approach, which aims to improve both private and communal livelihood benefits from wide-ranging technological and institutional interventions. The concept of IWM goes beyond traditional integrated technical interventions for soil and water conservation to include proper institutional arrangements for collective action and market-related innovations that support and diversify livelihoods. This concept ties together the biophysical notion of a watershed as a hydrological landscape unit with that of community and institutional factors that regulate local demand and determine the viability and sustainability of such interventions. Integration of the biophysical concept of a watershed and the social concept of a community helps to design appropriate technical interventions while also strengthening local institutions for collective action to internalize undesirable externalities and stimulate joint investments to address community-wide resource management problems (Wani et al., 2003,
2006; Shiferaw et al., 2006).

In the last few years, the approach for soil and water conservation in agriculture has also slowly moved towards the concept of sustainable land (and water) management, at both farm and landscape level. There is no single definition for sustainable land (and water) management but Hurni (2000) suggests that it implies 'a system of technologies and/or planning that aims to integrate ecological and socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and inter-generational equity'. The broadening of the concept shows the complexity of the challenges and the need for broadening of desired partnerships and the disciplinary analyses required for stimulating and promoting options for sustainable land and water management. The following section builds on this broader concept of sustainable land (and water) management and develops an

integral conceptual framework for analyses of challenges for adoption and adaptation of beneficial conservation methods and practices.

Conceptual Framework

Smallholder farmers in many developing regions are dual economic agents engaging simultaneously in the production and consumption of the same commodities and investments in improving productivity and sustainability of natural resources. Hence, smallholder farmers are often referred to as farm-households. This means that smallholder decisions for land and water management in agriculture are likely to be influenced by several interrelated factors on both the production and consumption side. This is especially the case when smallholder farmers operate under imperfect information and market conditions that prevent them from pursuing a purely profit-maximizing principle in their production and investment decisions. Based on the prevailing approaches discussed above, in this section a broader conceptual framework for analyses of factors that condition farm-household decisions for adoption and adaptation of NRM interventions is presented.

The farm-household, pursuing certain feasible livelihood strategies, is the ultimate decision maker on how and when to utilize natural resources in agricultural production or to undertake certain productivity-enhancing investments to attain preferred objectives. Understanding the investment decisions of the resource users and the most important factors that drive such decisions will allow designing effective strategies for upscaling promising options for sustainable land and water management. In the context of multiple outcomes and pathways that are possible, this would also provide insights on how policy makers, analysts and development practitioners motivate and tailor farmer resource use, production and investment strategies towards win–win pathways that reduce poverty and enhance future production possibilities. This requires a more holistic conceptual framework (as depicted in Fig. 13.1) that captures the intertemporal investment decision problems across alternative livelihood options (crops, livestock and nonfarm diversification) and on-farm natural resource investment possibilities that resource users face at each period and the consequences of these livelihood strategies on the quality of the resource base. The pattern of change in the quality of the natural resource base, household assets and livelihoods would then determine the evolution of the 'development pathway' and incentives for

future natural resource investments in subsequent periods (Shiferaw and Bantilan, 2004).

This conceptual framework builds upon the farmer-first and sustainable livelihoods principle (Chambers, 1987) by incorporating important elements from the theory of farm-household behaviour under market imperfections (de Janvry et al., 1991), the economics of rural organization (Hoff et al., 1993) and the role of economic policies (Heath and Binswanger, 1996), and institutions and institutional change (North, 1990). The conceptual framework clearly recognizes and places household investment decisions in the context of the evolving global, national and local policies and institutional changes that shape production and investment opportunities available to smallholder farmers. This is consistent with the broader evolving interdisciplinary and dynamic perspective required for technology design and development efforts targeting poverty reduction and sustainable NRM in agriculture.

In making their production and investment decisions in each period, smallholder farmers attempt to maximize their livelihood benefits over a period of time based on existing resource assets and expected shocks that jointly determine the vulnerability context. These decisions are also conditioned and mediated by the prevailing socio-economic and policy environment, including subnational and sub sectoral policy changes and responses to shifts in global and macro policies, transmitted to the local level through policy reforms, institutional changes and infrastructural investments, which in turn determine relative input–output prices and access to new technologies and markets at the local level (Shiferaw and Bantilan, 2004). The extent to which global and national policies are transmitted to the local level depends on trade policies and the extent to which input and output markets are integrated. In some situations (e.g. watershed management), collective action by the community may further enhance and supplement individual production and investment possibilities (Sreedevi et al., 2006; Wani et al., 2006).

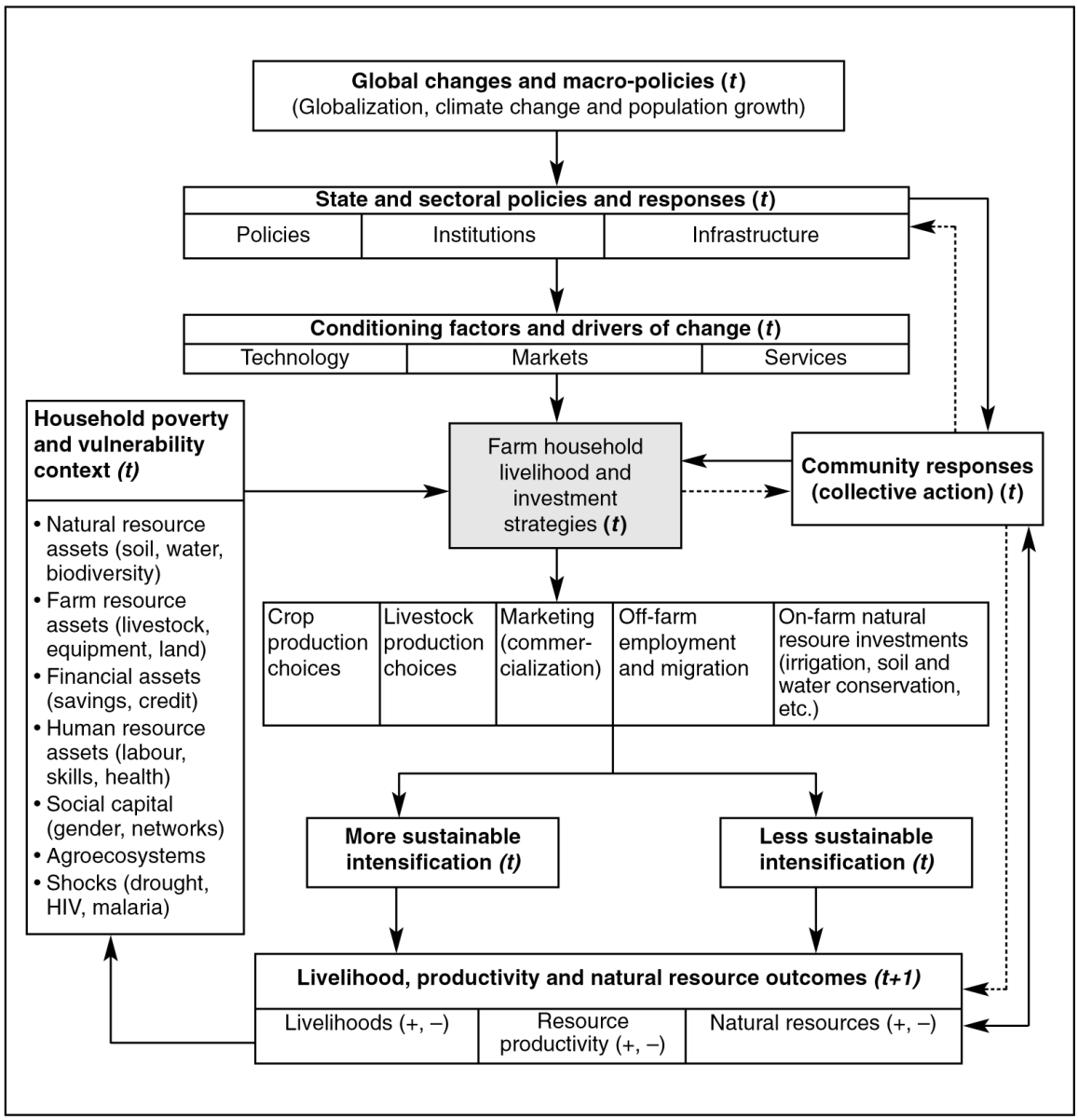

Fig. 13.1. Factors conditioning smallholder natural resource investments and development pathways.

The diversity of household assets and the prevailing biophysical and socio-economic environment therefore jointly determine the livelihood options and investment strategies available to farmers. Access to markets (including output, credit, input markets), appropriate technologies, and the input and output prices define the production feasibility set and determine the livelihood and investment strategies. While the endowment of family resources and assets determines the initial production and investment capabilities, the socio-economic and policy environment shapes the resource use patterns and the ability to relax initial constraints through trade and market participation (Fig. 13.1).

The framework shows that when more profitable resource-conserving or -improving technologies are available, and capital and institutional constraints are not limiting, farm-households may undertake productivity-enhancing resource investments. Enabling policies (e.g. secure rights to land and water), access to markets and institutional arrangements (e.g. credit services and extension systems) create incentives to invest in options that expand future production and consumption possibilities. Such resource-improving and productivity-enhancing investments provide opportunities for intensification of agriculture and diversification of livelihood strategies that will help combat resource degradation. This will in turn determine the livelihood and natural resource outcomes in the next period (t+1). In a dynamic sense, improved level of well-being and natural resource conditions will in turn enhance the stock of livelihood assets available for production, consumption and investment decisions in the subsequent periods. This shows how the interplay of good technology and conducive socio-economic conditions enable some households to pursue a more sustainable intensification strategy that will also help them escape poverty.

Nevertheless, these conditions are often lacking for many smallholder farmers in less favourable regions with poor market access and suffering from high levels of resource degradation. In the absence of enabling policy and institutional environments that encourage technological innovation, smallholder farmers lack the economic rationale to adopt and adapt interventions for sustainable land and water management. In such situations, increasing subsistence demand and land degradation further undermine the ability to manage the resource base. The interface of lack of viable technological options and adverse biophysical, policy and institutional environments may force smallholder farmers in marginal areas to practice more exploitative and unsustainable livelihood strategies. There may also be several such trajectories leading to less sustainable intensification pathways, indicating extractive resource use patterns (Shiferaw and Bantilan, 2004). In this case, the synergistic effects of poverty and resource degradation lead to worsening conditions of the poor, potentially leading to a downward spiral (Scherr, 2000). Breaking this spiral is a complex challenge requiring innovative strategies that stimulate technical innovation and enabling policy and institutional arrangements, including targeted subsidies for investments that generate positive public benefits (e.g. poverty reduction and sustainability). Based on a review of

examples from Africa and Asia, these specific factors are discussed in the following section.

Determinants of Farmer Conservation Investments

Farmers adopt and adapt new practices and technologies only when the switch from the old to new methods offers additional gains in terms of either higher net returns or lower risks, or both. This means that smallholder farmers are likely to adopt NRM interventions only when the additional benefits from such investments outweigh the added costs (Lee, 2005). Investment in soil and water conservation is often just one of the many investment options available to farmers. Farmers can therefore defer undertaking such conservation investments until the gains from such investments are perceived to be at least equal to the next best investment opportunities available to them (Kerr and Sanghi, 1993). In other words, farmers in developing regions implicitly compare the expected costs and benefits and then invest in options that offer highest net returns (in terms of either income or reduced risk). In some cases, the highest (but short-term) net returns might be realized from foregoing soil and water conservation. Where private costs of adopting and adapting conservation interventions outweigh the benefits, voluntary adoption will be greatly hampered unless society is willing to internalize some of the costs and offer subsidies to farmers.

The literature identifies a number of factors that condition the adoption and adaptation of soil and water management intervention in smallholder agriculture across Asia and Africa. In many cases, farmers reject some interventions for lack of additional benefits (incentive problem). In other cases, farmers also find themselves highly constrained to adopt and adapt otherwise profitable (or economically attractive) interventions due to poverty, imperfect information, market, policy, institutional and other limiting factors. These constraints further limit the economic gains from investments in some NRM interventions and make it unattractive for farmers to adopt and adapt them on their farms. These factors can be broadly categorized into incentive and market factors, poverty and capacity factors, policy and institutional factors, participation and information factors, and environmental factors. These are discussed in turn below.

Markets and incentives

The fundamental economic incentives (related to relative profitability and risk reduction gains) for farmers to adopt NRM interventions are often affected by prevailing relative input and output prices, interest rate, and access to labour and output markets.

Relative output and input prices

Studies that examine the effect of commodity prices on land and water management find mixed effects of price changes on conservation investments. An increase in the price of agricultural commodities may often mask the effect of land degradation and make agricultural production using erosive practices attractive to farmers. In other cases, an increase in commodity prices may make certain NRM interventions profitable or attractive to farmers. Accordingly, some studies find a positive relation between increase in commodity price and adoption of conservation technologies (e.g. Shiferaw and Holden, 2000; Lee, 2005). Shiferaw and Holden (2000) showed that when conservation offers short-term productivity gains, an increase in commodity prices enhances the adoption of soil and water conservation technologies among highland smallholder farmers in Ethiopia. They also found that when conservation does not provide such complementary economic benefits, an increase in the price of an erosive crop would encourage smallholders to expand or intensify the production of such crops without investment in conservation. The same effects can be observed when governments provide price support and other subsidies for certain crops that would distort the incentives faced by resource users. The case in point is the commodity price support to irrigated crops, e.g. rice (Oryza sativa) and wheat (Triticum aestivum), that discourages farmers in semi-arid areas to cultivate sorghum (Sorghum bicolor) and other water-efficient dryland crops. This indicates that policies introduced with good intentions for attaining food security could lead to extensive land degradation and depletion of groundwater resources by encouraging dryland farmers to abandon traditional crops in favour of more erosive or water-intensive irrigated crops (Shiferaw et al., 2003). The overall effect of commodity price changes therefore depends on the likely impact of the associated agricultural practice for the particular

product and how this affects the relative prices and profitability of conservation investments.

Looking at the input prices, a major determinant of adoption of conservation practices is the price that farmers have to pay to have the technology in place, i.e. the cost of adopting a conservation technology. These costs often raise the cost of production and reduce the profitability of the technology or even make it unaffordable to farmers to invest in such interventions. One obvious example is how an increase in the price of fertilizer may reduce the profitability of its use while also making the input increasingly unaffordable to small producers. This is particularly the case in Africa where countries have removed fertilizer subsidies and poor infrastructure often raises the price of imported fertilizers. As expected, studies that investigate this question find an inverse relationship (Pattanayak and Mercer, 1997). That is, the higher the price of inputs that constitute the conservation practices, the higher the costs and the lower the profitability of the technologies. The majority of these studies investigate how the cost of land and water management interventions (e.g. hedgerow cropping, terracing, minimum tillage, no tillage, etc.) and agricultural water-harvesting techniques affect adoption of such technologies (Pattanayak and Mercer, 1997; Baidu-Forson, 1999). In some cases the cost of conservation may not show directly in terms of actual cash outlays but in terms of indirect short-term effects on production or risk management. But if farmers are able to recognize such indirect costs, they will be factored into their consideration of investment strategies.

Market access and off-farm employment opportunities

Market access for agricultural products often facilitates commercialization of production and adoption of commercial inputs like fertilizer, pesticides and the like. When farmers clearly perceive the future costs of current land degradation and when policy and institutional mechanisms support changes in behaviour, improved market access can be the driving force for sustainable intensification of agriculture. But this is not always the case there are situations where market access for certain products may end up encouraging less sustainable practices. Hence, the overall effect of improved market access on investments in land and water management is not always positive. The positive role of market access in promoting land and water conservation is best demonstrated by the often-cited example of Machakos district in Kenya (Tiffen et al., 1994; Barbier, 2000). The district suffered serious soil erosion problems in the 1930s due to failed colonial government soil conservation policies. By the mid-1980s, the

district had not only brought soil erosion largely under control but also realized increased per capita income, even after a six fold population growth during the period. This tremendous success has been in part attributed to good access to markets for local produce, which was facilitated by proximity to Nairobi. This has accelerated commercialization of agriculture, which raised the profitability of farmer investments, raised incomes and facilitated adoption and maintenance of conservation practices in this largely semi-arid area.

Using large-scale survey data from Uganda, Pender et al. (2004) used alternative indicators (physical distance to all-weather road, distance to nearest market, etc.) of market access to examine how these affect crop production and soil erosion. They found that physical distance to the nearest market was not significantly correlated with production or erosion levels, but distance to nearest all-weather road had a negative effect on production and soil erosion.

However, market access is constrained in many rural areas by the poor transport and communication infrastructure, leading to high transaction costs in accessing markets. The associated high transaction costs and limited market opportunities in turn affect adoption of sustainable land and water management options (Pender and Kerr, 1998). Such market failure caused by high transaction costs is especially endemic in marginal areas where basic market infrastructure and supporting institutions are lacking or underdeveloped (Poulton et al., 2006). Pender and Kerr (1998), for example, examined the role of output market failure on adoption of soil and water conservation in the semi-arid areas of India. Their findings suggest that market failure in both input and output markets affects the profitability of investments in such technologies and hence constrains adoption. Since market failure often affects households differently depending on their resource endowments, this study explained why technology choice and conservation investments may actually vary from farmer to farmer.

The effect of market access or performance on farmer conservation choice and investments may also vary depending on the dimensions of the affected market. When labour markets are missing or imperfect, the empirical evidence shows that households endowed with more family labour will have an advantage to adopt labour-intensive methods. When credit markets are imperfect, wealthier households with higher liquidity will have an advantage to invest in practices that require cash outlays upfront (Pender and Kerr, 1998).

An interesting relationship is the effect of off farm and non-farm employment on adoption and adaptation of sustainable land and water management interventions. The empirical findings are mixed (Reardon et al., 1994; Pender and Kerr, 1998; Holden et al., 2004). In the case of parts of the Ethiopian highlands where on-farm returns to family labour are low, Holden et al. (2004) showed that increased availability of opportunities for off-farm employment will have a positive effect on household welfare but a negative tradeoff with reduced soil and water conservation investments. Kerr and Sanghi (1993) found reduced soil and water conservation investments around large Indian cities with active off-farm labour markets compared with more remote areas. Reardon and Vosti (1997) found similar results in their study of adoption of sustainable soil management technologies in Rwanda, Burundi and Burkina Faso. Two reasons are offered in the literature for the negative outcomes. First, under some situations, household workers face higher opportunity costs and prefer to allocate family labour into off-farm activities, where it fetches higher returns than on-farm soil and water conservation. Second, off-farm employment often directly overlaps with slack-season conservation activities and reduces the labour available for adoption and maintenance of conservation practices.

Therefore, opportunities for off-farm employment, when they exist, not only affect the decision to adopt conservation technologies but also the degree of adoption as well as the maintenance of conservation structures once they are in place (Shiferaw and Holden, 2000; Pender et al., 2004). Shiferaw and Holden (2000) found a negative relationship between off-farm income and maintenance of implemented conservation structures. They found that, given the higher returns to off-farm labour, households with unconstrained access to nonfarm employment are likely to conserve less land than their counterparts.

Other authors, however, argue that there exists a positive relationship between off-farm employment and adoption of conservation technologies (Tiffen et al., 1994; Scherr, 2000). These studies review empirical examples across subSaharan Africa that show how income from off farm employment under certain enabling conditions can be used to fund essential soil and water conservation investments and contribute to reducing the problem of land degradation. Off farm employment and migration opportunities may also ease the pressure on land and reduce the intensity of resource use in densely populated areas.

The emerging picture from the above discussion is that market access, especially off farm employment, should not necessarily be bad for land and water conservation. It would seem that the direction of the effect will depend on the opportunity cost of labour, the policy and institutional environment, and how important agricultural income is for people's livelihoods. Where returns to family labour in agriculture are high due to better market opportunities and supportive policies that encourage farmer conservation, market access is likely to induce adoption of strategies for sustainable intensification.

Poverty, asset endowments and scarcity

There has been a growing concern about the potential linkages between poverty and land degradation, some positing a nexus that locks poor people under a low-level equilibrium that perpetuates poverty and environmental degradation (Reardon and Vosti, 1995; Holden et al., 1998; Scherr, 2000). Several studies across the developing world have shown that under conditions of imperfect credit and insurance markets, asset endowments and wealth will have a significant influence on the ability of smallholder farmers to adopt and adapt certain conservation practices. This section reviews the empirical regularities and relations between poverty and sustainability investments.

Farmer capacity to invest in conservation

As discussed earlier, credit, insurance and labour markets in rural areas of many developing countries tend to be either missing or highly imperfect. This means that households who lack in cash capital, labour, essential skills or in their ability to manage risks will face constraints, especially when these resources are needed for adoption and adaptation of sustainability investments. This indicates that the smallholder farmer better endowed with such family resources will have greater capacity to undertake certain conservation investments that require more of these resources. For example, education and human capital endowments affect adoption and adaptation of such practices through several directions. First, it enhances the likelihood of farmers perceiving land degradation as a problem. Second, it increases the likelihood of farmers to receive and process information about a technology that can solve the

problem by increasing their managerial ability. On the other hand, higher levels of education under certain conditions may raise the opportunity cost of family labour in agriculture and direct its allocation into other activities that offer higher returns (e.g. migration and non-agricultural wage employment).

Another important factor for farmer investment is operating capital or access to credit. This is particularly important for certain capital-intensive investments that require heavy investments upfront (e.g. irrigation, terracing, tree planting and fertilizer use). While credit is generally found to have a significant effect in stimulating farmer investments for land and water management, it may at times conflict with the adoption of indigenous soil and water conservation practices. Holden and Shiferaw (2004) tested the effect of access to input credit (seed and fertilizer inputs) on adoption of sustainable soil and water management strategies in Ethiopia. They observed that increased access to input credit for fertilizer may reduce farmer conservation investments in terms of traditional soil and water conservation works on farmers' fields. This can, however, be tackled through cross-compliance policies that require farmers using subsidized inputs that may cause such tradeoffs to comply with certain minimal on-farm conservation requirements.

Land and water scarcity

The effect of population pressure on incentives for sustainable resource management has been contested for a long time. Diverging theories exist on how population growth and the relative scarcity of agricultural land may affect incentives for land and water management (Boserup, 1965; Cleaver and Schreiber, 1994). These theories will not be reviewed here but empirical evidence provides support to both Malthusian and Boserupian type responses. However, the empirical regularities seem to suggest that, other things being equal, scarcity of land and water would stimulate farmer innovation and investment patterns in conservation practices or methods that augment and enhance the productivity of these resources (Templeton and Scherr, 1999; Scherr, 2000; Mazzucato et al., 2001; Shiferaw and Bantilan, 2004). Lack of proper policy and institutional arrangements and informational asymmetries may, however, prevent farmers from pursuing strategies that save or conserve scarce resources, as is often observed in overexploitation and depletion of common pool resources (groundwater, grazing lands, lake fish, etc.). Similarly, poverty and lack of

credit arrangements also prevent farmers from adopting fertilizer and improved seeds, the necessary land-augmenting investments needed as farm size and/or soil fertility decline due to population growth and land degradation.

Risk

Another important factor conditioning adoption and adaptation of conservation technologies is risk. Smallholder farmers are generally risk averse and face constant difficulties in buffering various risks triggered by health, climatic and socio-economic shocks. Hence, land and water management technologies that increase variability or uncertainty of the income stream tend to be shunned by farmers. Such risks can arise from greater odds of crop failure or could be caused by insecure property rights. Whereas soil and water conservation generally tends to reduce production risks, there may be circumstances in which some proposed interventions may actually increase risks (Shiferaw and Holden, 1998; Mazzucato et al., 2001). For example, some water-harvesting technologies can exacerbate flooding problems and cause loss of crop income. A study in Ethiopia found that soil and stone bunds caused pest infestation (or even flooding) that reduced crop yields for farmers (Shiferaw and Holden, 1998), or such technologies may not necessarily increase returns to land and labour in the short term (Shiferaw and Holden, 2001).

In addition to the above risks associated with conservation itself, exogenous risks can also dampen farmers' motivation to adopt conservation technologies. Unless conservation counteracts the problem, the increased risks of crop failure due to weather variability and pest and disease outbreaks can also discourage farmer investments. But substantial empirical evidence shows that when farmers perceive the risk-reducing benefits of conservation investments, they will be willing to increase expenditure as part of their strategy to cope with and adapt to drought and climatic shocks (e.g. water harvesting and irrigation in many semi-arid areas of India and Africa). This shows the need for farmers to recognize the risk-reducing benefits of land and water management interventions, which could serve as an additional incentive to stimulate greater adoption of such practices.

Time preferences

Most resource management investments require heavy initial investments (either in cash or in kind) but deliver benefits many years in the future. At the same time, land and watershed degradation often impose long-term economic and environmental effects. For example, the short on-site productivity effects of soil erosion are often small but impose greater long-term consequences unless action is taken immediately. However, most resource-poor farmers have short planning horizons and face difficulties in adopting a long view (Holden et al., 1998). This is particularly the case when the cost of borrowing is high (e.g. high rates of interest) and capital markets in rural areas are largely imperfect. This raises the subjective rate of discount for poor farmers contemplating certain investments and discourages adoption of technologies that may not offer immediate benefits but improve livelihoods only in the long haul. This is demonstrated in Fig. 13.2.

Let us assume alternative income streams from adoption of different resource management investments (e.g. corresponding to Options 1 to 4 in Fig. 13.2). For simplicity, the current resource-degrading practice is shown under the status quo (Option 1), whereby incomes constantly fall over time. Under the next best available conservation option (Option 2), incomes also decline but more slowly than the current farmer practice. As is typical for many conservation investments, the net income in the first few years to period t is lower than the status quo but higher thereafter. The question is whether poor farmers afford to internalize these initial losses in order to gain higher incomes in the future. Evidence shows that if the farmer is just faced with these two alternatives, the resource conserving available technology (Option 2) is unlikely to be adopted (Holden et al., 1998). The main reason is that poor farmers will find it difficult to sustain initial income losses even when adoption may improve future income to compensate initial losses. Unless subsidized, farmers with a positive discount rate may not be interested in such options.

Alternatively, if the farmers have access to technological options depicted under Options 3 and 4, there will not be such tradeoffs between current and future income. If farmers are not constrained by other factors, one would expect widespread adoption and adaptation of such technologies. One major challenge is that many of the currently available land and water management technologies often cause temporal income tradeoffs and may not be similar to those depicted under Options 3 and 4.

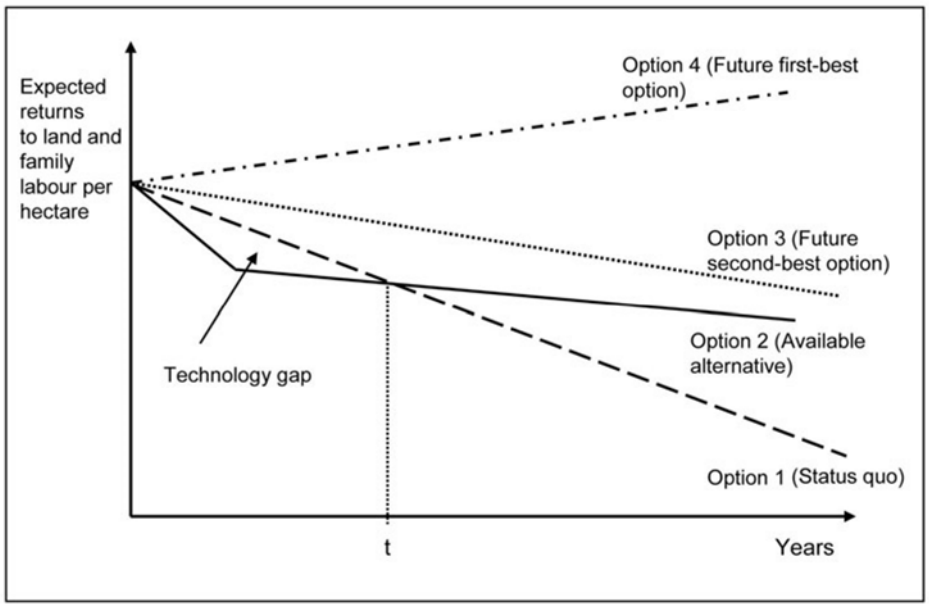

Fig. 13.2. Challenges in the design and development of pro-poor natural resource management technologies.

Policy and institutional factors

There has been an increasing recognition of the role that policy and institutions play in sustainable management of natural resources and the environment (Heath and Binswanger, 1996; Barbier, 2000; Pandey, 2001; Reddy, 2005; Shiferaw et al., 2006). The effect of markets and prices on adoption of land and water management interventions has been discussed above. In this section, the effects of other agricultural and sector policies and institutions on adoption and adaptation of sustainability investments are examined.

Agricultural policies

One of the important policy issues is the interest of some governments to provide certain agricultural input and investment subsidies to improve productivity and reduce reliance on rainfed agriculture. Unlike some Asian countries (such as India), many African countries have done away with such subsidies, but there is an ongoing debate to reintroduce some targeted subsidies (e.g. for fertilizer, seeds and irrigation). The effect of agricultural policies on conservation investments can best be examined by looking at public support for irrigation water and infrastructure. In India, as in many Asian countries, water for smallholder irrigation is free while the electricity used for pumping groundwater is highly subsidized (Shiferaw et al., 2003; Reddy, 2005). These

subsidies provide distorted signals to farmers and landholders and displace efforts to invest in soil erosion control and conservation of available water (Shiferaw and Bantilan, 2004; Reddy, 2005). In addition, irrigation subsidies cause farmers to shift cropping patterns to water-intensive crops, which should not be promoted in semi-arid areas. Subsidies can also temporarily raise the returns to conservation practices and create an impression that farmers are investing in the new management practices only for them to resort to old practices once the subsidies are withdrawn. The upshot is that while subsidies could be justified under some conditions where market or institutional failures prevent socially desirable conservation, there is a need for careful appraisal of the equity and sustainability implications of policies that affect smallholder resource use and management decisions.

Institutions for collective action and property rights

The institutional factors conditioning the adoption of conservation technologies mainly relate to the prevailing system of property rights, i.e. the right of access and security of rights to land, water and other natural resources. Understandably, farmers lack economic incentives to invest their time or money if they cannot capture the full benefits of their investments. This condition may prevail when farmers have insecure rights to land (e.g. non-transferable usufruct rights) or when the natural resource is governed by an open access property regime. In addition, farmers are not likely to invest in sustainable resource management of rented private property if the length-of use right does not allow them to recoup their investments (Ahuja, 1998; Barrett et al., 2002; Shiferaw and Bantilan, 2004).

Incomplete property rights and the associated public goods externalities (high costs of exclusion and non-rivalry) can also discourage private conservation investments. This is typical in investments characterized by externalities such as flood control in community watersheds. In some cases the externality may flow in both directions (reciprocal externality) or in one direction. In such cases, the interdependence of resource users and resources (as in watershed programmes) will require collective action and cooperation to achieve socially desirable levels of conservation investments. Promotion of certain interventions that affect several users

within a given landscape and provide public goods benefits may therefore require new kinds of policies and institutional arrangements to induce and sustain collective action.

Evidence also shows that collective action (which embodies social capital) can play a significant role in the adoption and adaptation of technologies for conservation and management of contested resources (Wani et al., 2006). Ahuja (1998), Gebremedhin et al. (2003) and Pender et al. (2004) have examined the effects of collective action (especially membership of a farmer group/association) on adoption of conservation technologies in Côte d'Ivoire, northern Ethiopia and Uganda, respectively. Their results show that collective action can enhance adoption of conservation practices by helping farmers address market failures and information constraints.

The impact of collective action on adoption of land and water management practices is greater when a larger proportion of the community has a shared vision and common interest in maintaining and improving the existing natural resources. Such interests may be similar irrespective of the asset ownership (e.g. landholding) but tend to occur when asset productivities are linked with resource conditions and are influenced by socio-economic and cultural backgrounds of the communities. For instance, evidence from India indicates that the degree of homogeneity in socio-economic and cultural conditions of the community determines the success of community-based liftirrigation schemes (Deshpande and Reddy, 1990). Other studies have also shown that equity in economic and social structure of the community facilitates collective action (e.g. see Tang, 1992; Bardhan, 1995) because they reduce the transaction costs of mobilizing and organizing the community to undertake joint investments.

Collective action and property rights are also interlinked, although causality is difficult to establish. Property rights can induce and stimulate collective action, especially when property rights guarantee equity in distribution of costs and benefits. In the absence of equitable benefit and cost sharing, strategies that rely on collective action tend to hurt the poor and may not be effective in stimulating adoption and adaptation of conservation technologies. The high transaction costs involved in addressing the equity issues in property rights deter the required changes, thus allowing the persistence of inefficient property rights regimes (Libecap, 2002).

The success of land and water management interventions also depends on the degree to which the user communities are involved through local collective action in

the design and implementation of the programmes. In India, studies observe that the programmes implemented by non-governmental organizations often outperform those implemented by the government, mainly because the former ensure active and sustained participation of the community (Vaidyanathan, 1991, 1999; Farrington et al., 1999). Integration of the interests and knowledge of the local community into watershed management programmes also tends to be lacking in government-implemented programmes because government line departments typically centralize the management of such programmes and adopt a top-down bureaucratic approach. In addition, many government-run programmes in the past ignored the importance of integrating other enterprise and economic activities into watershed management programmes and, if they did, it tended to take a topdown uncoordinated approach.

Gender issues

Along with men, women play an important role in improving land and water productivity and conservation of natural resources. In many cases, women are major stakeholders in sustainable NRM, mainly because they represent the main users and immediate direct beneficiaries from improved availability of water, fodder, fuelwood and other livelihood resources. Successful land and water management interventions that result in increased availability of livelihood resources for domestic use directly benefit women by reducing the time they spend searching for water, fuel-wood and similar resources. While equitable participation of women in land and water management programmes is critical, improvements in resource conditions could release some of the time for investment in land and water management. Available studies also indicate that women often show clear resolve and dedication for resource improvement and tend to be more spiritual in dealing with natural resources, perhaps making them better managers (Mikkelsen, 2005). Integrating the unique interests of women and their active participation at all stages in the process of land and water management can therefore help in improving the effectiveness and sustainability of such interventions (d'Souza, 1998; Pangare, 1998).

The specific needs of women can be addressed more effectively when they participate in decision making and in implementation of the programmes. However, women are often left out of decision making because they rarely own or control

resources. In many watershed management projects, women provide hired labour for installation of selected interventions but are not involved in decision making (Sreedevi and Wani, 2007). Pangare (1998), for instance, suggests that women rarely receive the benefits (in terms of access and control) from the resources they help to create and conserve because of social and cultural inhibitions. Future interventions for sustainable land and water management would need to explicitly address the needs of both men and women resource users and seek equitable sharing of benefits (Sreedevi and Wani, 2007).

Information a symmetry and farmer participation

Farmer participation in the design of conservation technologies and availability of information about the potential benefits and risks associated with new methods has an important role to play in influencing farmers' attitudes and perceptions. Many past interventions that followed the top-down non-participatory approach have failed (Reij 1991; Tiffen et al., 1994). A number of factors have contributed to the success of participatory conservation technologies designed using bottom-up approaches. First, such technologies take into account the unique socio-economic characteristics of target farmers, allowing them to adapt to their specific circumstances. Second, farmers are able to test, try or experiment with and adopt various practices at their own pace and preferred sequence. This process of farmer innovation and adaptive experimentation leads to a high degree of compatibility with local situations and farming systems. Third, participatory approaches allow farmers to gradually adapt the technology to changing market and agro climatic conditions (Bunch, 1989).

The information and perception issues are also important as some types of land degradation may not be directly visible to farmers, especially when external variability in growing conditions makes it difficult for farmers to attribute such changes to declining resource quality. Farmers will adopt technologies only if they perceive soil and water degradation as a major problem that affects their livelihood (Fujisaka, 1994; Baidu-Forson, 1999; Cramb et al., 1999). Along with participatory technology design, education and awareness about new options and the process of resource degradation or depletion (e.g. levels of soil fertility or groundwater depletion) are critical in stimulating awareness and action by individual resource users and communities.

Biophysical environment

Finally, the profitability of natural resource investments will ultimately depend on the agro ecological and biophysical conditions. Factors like the natural fertility of soils, topography, climate and the length of the growing period influence the success of research investments and the type of technologies needed to sustain livelihoods and conserve the resource base. For example, meta-analysis of watershed development impacts in India identified rainfall and water availability as major determinants of the success of community watershed programmes. Cost–benefit ratios were found to be largely positive in medium rainfall (701–900 mm) and low-income regions (Joshi et al., 2005). This indicates that in drought-prone semi-arid areas with infertile soils and erratic rainfall patterns, risk considerations imply emphasis on water management to reduce vulnerabilities to drought and to increase crop yields. In such areas suffering from moisture stress and seasonal drought, water conservation provides an important entry point; hence, the need to focus on enhancing in-situ conservation and productivity of water. Technologies for water harvesting and supplementary irrigation provide higher incentives for farmers to adopt other complementary inputs. This is mainly because the quick gains in terms of reduced risk of drought and increased productivity of other purchased inputs (e.g. fertilizer) enhance the expected returns from such investments.

Similarly, in higher rainfall areas, soil and water conservation may emphasize mitigating soil erosion through cost-effective methods, which reduce overland flow and improve safe drainage of excess water. Even in such areas, the excess water may derive some benefits for supplementary irrigation during the post-rainy season or for domestic and livestock use.

The heterogeneity of the biophysical system in both dry and wet areas therefore suggests the need for careful consideration of local conditions in designing conservation options. The challenge is how to balance applied research needed to adapt to micro-niches with the need for strategic knowledge on cross-cutting issues that will have wider relevance and application.

Conclusions and Policy Implications

This chapter reviewed the challenges that diverse stakeholders and smallholder farmers face in tackling the long-standing problem of land degradation and sustainable management of agroecosystems. Review of the wide literature shows that resource-poor farmers, especially in marginal and rainfed regions, continue to face complex challenges in adopting and adapting alternative management practices and innovations for mitigating this problem. In an effort to address this challenge, the approach to soil and water conservation itself has evolved over several phases, latest perspectives encouraging the need to ensure farmer participation and consideration of market, policy and institutional factors that shape farmers' incentives. The need for farmer participation and innovation is justified by the fact that most soil and water management problems tend to be site and even farm specific. This calls for the need to provide farmers with a set of options to fit specific niches depending on specific constraints rather than a wholesale 'one-size-fits-all' type approach that promotes a single technological package in all areas.

The review also indicates that adoption and adaptation of land and water management innovations is constrained by failure to link conservation with livelihoods, extreme poverty and imperfect factor markets, inadequate property rights systems, and weak organizational and institutional arrangements at different levels. The best way to ensure adoption of innovations for sustainable land and water management is to develop them iteratively, in collaboration with the target group. This can be done through linking formal research with indigenous innovation processes of local resource users and communities. Effective soil and water conservation interventions are characterized by a process of joint innovation that ensures farmer experimentation and adaptation of new technologies and management practices and careful consideration of market, policy and institutional factors that condition and shape farmer conservation decisions.

Linking farmers to better markets for their produce and inputs like fertilizer and credit generally makes a positive contribution in raising the returns to land and labour in agriculture. When complemented with proper policies and institutional mechanisms to induce the process of farmer innovation and adoption of conservation practices, market access can be a useful driving force towards sustainable intensification of

smallholder agriculture in both rainfed and irrigated areas. Given that investment poverty and lack of farmer capacity can be a major limiting factor for certain sustainability-enhancing investments, access to investment credit at farmer-affordable rates and availability of pro-poor options for beneficial conservation (i.e. offer short-term livelihood benefits) will be an important step in solving some of the long-standing constraints.

In addition, experience has shown that projects should act as 'toolboxes', giving essential support to resource users to devise complementary solutions based on available options, rather than imposing exogenous practices and technologies. If investments in the resource provide a worthwhile return and when enabling policy and institutional arrangements empower individual resource users and communities, smallholder farmers often try to protect their land and water resources from degradation. The major challenges for future land and water management will be in addressing the externalities and institutional failures that prevent joint investments for management of agricultural landscapes and watersheds. This will require new kinds of institutional mechanisms for empowering communities through local collective action that would ensure broad participation and equitable distributions of the gains from joint conservation investments.

Finally, some of the key lessons for the future include: (i) future land and water conservation projects should be flexible enough to respond to land users' innovations and inputs; (ii) land and water conservation interventions should favour approaches that provide a number of different technologies and management practices, which individual resource users can choose, test, adapt and adopt or discard as they see fit; (iii) resource-poor farmers are unlikely to adopt interventions that do not provide short term economic gains, especially when credit markets and property rights are imperfect to permit investments with long payback periods; (iv) adoption requires a conducive institutional and policy environment and good linkages with product and factor markets to enhance the returns to beneficial conservation investments; and (v) integrated and landscape-wide interventions require community participation and collective action to coordinate and regulate resource use and investment decisions.

ESTABLISHING A GROUP

Four basic principles in-group formation

Four basic principles should be followed in-group formation:

The group should be small

The ideal number of members is between eight and 15. In a small group all members have the chance to speak and to contribute their energy and ideas to group development. Small groups are less likely to be divided by arguments or. dominated by a minority.

The groups **should be homogeneous**

Members should live under similar economic conditions and have close social affinity. Homogeneity reduces conflict within the group members with similar backgrounds are more likely to trust each other and accept joint liability for their activities.

The group should be formed around income-generating activities.

Income-generating activities are crucial to group development because they produce assets that help build self-reliance.

Groups should be voluntary and democratic

Members should decide who can join their group, who will lead them, what rules they will follow, and what activities they will undertake. Decisions should be taken by consensus or a majority vote.

Formation of viable and stable groups requires patience and, in most cases, a period of from two to six months. You should avoid both overly rapid formation and overly long delays, which may dampen the interest of potential group members.

Discuss membership

Make a list of people interested in forming a group. Explain to them that the group should not become too large. Groups of 8 to 15 members are usually the most effective. Remind people that membership implies certain rights and benefits, such as the right to attend group meetings and share in profits from group activities.

However, it also implies the following obligations:

Source: FAQ. The Group Promoter's Resource Book. 1994. P.P. 32-37

- To attend meetings regularly;
- To pay a membership fee (this ensures that only serious persons apply for group membership and helps raise initial capital for financing the group activities).\To elect the group leadership
- To make regular contributions to the group savings fund if established
- To repay group loans quickly
- To help other members when in need

Discuss women's participation:

Promoting women's participation in groups when men are around can be difficult. This is because women are reluctant to air their views or challenge the views of males in public. What can be done?

In-group formation, be flexible. In many places, the natural tendency may be to form mixed groups, with both male and female members. Be aware that, because men generally dominate such groups, they do not always provide the best learning environments for teaching leadership skills to women.

Forming all- female groups may be a good first step. If a mixed group has already been formed, suggest breaking them into separate husbands and wives' subgroups, so that the women can meet separately from the men and gain self-confidence in speaking and publicly presenting their views.

Women are generally more homebound than men. This may make it more difficult for them to attend meetings. To help them, you should first identify the occasions in which women traditionally meet (e.g. when they go to collect water or gather for certain events). You can then identify the most suitable circumstances for getting poor women together to discuss their common problems.

If men object to the formation of separate all — female groups, mixed groups can be formed, but measures should be taken by the GP to ensure female participation in-group decision making. For example, it might be agreed that a percentage of the members and group officers should be female.

Men need to be shown the benefit of increased women's participation in decision-making. - For example, in some rural areas, women tend to be more concerned with details than men and tend to make better treasurers and secretaries than men. Women also tend to save more regularly than men and are more concerned with paying back debts. Remember that women are less likely to be able to read and write than men. In this case, more attention has to be given to encouraging women's participation. Always encourage the participation of non-literate members in the group.

Choose a name for the group

The members should choose a name for the group. In some countries, people name their groups after their village or locality, followed by a number if there is more than one group. Other groups have names like "Unity" or "Working together".

Decide when and how often to meet:

Schedule meeting days and times that are convenient for the members. Frequent meetings (weekly or bi-weekly) are desirable especially during the early stage of group formation and learning. Stress the need for regular attendance at these meetings.

Set specific objectives:

Help the members agree on clear objectives for their group (see discussion on expectations and clear and vague goals in Step 3). Once people have agreed to work together for a common purpose you can help them establish a participatory self- help group.

Initially, you will play a major role. Later, as the group gains experience and confidence, you should gradually reduce your involvement and start shifting your attention to starting up other groups and activities.

You should encourage all members — men and women — to participate in discussions and decision-making. You should help members acquire skills and organize training and workshops to exchange ideas with other groups. Also, you should help the group monitor and evaluate its decisions and action.

Overcoming opposition to group formation:

The process of group formation often faces serious obstacles. The poor may not be receptive to your ideas for several reasons. Heavy workloads and generally poor health often leave them with little energy for "participation". Their low level of education and geographic isolation cuts them off from progressive ideas.

Remember also that the poor are usually dependent on big farmers, traders and middlemen. They are accustomed to leaving initiatives and decisions to these people and may be afraid to become involved in groups or organizations. In fact, local power-holders - and even slightly better off farmers — may see the groups as a threat to the social order.

At local level, you can overcome such antagonism by winning the support of traditional, administrative and other leaders. You and your supervisor may need to call meetings to sensitize leaders to your objectives and, above all, to illustrate the benefits of your activities to the area as a whole. These benefits include improvements in community living standards, an increased flow of services to the village and, consequently, greater prestige for the village and its leaders.

Discuss the importance of attending meetings:

Make it clear that group meetings are the most important place for discussions, learning and decision making. Members who do not attend meetings are not able to participate properly in the group. If a member cannot come to a meeting, they should report in advance giving the reason for their absence.

If members stop attending meetings, you should try to find out why. For example. Members may stay away because they cannot afford to pay the membership fee. In that case, the group should discuss whether member fees should be reduced.

In other cases, it might be that the member fails to receive any benefit from meetings. You need to find out why. Maintaining group unity and commitment is important and sometimes requires adjustments in objectives and ways of achieving them Members' interests can change and the group must adjust. to these changes if it is to be a success.

Discuss the importance of good communication:

Communication between members is very important. Poor communication can create irritation and misunderstanding. Good communication will strengthen relations between members. Communication needs to be two way: group leaders should discuss the group's affairs with their members and the members should discuss feely with their leaders. Working together as equals in the group helps to build confidence and cooperation. This, in turn, makes the group successful.

Discuss the building blocks of a self-help group:

A cohesive and sustainable group consists of four key elements or building blocks. They are:

* **Leadership**

A group that is well led usually succeeds. Leaders and committee members must be chosen carefully.

* **Contributions**
Regular group savings are essential. Members' contributions to their group activities help to build a sense of group ownership and solidarity.

*** The group constitution**
A constitution — that is, a written record of the purpose and rules for the group — help the group avoid internal conflicts and makes the responsibilities of each member clear.

* **Record -keeping**
Records help the% group remember what has been decided at meetings. They are very important in monitoring and evaluation.

The form each of these building blocks takes depends on the ideas and experiences of the members. The final form of the group must be agreed by the members themselves, and adjusted to suit their needs and views.

Building A Strong Group

THE 'CULTURE' OF A STRONG GROUP:

The culture of the group is determined by the attitudes and customs established by practice by the group members. Now, united, as members of the DWCRA women's group, the new culture will be marked by

- A strong feeling of Unity
- Freedom of expression of ideas and feelings
- Respect for others
- Democratic decision — making
- Equality in the commonality of group membership
- Each person taken seriously, and important, in such a way that the women can feel 'empowered', and work together to change their world.

The culture of a group is built up over time in many ways:

- Non-verbal and symbolic gestures
- Words
- Group processes

A smile, a sniff, rolling of the eyes, a shrug of a shoulder, touching, not touching, sitting arrangements, all are examples of the kinds of non-verbal and symbolic gestures that influence group culture. Meeting arrangements in which the women sit in a circle communicates 'equality', 'democracy' and 'unity'. When a group member joins the group, a space is made for her in the main circle **'—** 'each person is taken seriously', there is 'equality' and 'respect'. Closeness and common understanding will be communicated in many ways. The words used in communication will reflect the culture of the group.

'What we say and what we do' must be in harmony. And group processes of participatory decision — making, of making sure all members express their views will certainly support the values of the culture of the women's group we hope to promote.

As Gram Sevika, the pattern you set yourself, and the way you alert the group members and Group Leadership to this important aspect of 'group culture', will to a great extent determine the strength or weakness of the group.

Points to remember:

- Group formation is important for collective action
- A Group composed of strong, self — respecting, confident women can effectively work on the problems of poverty, deprivation, gender inequality and injustice

- You as a Gram Sevika must foster a strong feeling of unity, democracy, and a strong 'we' feeling amongst members
- Strong groups should be able to absorb setbacks without splintering, and to learn from mistakes.
- The women's groups should link with other groups on common issues and actions.

A. Collection of people will be called a group if:

- They come together to work *for a* common purpose.
- The people who come together have a common interest. No purposeful dialogue can take place until the members have a common interest.
- The members have a common understanding of their reason for meeting, of themselves as members
- The members meet regularly and participate actively
- There is a conscious membership — members know they are members, and others who are not members know they are not. Membership criteria and responsibilities, as well as rights, are known
- They have decided on some rules and procedures for their being together and working together. These rules may be formally written down, or they may be only commonly understood.
- There is identified 1eadership. The leaders may be one or several, but the group recognizes the leadership, and the leaders 'lead;
- The members take collective action, and carry out decided —upon plans. A collection of people that doesn't do anything is not a group
- There is free and open communication and feedback among members
- The size is big enough and small enough to allow members to interact, participate. In terms of what 'feels like a group' and what is a minimum size for effective collective work together, it can be said that when ten to fifteen or more, persons get together regularly, meet and talk to each other, it is 'a group'.

Organization of the farmers Groups:

Everywhere in the world, small-scale farmers are collaborating with each other in some way – forming groups, sharing information, working together. Under the right circumstances, farmers' groups can make a very positive difference to the lives of those working to improve their livelihood options, as well as to the sustainable management of natural resources. The benefit of strength in numbers is not a new concept, and for many farmers and communities in rural areas, working together is an obvious, time-tested and often necessary idea.

Working together can take many forms, and a variety of terms are used to cover the scope of this idea – collective action, farmers' organizations, women's' groups, unions, co-operatives, self-help groups, networks, alliances, associations, committees, clubs, partnerships. These terms imply a range of methods for joining forces, at different levels, in a variety of sizes and scopes, with different aims, or with different legal status. In this issue, which discuss and analyze the experiences of some of these types of groups, looking especially at how, where and why farmers organize themselves, and drawing out some lessons.

Why should farmers organize?

For individuals and communities, it is useful and effective –sometimes a matter of survival– to organize and work together for many reasons. In general, farmers and groups organize themselves as a response to a commonly felt need to improve their own social or economic situations. This can create different dynamics and present exciting opportunities. Experiences with Farmer Field Schools show how this works: farmers come together because they have lot of problems with pests. In the process of learning how to deal with this, they discover that pests are a symptom of a bigger problem. They also discover the value of working together in a group, and then find ways build on this to their advantage (see Braun et al., p. 18).

Many tasks related to managing sustainable agricultural practices are best done in groups. This is clear from the various types of informal institutions such as voluntary work groups and long-practiced traditions of reciprocity, which are common, and found in countries as diverse as Ghana, the Philippines, and Brazil. These farmer groups are based on community ties, trust between members, obligations, and are based in

tradition. In the example of the traditional farmers' groups among the Apatani in India (see Dollo, p. 22), the groups provide the means for sharing and preserving local knowledge, strengthening the cohesiveness of the community through mutual dependency and contributing to effective and long-term natural resource management. Farmers' organisations of all types have an important role in development – they provide space for participation, which contributes to group members' ownership of the issue at hand as well as any solutions. This in turn builds group cohesiveness, solidarity, and promotes mutual support. They can be the platform for building a sense of community, a social support system, increasing self-confidence, learning together and providing a sense of equality. A well-organized group can be taken seriously in a Wider environment. Farmers' organizations are increasingly about empowerment, of individuals as well as of the groups themselves.

Groups with common interests can secure access to services that individuals cannot, such as training, credit or equipment. Lack of access to any of these could be the vital issue that an individual farmer faces, yet by joining a group, different opportunities arise, enabling farmers to learn, decide and act. This is particularly the case where farmers organize as a response to marketing concerns, as there are clear economic benefits of working in groups. These include the ability of groups to buy seed in bulk, or access more distant markets. Working together can increase members' bargaining power, which helps to share and lower risks and costs. In areas where farmers are scattered geographically, and transport and communications are difficult, the importance of such organizations is even greater.

Lastly, farmers' groups are an important way for farmers to become recognized, economically, socially and politically. With increased emphasis on farmer-led or demand-driven development processes, groups are an important tool enabling farmers to lead the way and giving them more power. By building on what they have, know, and share (including knowledge, interests and obligations), organizing is an important way for farmers to have a voice and increase their influence. This is vital when working towards improving their own social, economic and environmental conditions and can be achieved through lobbying and advocacy activities.

Organizing for change:

The articles in this issue give some examples of the common goals that farmers organize themselves around – environmental concerns related to social and economic improvement or access to markets and related opportunities (see Kruijssen et al., p. 6). Groups of farmers who come together spontaneously or through their own efforts to answer their own felt needs are more likely to be effective than groups that are brought together to suit the needs of an external agency. Spontaneous and voluntary formation of social groups involves a high degree of trust, which cannot be manufactured. This is one reason why community groups are often formed around one strong personality, and is formed due to some immediate issue which needs attention. It is very common to find women's or youth groups, as they will share a number things in common and are often more comfortable working together than in more mixed groups.

There is an important difference between farmers or communities that organise themselves to work together, and farmers being organized in groups by external actors who see this as a vital step and entry point for community development. External agencies often view the creation of organizations as a positive intervention, a way of increasing impact and sustainability of activities. Farmers and communities often do benefit from participating in such projects through gaining access to trainings, information, resources and further linkages. However, groups formed in this way are typically more prone to difficulties at the start and there is a risk they will not continue if or when the initiating institution pulls out. Alternatively, where previously established local groups gain the support of external agencies, this arrangement can be very positive. A key challenge for these agencies (whether big government programmes or small NGOs) is then to act as catalysts and bring out the self-organizing capacities of farmers and local communities in the most locally relevant and useful way. Effective support can facilitate or enable local groups to achieve more, or be heard by the right people. It can be especially constructive while community groups are establishing themselves, or in response to a stated need. However, as groups develop and find their own strength, the external agencies then need to consider the different type of support groups may need. Established groups may move on to needing legal advice, infrastructure such as transport or computers, and will generally need more complex and focused support to maintain as well as develop activities.

Limitations and difficulties in farmers' organizations:

There are other difficulties, which must be overcome if groups are to develop and flourish in the long term. Often these are problems of day-to-day management, such as farmers not having enough time to participate as fully as they would like, or having difficulty in finding fees or other contributions required. Farmers will weigh these investments against benefits, but often these and other pressing practical concerns can become a difficulty for farmers' groups.

According to the circumstances in which specific organizations are formed, each group will need different types of support, resources and information. Access to this can affect how groups perform. In larger groups or networks, difficulty in reaching decisions and resulting internal conflict is more common. If objectives are not achieved, or results do not come up to expectations, members may lose interest. Groups also have to deal with external pressure or influence, and always have to operate within the local political and economic environment. Challenges faced by groups include ensuring that everyone can be involved, and avoiding that certain interests or voices becoming dominant. This is especially the case with gender and cultural or religious concerns.

Although working together is beneficial in many situations, it must be recognized that organizing for the sake of organizing, or organizing because it is requested by outside projects will not necessarily bring the results expected. Successful groups take some planning, thought and careful consideration of what form they should take in order to reach their goals. Would a co-operative work in the local economic climate? What local or traditional institutions already exist that can be built on or formalized? How large does the farmer's organization need to be to get local government to listen to them? Members should also look at why it is beneficial to be in a group, and consider all their options (see Hellin et al., p. 26).

Successful Groupings:

By looking at examples of success, we can begin to draw out some common characteristics of effective groups. Research and experience with groups shows that the most successful are often small, informal groups, formed by people of similar backgrounds or concerns, who have a clear objective and vision, are responding to

commonly felt needs, and share a high degree of trust. Members of successful groups also realize that the benefits of organizing outweigh the costs. They are able to secure adequate support, have clear rules and responsibilities, hold meetings and communicate effectively. These groups are often focused on income generation, and many have a savings or emergency fund.

Legal status is also usually needed for an organization to be recognized by public authorities, or access public services. It can also be useful when finding partners and institutionalizing into more formal structures – developments which can help an organization to progress and move forward. Supportive local policies and a conducive institutional environment are of critical importance. Power relationships at the local and district level are often complex, and strengthening farmers' voices, and making sure they are listened to, are crucial elements of sustainable agriculture.

On a larger scale

If strength can be found in a well-functioning group, then this effect can be amplified when groups work together, or form networks to achieve their aims (see Braun et al., p. 18). Many groups start small, and quickly see the advantages in joining forces with other groups, NGOs or research institutions. This can be beneficial for all parties, provide options that are based in local realities and be more effective and efficient. Depending on the group's objectives, scaling up and reaching out is often a natural step. Such alliances, however, are not always easy to manage, due to different expectations, working practices or attitudes. Much more is known about what makes a successful community level organization than what is needed to create effective collaborative structures at higher system levels, and this challenge needs to be addressed.

However, with honest and open communication, many operational difficulties can be overcome. Strong networks of farmers groups have developed in Latin America, at both regional and national levels. In India there has been a phenomenal increase in and development of women's' self-help groups. These groups have gone on to establish federations and larger structures, which have succeeded in making small farmers' concerns, heard where they were never heard before

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Moving forward

Many groups organize themselves as a response to a felt need. If this need is resolved, members may feel that working as a group is no longer necessary, or that they need to change their objectives to suit the new situation. As such, some groups are not meant to last forever and it is valid for them to achieve their objectives and move on. What is important is that a group has a clear vision of where it is going and what it wants to achieve – this vision can be adapted over time. In most circumstances, farmers' organizations are beneficial to those involved, although choosing the most appropriate type of organization, and its internal management, needs careful thought in relation to how to achieve objectives.

The articles in this issue, as well as numerous other experiences, show that farmer organization is critical and central to furthering sustainable agriculture. This works at every level, from farmers experimenting together to locally improve techniques, to jointly representing their interests at an international level. Given the difficulties faced by small-scale farmers, every effort is needed in order to achieve the improvements needed in their various circumstances. Farmers' groups, networks or federations can all make a huge contribution to raising awareness and campaigning for change. In the majority of cases, strong local organizations are, and will continue to be, key to building sustainable livelihoods based on low external input agriculture.