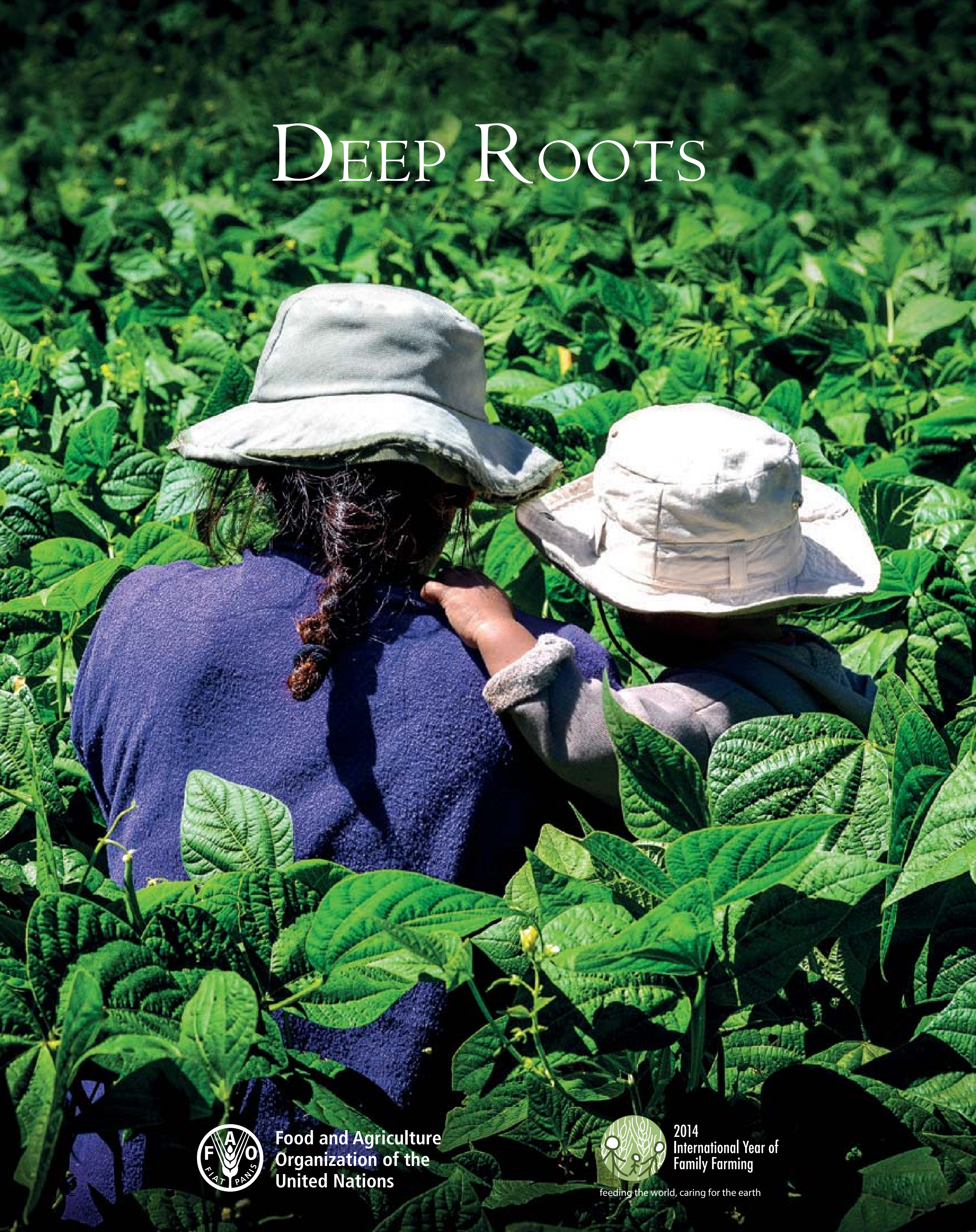
DEEP ROOTS



Food and Agriculture Organization of the United Nations

2014 International Year of Family Farming

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Harnessing the potential of family farming in India and China

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Ninety per cent of the world's farmers are in developing countries and 85 per cent of farms worldwide are less than 2 hectares.[1] Presently, family farming feeds up to 80 per cent of the population in Asia and sub-Saharan Africa, and supports the livelihoods of up to 2.5 billion people.[2] Small family farms will play a vital role in achieving food security for 9 billion people by 2050 as world agricultural production will have to increase by 70 per cent.[3]

Small family farms are more efficient in resource use and per-unit productivity than large farms[4] but their full potential is not yet realized. Thus, the challenge is to develop models for unlocking the potential of rain-fed agriculture. There is a need to transform family farms from a subsistence level to a business model using innovative economies of scale, so they can fulfil their multiple functions against adverse environmental conditions and demographic transformations.

In Asia, almost all farms are small family farms, and current farmers' field crop yields are two to five times lower than the achievable potential. In many parts of the world, smallholder agriculture could contribute to growth and employment, environment and climate change adaptation, and food and nutrition security[5] by bridging these yield gaps. In this context, family farms in India and China face similar challenges such as fragmentation of farms, low crop yields with subsistence farms, water scarcity, land degradation, acute population pressure and inability to access credit and markets. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and its partners have established a 'proof of concept' demonstrating the potential for transforming small family farms in Asia by adopting integrated farmer-centric watershed management for improving livelihoods. Two case studies from India and China illustrate the technical, social and institutional nuances and innovations used to harness the production efficiencies of small family farms with scale efficiencies to access inputs and markets through farmers' collective action.

Researchers and development agencies in India have adopted rainwater harvesting and soil conservation inter-

Images: ICRISAT

Low-cost water harvesting at Kothapally, Telangana, India ventions to tackle frequently occurring droughts affecting dryland agriculture since 1970. ICRISAT and its partners developed Vertisol management technology using a watershed management approach in 1976 and took it for on-farm demonstrations during the 1990s but, although economically remunerative, the technologies weren't adopted by farmers. Based on the lessons learned from different evaluation studies of conventional watershed management programmes in India, in 1998 an integrated farmer-centric watershed model adopting an Integrated Genetic and Natural Resource Management (IGNRM) approach was developed and piloted to address tangible economic benefits to smallholders, ownership of the interventions, women's involvement, enhancing collective action, and technical backstopping ensuring knowledge sharing.[6] ICRISAT later adopted the Inclusive Market Oriented Development (IMOD) strategy to link small farmers to markets and ensure profits through innovative collective action using new information and communication technologies. The IGNRM and IMOD pillars harnessed the potential of crops, livestock, poultry, fisheries, trees and value-adding microenterprises, linked production and markets to benefit smallholders and transformed their lives through an integrated approach.[7]

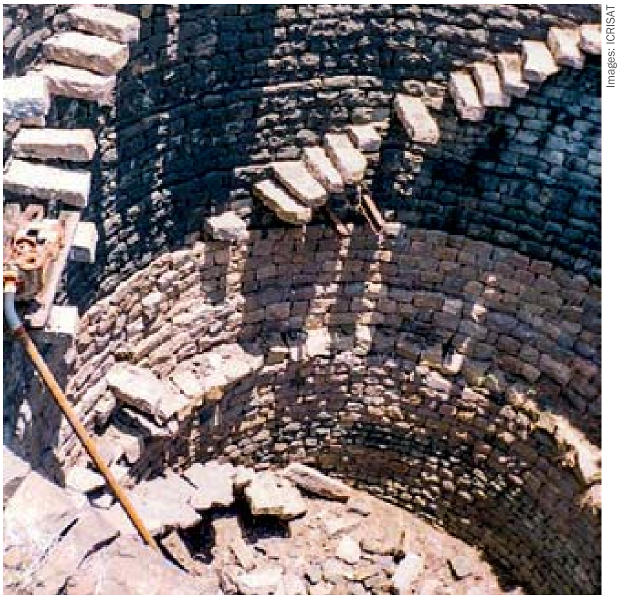
Many partners are engaged with farmers and co-invest their knowledge, technologies and practices to address key constraints that farmers face as suppliers. This initiative was initially supported by the Asian Development Bank for pilots in India, Thailand, Viet Nam and China. Later, development investors such as the Indian Ministry of Rural Development, the World Bank through the Sujala Watershed Program in Karnataka, the Department for International Development through the Andhra Pradesh Rural Livelihoods Program, the Sir Dorabji Tata Trust and the Sir Ratan Tata Trust supported further refinements and scaling-up in India.

Identifying a suitable entry point activity (EPA) for promoting collective action and gaining the trust of the community is critically important. The EPA must be knowledge-based rather than cash-based to benefit large numbers of community members. Based on close study of the constraints, suitable EPAs were identified for increasing productivity quickly, as in Adarsha watershed, Kothapally in India, or addressing a major common need such as drinking water in Lucheba watershed in China.[8]

Adarsha watershed, India

In 1998/99 Kothapally village in the Shankarpally mandal of Ranga Reddy district in Telangana (previously Andhra Pradesh) was a village with little development and no transport facilities. Eighty per cent of its 462 hectares of agricultural land was rain-fed, growing one crop per year. The main crops were cotton, maize, sorghum and pigeonpea with 1-1.5 t ha^{-1} productivity of sorghum and maize and 200 kg ha^{-1} of pigeonpea. All the 62 open wells were dry from January onwards and village women had to travel 2-3 km to fetch drinking water from February until the June-July monsoon rains. Milk production was low and there was little surplus milk to sell. Smallholders were migrating to the city for livelihood during the off season.

In 1999, at the request of the district administrator and the government Drought Prone Area Programme, the ICRISAT team selected Kothapally for drought-proofing with improved technologies based on the severity of water scarcity, large rain-fed area, low crop yields, poverty and the willingness of the community to work together. ICRISAT brought the partners together with the Government of Andhra Pradesh, MV Foundation (a non-governmental organization operating in the district), the Central Research Institute for Dryland Agriculture and the National Remote Sensing Agency in a consortium.



Images: ICRISAT

Open wells in Kothapally before watershed scenario and after, with recharge pits

Images: ICRISAT

Vegetable cultivation in Kothapally, India

Using a wilt-tolerant pigeonpea high-yielding cultivar grown on broad beds and furrows as an entry point, community mobilization was achieved. During the first season the pigeonpea yield increased to 600 kg ha^{-1} giving farmers additional income of Rs6,000 ha^{-1} in 1999. The tangible economic benefit to smallholders triggered collective action and common activities such as rainwater harvesting structures benefiting the community were then easily facilitated. In 1999, the first earthen check dam near the village was constructed with an investment of Rs78,000 (US$1,733), benefiting nearby farmers' wells and providing drinking water for animals and for washing clothes. Low-cost constructions included 43 rainwater harvesting structures, 14 masonry structures, 37 sunken pits and 97 gully control structures, and 39 open well recharging pits. Soil nutrient status mapping and soil test-based fertilizer recommendations, the introduction of improved cultivars, integrated pest management, vermicomposting, Glyricidia plantation on bunds to generate nitrogen-rich organic matter, avenue plantation, nursery raising, fodder production in wasteland, and livestock breed improvement through an artificial insemination centre in the village were undertaken in participatory mode, and farmers contributed in cash and kind to ensure ownership of each activity.

The most visible impact in Kothapally today is the farmers' — especially the women's — confidence that they can cope with the challenges of climate change. During 2014, in spite of deficit rainfall, farmers have grown their crops using available water. Farmers are delivering 600 litres of milk every day at the computerized milk collection centre set up by the Reliance group and about 500 litres per day at private milk collectors. From milk alone Rs40,000 per day are added to village income. With the help of the SABMiller women's group, a new initiative provides spent malt as quality feed for dairy animals, resulting in a 1.5 litre increase in milk productivity per animal per day and Rs9,710 per day additional income in the village. Increased water availability has transformed the village's one-season agriculture to three crops, with a move from maize and sorghum to Bt cotton and high-value vegetable production. Water is available year-round in the open wells and women get drinking water through taps using borewell water. The village is buzzing with activity and has 35 autos, two luggage vans, four lorries and nine tractors. The average crop yields of sole maize increased by 2.2-2.5 times (3.8 t ha^{-1} compared to 1.5 t ha^{-1}), intercropped maize pigeonpea with improved management produced 6 t ha^{-1} compared to 2.9 t ha^{-1}, pigeonpea yields increased to 900 kg ha-1 against 200 kg ha^{-1} in 1998. Similarly, hybrid cotton was replaced by Bt cotton with increased productivity of 7.1 t ha^{-1} compared to 2.1 t ha^{-1} in 1998.[9]

Average household income from crop production activities within and outside the watershed is Rs15,400 and Rs12,700 respectively. The respective per capita income is Rs3,400 and Rs1,900. The average income from agricultural wages and non-farm activities during 2002 was Rs17,700 inside the watershed and Rs 14,300 outside it. Growing more diversified crops and diversifying their income sources through livestock rearing increased farmers' average incomes threefold in 2010 compared to Rs25,000 in 1998. Even during the drought year of 2002, income was 1.5 times higher than non-watershed farmers' incomes, and the villagers in Kothapally did not migrate for their livelihood. Watershed development has helped improve the resilience of agricultural income despite the high incidence of drought during 2002. While drought-induced shocks reduced the average share of crop income in the non-watershed area from 44 to 12 per cent, this share remained unchanged at about 36 per cent in the watershed area. In addition, environmental benefits include improved

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A concrete house and internet training facility at Lucheba watershed, China

water quality (pesticide residues free), increased year-round water availability, reduced run-off (30-40 per cent), reduced soil loss (from 10 t ha^{-1} to 2 t ha^{-1}), increased greenery cover and associated increased carbon sequestration through tree cover.

Lucheba watershed, China

Lucheba village in Pingba County, Guizhou province in southern China was selected in 2003 for integrated watershed interventions by the International Development Research Centre and ICRISAT team. This cluster of six villages (11 natural villages) with 340 households and 1,373 people was growing maize, rice, soybean, sunflower and rapeseed during the year. Women in the villages were unhappy as they had to travel long distances to fetch drinking water and houses were dilapidated. The village had no access road connecting it to the main road and people used to migrate to cities to work as construction labourers.

In 2003, based on discussions with the village communities, two drinking water schemes were undertaken as an EPA with project funds and contributions from villagers. Springs in the hills were tapped, and water was piped to the village. This promoted collective action and brought farmers together. The watershed management programme introduced various interventions focused on reducing poverty and land degradation by adopting a farmer participatory approach. These included soil and water management, improved cropping systems, crop diversification, integrated nutrient and pest management practices, along with other income-generating microenterprises such as poultry and pig rearing. The communities were involved throughout the programme, and were active in identifying constraints and interventions, and modes of implementation, monitoring and evaluation for the impact assessment. Some 151 rainwater harvesting/irrigation water storage tanks of 5 m^3 capacity were constructed, 133,600 trees were planted on 100 hectares of wasteland, and a 4.8 km village approach road was built from the main road. Later a 6 km-long field road was constructed with government support. Crop diversification was undertaken, with high-value vegetable crops. More than 260 biogas plants were set up in village households to reduce pressure on fuelwood and protect the forests. The whole village now has biogas powered street lighting. Microenterprises for women were promoted along with forage production on bunds. Training courses were conducted for farmers and later, with government support, a computer-aided training centre with internet facilities was established. The Lucheba watershed area is now covered with lush green vegetation. The old and dilapidated houses have been transformed into new concrete houses with big courtyards and gates, equipped with modern appliances.

"We started using harvested rainwater for cultivation, and everything just changed," said Peng Fay Ou, a farmer with a 1 hectare landholding in the Lucheba watershed. With seven members in the family, he used to earn ¥3,000 (US$500) per year. Now his agricultural income has increased threefold, to ¥10,000 (US$1,650) per year. With water now available, three crops of vegetables are grown in the village. The Vegetable Growers' Association plans the growing cycle and markets the crops using the internet facilities. The benchmark crops (rice, corn, rape, soybean, sunflower and kidney bean) were replaced with high-value crops like cabbage, watermelon and vegetables like tomato, pumpkin, chillies and eggplant using hybrid seeds and improved agronomical practices. The average area under cultivation of rice, maize and peas has decreased by 18 and 38 per cent respectively, while the area under cultivation of high-value crops has increased by two to six times. Yields for different vegetables have increased by

Images: ICRISAT

Grading and packing of green chilli and vegetables, which are then loaded onto a lorry for transport in Lucheba watershed, China

32-673 per cent.[10] Substantial increases in the area under high-value crops (40 hectares in 2003 and 113 hectares in 2005) were observed.

In three years (2003-2005), the net yield advantage and net monetary benefit per unit of water conserved for watermelon and vegetables were 287.3 and 78.7 kg mm^{-1} ha^{-1} respectively. Net monetary benefits for vegetables and watermelon were ¥147.1 and ¥83.4 (US$18 and US$10) mm^{-1} ha^{-1} respectively. This reflected a similar trend of net monetary advantage per unit area of ¥9,253 and ¥5,246 (US$ 1,141 and US$647) ha^{-1} respectively over three years due to availability of water during the most critical stage for these crops. Net returns of vegetables per unit of water per unit area in 2005 were 3.5 times higher than in 2003. Higher benefit-cost ratios were observed with vegetables than watermelons during the pre- and post-project period.[11]

Lucheba now boasts two animal health centres, one computer-aided, internet-enabled farmers' training centre and one Vegetable Growers' Association. Those who had migrated to cities have returned to villages as the quality of life is better than in the city. The village's average per capita income is twice as high as the provincial per capita income.

The future of family farming in rain-fed areas

These cases underscore the role of smallholder farming in food security and environmental sustainability in India and China. The integrated approach combines progress in productivity, sustainability and impact on food security. There are two key points to note:

- agriculture, and family farming in particular, should be the clear focus of a goal related to food security and environmental sustainability
- smallholder agriculture should enter the agenda not only through a focus on productivity but also through a broader agenda of sustainability and building system resilience.

The benefits of family farming in India and China go far beyond resource degradation and scarcity and contribute to societies at large. In these countries, rain-fed agriculture provides food for about half the population, in many ways thanks to the integrated management practices adopted by farmers. Family farming in most regions, including India and China, is undergoing rapid transformation due to internal and external drivers such as population growth, urbanization, migration and resource degradation. These have contributed to increased pressure on local resources, unsustainable practices in land use, disintegration of local customs and traditions, and increased vulnerability to global change.

Smallholders in these regions have shown the potential to bridge large yield gaps by actively adapting to change. However, these efforts need to be supported by enabling policies that will help them adapt to ongoing changes in a sustainable way, to achieve sustainable livelihoods and maintain important ecosystem services. National policies need to support secure land tenure, access to resources and to empower women to promote family farming in these regions. The same is true for extension services that support farmers in achieving sustainable farming practices through advice in areas such as appropriate use of external inputs including seeds, fertilizers and pesticides. Innovative technologies and traditional knowledge need to be carefully integrated to increase and restore resilience along with better access to markets through collective cooperation.