

**האוניברסיטה העברית בירושלים**  
**The Hebrew University of Jerusalem**



**המרכז למחקר בכלכלה חקלאית**  
**The Center for Agricultural**  
**Economic Research**

**המחלקה לכלכלה חקלאית ומנהל**  
**The Department of Agricultural**  
**Economics and Management**

**Discussion Paper No. 9.11**

**Land use policies and practices for reducing vulnerability in**  
**rural Tajikistan**

**by**

**Zvi Lerman and Bettina Wolfgramm**

Papers by members of the Department  
can be found in their home sites:

מאמרים של חברי המחלקה נמצאים  
גם באתרי הבית שלהם:

<http://departments.agri.huji.ac.il/economics/indexe.html>

P.O. Box 12, Rehovot 76100, Israel

ת.ד. 12, רחובות 76100

# Land use policies and practices for reducing vulnerability in rural Tajikistan<sup>1</sup>

Zvi Lerman

Department of Agricultural Economics and Management, The Hebrew University of Jerusalem, Israel  
[lerman@agri.huji.ac.il](mailto:lerman@agri.huji.ac.il)

Bettina Wolfgramm

CDE – Center for Development and Environment, University of Bern, Switzerland  
and UCA – University of Central Asia, Bishkek, Kyrgyzstan  
[Bettina.Wolfgramm@cde.unibe.ch](mailto:Bettina.Wolfgramm@cde.unibe.ch)

## Abstract

Tajikistan, with 93% of its surface area taken up by mountains and 65% of its labor force employed in agriculture, is judged to be highly vulnerable to risks, including climate change risks and food insecurity risks. The article examines a set of land use policies and practices that can be used to mitigate the vulnerability of Tajikistan's large rural population, primarily by increasing family incomes. Empirical evidence from Tajikistan and other CIS countries suggests that families with more land and higher commercialization earn higher incomes and achieve higher well-being. The recommended policy measures that are likely to increase rural family incomes accordingly advocate expansion of smallholder farms, improvement of livestock productivity, increase of farm commercialization through improvement of farm services, and greater diversification of both income sources and the product mix. The analysis relies for supporting evidence on official statistics and recent farm surveys. Examples from local initiatives promoting sustainable land management practices and demonstrating the implementation of the proposed policy measures are presented.

**Keywords:** Vulnerability to risks; rural incomes; agriculture; land use policies; Tajikistan; climate change risks; sustainable land management; transition countries.

Tajikistan is a mountainous country, with 93% of its surface area taken up by Tien-Shan and Pamir ranges. Almost half the country is at altitudes of more than 3,000 m. Despite the inhospitable terrain, Tajikistan is a highly agrarian country with agriculture accounting for 65% of employment and 25% of GDP (TAJSTAT 2010a). As is typical of agrarian economies, Tajikistan has low income per capita (WDI 2010), which is the lowest in the Commonwealth of Independent States (CIS). Tajikistan also has high rural poverty: 43% of the rural population live below \$2.15 per day, compared with 30% for the urban population (TAJSTAT 2010b).

Because of its profile – mountainous terrain, high dependence on agriculture, low incomes, and high poverty – Tajikistan is vulnerable to risks, including climate change risks and food insecurity risks. By some vulnerability assessments, it is the most vulnerable among the 28 countries in the World Bank's Europe and Central Asia (ECA) region (World Bank 2009). This article examines how Tajikistan's vulnerability can be mitigated by a set of land use policies and practices. Vulnerability and resilience are treated within the conceptual framework of the Intergovernmental Panel on Climate Change (IPCC 2007).

The article is organized in five sections. The first section reviews the current state of land resources and the outcomes of land reform in Tajikistan. The second section introduces the three dimensions of vulnerability – exposure, sensitivity, and adaptive capacity – and identifies the

---

<sup>1</sup> This article is based on research carried out as part of the Pilot Program for Climate Resilience (PPCR) in Tajikistan, Phase 1, Component A5, Agriculture and Sustainable Land Management (SLM), February-August 2011.

characteristics that are responsible for Tajikistan's high sensitivity and low adaptive capacity. In the third section, policy measures for increasing the resilience of land use in Tajikistan are elaborated, drawing on national statistics and farm surveys for supporting evidence. The fourth section presents examples from local initiatives on how to implement the proposed policy measures in practice. The fifth section concludes.

## **Land resources and outcomes of land reform**

Less than 30% of Tajikistan's territory is agricultural land (4.0 million ha in 2009). Pastures are the dominant component – 75% of agricultural land. Cultivable area covers 25% of agricultural land – 22% arable land and 3% land under orchards and vineyards. Despite the dominant share of pastures in land resources, livestock accounts for only 30% of Gross Agricultural Output (GAO). Tajikistan's agriculture is 70% cultivated crops, produced on 25% of agricultural land. Crop agriculture is substantially more productive than livestock (Lerman and Sedik 2008).

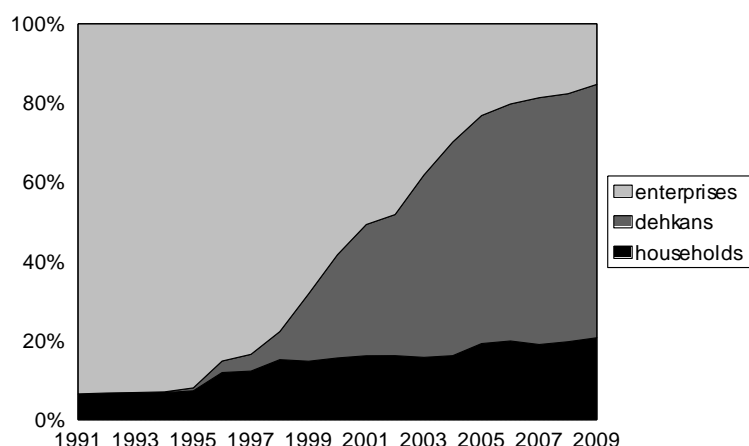
The climate in Tajikistan is semi-arid and arable agriculture is heavily dependent on irrigation, drawing water from the huge glaciers in the high mountains. However, the plentiful water does not always reach the fields because of the poor technical condition of the Soviet-era irrigation infrastructure. The deterioration of the irrigation system since independence is attributable to inadequate institutions for water sector management (Strategy 2006).

Tajikistan's land resources are inherently limited, while its population, especially the rural population, is growing rapidly. The area of arable land has remained fairly constant at around 850,000 ha since 1980, while the rural population more than doubled from 2.6 million to 5.5 million (TAJSTAT 2011). Rural population density was 6.3 persons per ha of arable land in 2009. This is comparable to that in Kyrgyzstan, Turkmenistan, and Uzbekistan, but an order of magnitude higher than in Kazakhstan, Russia, and Ukraine.

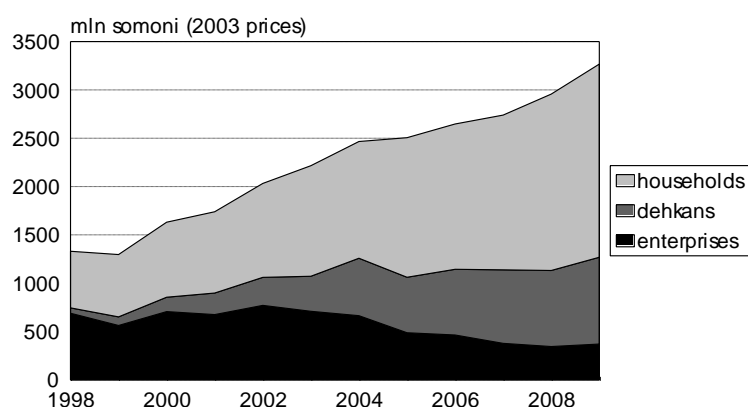
It is usually claimed that unsustainable land management in Tajikistan has led to large-scale land degradation. Unfortunately there are no systematic statistics on soil quality and land degradation. Available estimates indicate that 89% of agricultural land in Tajikistan suffers high and medium level of erosion and that erosion affects 60% of the irrigated land (UNECE 2004); degradation due to overgrazing involves approximately 3 million ha, or 85% of pastureland (NAPCD 2000). These fragmentary estimates indeed suggest that erosion and other types of soil degradation are important problems in Tajikistan, adversely affecting production and farmers' incomes. The problem has been addressed by many small initiatives and projects over the last 15 years. A recently conducted inventory of sustainable land management (SLM) practices in Tajikistan documented the experiences of 14 different governmental and non-governmental organizations, producing 70 case studies that cover an estimated 9,000 ha of land (World Bank 2011).

Land in Tajikistan is exclusively owned by the state and it is given to farmers and households in use rights (legally conferred by a land use certificate). Instead of land privatization, Tajikistan has undergone individualization of agriculture – a shift to individual and family farming on state-owned land (Lerman and Sedik 2008). Prior to 1992, 95% of cultivable land was controlled by agricultural enterprises (collective and state farms) and 5% was in household plots – the smallholder family agriculture that persisted all through the Soviet era (**Figure 1**). The land reform that began in 1992 reduced the share of agricultural enterprises to just 25% of cultivable land by 2009, while the share of household plots increased dramatically to 20% (through land distribution from the state reserve in 1995 and 1997) and another 65% shifted to dehkan (or peasant) farms, a new organizational form that began to emerge after 1992. Dehkan farms and household plots combined accounted for 85% of cultivable land in 2009, up from just 5% in 1991. Most dehkan farms today are individual and family farms, as the number of originally created partnership (or collective) dehkan farms is rapidly shrinking due to the government's

program reallocating land to individual farm members. The use of cultivable land in Tajikistan has been effectively individualized since 1991.



**Figure 1.** Structure of land use by farm type, 1991-2009. Source: Lerman and Sedik (2008), updated from TAJSTAT (2010a).



**Figure 2.** GAO by farm type (million somoni in constant prices). Source: Lerman and Sedik (2008), updated from TAJSTAT (2010a).

The allocation pattern for pastures is somewhat different: household plots do not have any pastures (only cultivable land); dehkan farms control about two-thirds of all pastures (roughly 2 million ha) and the remaining one-third is still held by agricultural enterprises (TAJSTAT 2010a). It is impossible to say how much of the 2 million ha of pastures in dehkan farms has been transferred to individual and family use and how much remains in collective use.

Despite substantial expansion, household plots remain very small, averaging 0.3 ha (compared with about 5 ha on average for individual and family dehkan farms and 100-200 ha for partnership dehkan farms). There are 750,000 household plots in Tajikistan (UNICEF 2009) and only 50,000 dehkan farms (TAJSTAT 2010a). The increase of land resources in household plots has inevitably led to an increase of their share in agricultural production. While the share of agricultural enterprises in GAO dropped from 65% in 1995 to less than 10% in 2009, the share of household plots soared from 35% to 65% (**Figure 2**). The remaining 25% comes from dehkan farms – the second component of the individual farm sector that started to contribute after 1997. Agricultural production, like land use, is now fully individualized in Tajikistan. Since household plots produce 65% of agricultural output on 20% of cultivable land, they are obviously much more productive than other farm types. Due to their high productivity, household plots are the engine of agricultural growth: they are responsible for the recovery of Tajikistan's agriculture, with GAO more than doubling between 1998 and 2009, despite the sharp decline in the output of agricultural enterprises (**Figure 2**). These achievements may be attributed to the well-known advantages of family farms with their strong internal cohesion and accountability.

## Dimensions of vulnerability: exposure, sensitivity, adaptive capacity

An individual or a household is *vulnerable to risks* (among them also risks associated with climate change) if these risks may result in a loss of well-being to a level below some threshold. The opposite of vulnerability is resilience. Vulnerability assessments usually rely on different combinations of geo-climatic and socio-economic variables, which are always matched to the three defining dimensions of vulnerability: exposure, sensitivity, and adaptive capacity (**Table 1**). Exposure and sensitivity both act to increase vulnerability, while higher adaptive capacity mitigates vulnerability.

**Table 1. The defining dimensions of vulnerability**

• <i>Exposure to risks</i> : the chance that assets and livelihoods will be impacted by risk
• <i>Sensitivity to risks</i> : the susceptibility of assets and livelihoods exposed to risk
• <i>Adaptive capacity</i> : the ability to deploy social risk management strategies (i.e., adjustments in assets, livelihoods, behaviors, technologies, or policies) for reduction of risk and human vulnerability; adaptive capacity signifies ability to recover from, to prevent, or to mitigate the effects of risk.

Source: Heltberg and Bonch-Osmolovskiy (2011)

Climate change is one of the elements that contribute to increased variability and risk, exacerbating already existing vulnerabilities (Oxfam 2011). Tajikistan is judged to have only moderate exposure to climate change risks in the sense of likelihood to experience the greatest increases in climate extremes by the end of the 21st century, but overall it is the most vulnerable to climate change risk among the 28 ECA countries due to the combination of its high sensitivity and negligible adaptive capacity (World Bank 2009).

**Table 2** lists the socio-economic determinants of vulnerability that generally occur in various combinations in the literature. Family well-being is the main defining factor for vulnerability due to its dominant effect on adaptive capacity. Well-being in turn is primarily determined by family income – both the level of income and the stability of income over time. A complementary view of family well-being is provided by poverty data, such as poverty headcounts and indirectly also infant mortality, child undernourishment, or food insecurity.

**Table 2. The effect of main socio-economic variables on vulnerability**

Indicators	Effect on vulnerability	Situation in Tajikistan
• Income and well-being	–	Low but increasing
• Poverty (also infant mortality, undernourishment, food insecurity)	+	High but decreasing
• Debt and financial insecurity	+	Not critical
• Agricultural land	–	Small holdings, land not transferable
• Livestock	–	Small number of animals in each household, headcount increasing
• Commercialization (share of production sold)	–	Low, underdeveloped
• Population density: stress on land and water resources	+	Increasing (fast population growth)
• Irrigation: stress on water resources	+	Poorly maintained, inefficient system
• Water availability	–	Ample, from glaciers
• Diversification of income and farm production	–	Underdeveloped

Statistical data from Tajikistan (WDI 2010, TAJSTAT 2010a, TAJSTAT 2011, SOFI 2010) provide evidence of positive trends in all well-being indicators in recent years (GDP per capita, per capita household incomes, rural poverty rates, infant mortality rates, and the proportion of undernourished). These developments improve adaptive capacity and thus mitigate vulnerability,

but absolute levels of vulnerability remain high. Furthermore, rural population appears to be more vulnerable than urban population due to lower per capita incomes, higher poverty rates, and higher infant mortality.

### **Sensitivity of rural livelihoods in mountainous Tajikistan**

Reviewing the discussion of land and water resources and farm structure through the lens of vulnerability, we can identify the following characteristics that are responsible for Tajikistan's high sensitivity:

- High population density (high stress on both land and water resources)
- Small farm sizes and cultivation of small plots on mountain slopes (low income potential)
- Acute dependence on irrigation combined with degraded irrigation infrastructure (high stress on water resources, sensitivity to climate change due to glacier melting)
- High soil degradation, unproductive lands (adverse effect on production and income)
- Difficult access to markets due to a combination of physical (mountainous terrain) and institutional (underdeveloped sales channels) factors (adverse effect on income)

### **Adaptive capacity of mountain rural population**

We proceed to discuss measures that can be used to improve the adaptive capacity of Tajikistan's large rural population. We primarily focus on measures that increase family incomes and thus make the rural population more resilient to risks. Families with high and stable income are less sensitive to risk and are able to apply a wider range of coping strategies (i.e., have high adaptive capacity). Poor families are more sensitive to risk and have no resources to cope with adversity.

Rural families largely depend on agriculture and their income is primarily generated by land and livestock (plus family labor). Productive farming also requires access to machinery, purchased inputs (such as fertilizers and quality seeds), veterinary services, and extension information. Cash income is augmented through sale of part of farm output, and this requires marketing channels. Adequate resources and farm services make it possible to maintain income generation at satisfactory levels and thus act to reduce vulnerability.

Income from agriculture – especially in mountain regions – is highly variable due to its dependence on weather and other natural conditions. This variability is likely to increase in the future due to climate change. Diversification of income sources is a standard technique for reducing the variability of income streams and thus mitigating vulnerability.

Individualization of cultivable land in the process of land reform has led to recovery of agricultural growth and increased productivity (Lerman and Sedik 2008). Family farms (including household plots) have proved substantially more productive than farms of other types, which underscores their high adaptive capacity. Thus, supporting family dehkan farms and household plots is an effective policy to increase the adaptive capacity of rural livelihoods in Tajikistan.

### **From vulnerability to resilience: an agricultural economics perspective**

The conceptual framework developed above suggests three policy directions for improving the adaptive capacity of Tajikistan's rural population:

- Improve income generating capacity through attention to the resource base: increase the land endowment of the rural population, increase land use efficiency and sustainability
- Improve income generating efficiency through better access to farm services: increase farm commercialization and livestock productivity

- Encourage diversification into additional crops and new income sources

Below we explore these directions as opportunities for the rural population to become more climate resilient.

### **Land and commercialization increase family well-being**

Evidence from all CIS countries conclusively shows that per capita family incomes and family well-being increase with the increase of the land allotment in family farms. Furthermore, families with more land demonstrate a greater readiness to sell their farm output and thus increase their available income with cash revenue from sales. New survey evidence for Tajikistan (World Bank 2011, Appendix 2) demonstrates that larger family farms attain a higher level of well-being (**Table 3**, first column) and that greater commercial orientation is associated with higher levels of well-being (**Table 3**, second column). Respondents who fall in the “high” well-being category have more land than those in the “low” well-being category (6.0 ha compared with 3.5 ha) and earn a higher share of their family income from farm sales (42% compared with 30%).

**Table 3.** Farm size and share of farm sales in family income for different levels of well-being

Well-being level	Irrigated land, ha	Share of farm sales in family income, %
High: comfortable consumption regime (n=60)	6.0	42
Low: able to purchase food and daily needs only (n=46)	3.5	30

Source: PPCR farm survey, May 2011 (World Bank 2011, Appendix 2).

### **Expansion of land holdings**

A clear policy prescription for reducing vulnerability is to expand the land allotments of the highly productive rural households and family dehkan farms. This can be accomplished in several ways.

#### *Distribution of inefficiently used land*

The state land reserve in Tajikistan is less than 1% of arable land (land balance data for January 2010), which rules out another wave of land distribution for expansion of the small farms. However, 15% of cultivable land (nearly 130,000 ha) is still managed by agricultural enterprises (**Figure 1**), which achieve relatively low productivity levels. In addition, a substantial area of cultivable land is held in collective dehkan farms, which are not more productive than the former *kolkhozes* that they succeeded. Land in agricultural enterprises and collective dehkan farms is a large hidden reserve that may be as high as 30% of Tajikistan’s 1.1 million ha of cultivable land (Lerman and Sedik 2008). Making at least part of this land available for distribution to small family-based farms could further increase the productivity of the agricultural sector and reduce vulnerability of the rural population. Government initiatives promoting transformation of partnership dehkan farms into family farms since 2007 have already produced noticeable increases in the average size of small farms (TAJSTAT 2010a). These and similar efforts for expansion of small farms should be broadened and intensified.

#### *Development of land markets*

Since the options for additional land distribution are inherently limited, it would be important to enable farmers to adjust the size of their holdings through land market transactions. Land markets allow land to flow from less efficient or inactive users to more efficient and productive ones, and the development of land markets will allow enterprising farmers to increase the size of their farms and achieve higher incomes. Given that all agricultural land in Tajikistan is owned by the state and thus cannot be bought or sold, the only feasible way for land markets to develop today is by allowing transferability of land use certificates – either temporarily (through leasing) or permanently (through selling). This option is included as one of the proposed amendments in

the new Land Code currently under discussion. Safeguards ensuring that distressed smallholders cannot be pressured into giving up their land to more powerful land users will have to be introduced as land markets develop. These safeguards may restrict transactions in agricultural land to bona fide farmers, thus precluding land accumulation in the hands of rich investors; they may ensure that no household remains landless through bankruptcy or forced sales by allowing distressed families to keep at least their household plots.

#### *Return of unused land to cultivation*

Another option involves identification of currently unproductive or unused lands that have a potential for being upgraded to productive use. To implement this option, unproductive and unused lands should be fully inventorized at the village level and earmarked for distribution to small farmers for productive cultivation. Such practices have already been implemented in Tajikistan: examples are listed in **Table 5** below (the agroforestry category).

The process may require overcoming certain legal obstacles, such as permissions to convert pastures into orchards. Farmers willing to invest in rehabilitating degraded land should benefit from incentives, such as tax credits, exemption from the higher tax applicable to orchards, and access to low-interest micro-loans or grants for investment in conversion.

#### **Improving livestock productivity**

In Tajikistan the livestock herd is concentrated almost totally in rural households, each with 1-2 animals (**Table 4**). Livestock is an important source of both food and income for the rural households. There is a ready cash market for live animals, while milk is easily sold to dairies or directly to consumers. Livestock sales represent 56% of total sales revenue from household plots, most of it (36%) from sale of live animals and the rest mainly from milk sales (World Bank 2011, Appendix 2). Milk yields in Tajikistan are the lowest among all CIS countries, averaging 800 kg per cow per year. Higher livestock productivity will increase the production volumes per household, increasing their incomes and in effect taking them out of the “smallness trap”.

**Table 4. Livestock in rural households 2009**

	Headcount in rural households	% of national headcount	Average per household*
Cattle	1,676.3	92	2.2
Cows	909.7	96	1.2
Sheep & goats	3456.9	82	4.6

\*Based on 757,608 rural households (UNICEF 2009)

Source: TAJSTAT (2010a).

Poor animal genetics, inadequate supply of cultivated feed, and degraded pastures are among the main reasons for low livestock performance. While the animal headcount increases over time, the area sown to feed crops declined precipitously after 1990 and the quantity of feed harvested also fell sharply (in 2007 it was merely 15%-30% of the harvest in 1990). This contraction of cultivated feed crops is largely the outcome of government policies that until recently imposed production targets for wheat and cotton and in effect discouraged or even prohibited allocation of land for feed crops. In principle, decrease in feed crops should be compensated by increased grazing, but according to statistics the area of pastures has decreased by 300,000 ha (about 10%) since 1997. This was another outcome of government policies, which ignored efficient pasture management, contributing to unsustainable use and degradation of pastures. Climate change also contributes increasingly to low pasture productivity. Recent years have seen warmer winters and the decreasing snow cover adversely affects the availability of soil moisture on pastures in the spring.



Measures for improving livestock productivity may include the following:

- greater attention to feed sufficiency, including development of high-yield varieties of feed crops and rehabilitation of pastures (re-seeding, fencing, adoption of pasture rotation schemes, gully rehabilitation);
- provision of more watering points for animals in grazing areas;
- attention to animal health through modernization of veterinary services;
- improvement of animal breeds through artificial insemination, including breed selection for both higher yields and greater tolerance to local climate.

### **Increasing commercialization through improvement of farm services**

Small farmers will sell their products more readily if they have good access to marketing channels. Improvements in other farm services – input supply, machinery (rental and maintenance), extension, credit – will lead to more efficient production and generate higher incomes.

Best-practice world experience suggests that farmers' service cooperatives provide the most effective way of improving the access of small farmers to market services and enabling them to meet higher quality standards. Service cooperatives do not rule out private initiative: private trade intermediaries, integrators, and service providers should be allowed to co-exist with service cooperatives and continue their currently developing operations. Government officials and decision makers have to acknowledge the contribution of small farms and focus on policies that ensure a supportive market environment for the small-farm sector (including household plots).

### **Diversification of income and farm production**

More land, improved livestock productivity, and greater commercialization allow farmers to achieve higher incomes. Yet income flows are prone to variability and therefore risky. Diversification is a standard risk-reducing tool in economic practice, and it can be effectively used to reduce vulnerability.

Diversification should be increased on two levels: (a) diversification of income sources to reduce income risks and (b) diversification of the agricultural product mix to reduce production risks. Family incomes today are strongly dependent on a single source, with 50%-70% deriving from agriculture (World Bank 2011, Appendix 2). Diversification of income sources is usually achieved by accepting wage employment outside agriculture and by expanding entrepreneurial activities. Wage employment (including remittances for family members working abroad as migrants) constitutes already now a significant component of family income. Income from entrepreneurial activities, however, is so far negligible. Policy measures should be put in place to encourage development of off-farm activities in rural areas, including small-scale processing, cottage industries, and small business initiatives (transport, trade, intermediation, tourism). Encouragement of off-farm activities requires an intelligent public awareness and education campaign; it may also require micro-financing with loans or grants, establishment of alternative credit mechanisms (e.g., credit unions as an alternative to commercial banks), and innovative tax measures to provide additional incentives.

In terms of product diversification, Tajikistan's agriculture is 70% crops and only 30% livestock (TAJSTAT 2010a). Only one-quarter of small dehkan farms engage in both crop and livestock production (World Bank 2011, Appendix 2); the rest produce crops, but no livestock. Tajikistan's agriculture thus bears an unbalanced risk due to the dominance of crop enterprises with their exposure to weather and climate change risks. Measures to improve livestock productivity (see above) will inevitably result in higher output and increase the share of livestock production, leading to a more balanced and less vulnerable product mix.

Crop production is characterized by concentration in just two crops – cotton and wheat, which have traditionally occupied in varying proportions up to 70%-80% of total sown area (TAJSTAT 2010a). The remainder was split between feed crops and horticulture (potatoes, vegetables, melons, fruits, and grapes). Here, as with the crop/livestock mix, we witness basic diversification of crop production, but the diversification is not very pronounced: cotton and wheat dominate the cultivated area.

The specialization in cotton and wheat is an inherited feature of the government policies that prevailed until 2008. During most of the period since independence authorities dictated the allocation of land to “strategic” crops and set production targets for cotton and wheat. To encourage further diversification of dehkan farms away from cotton and wheat, the government should ensure strict compliance – at all levels – with the full intent of the “freedom to farm” provisions adopted in several rounds since 2007. These provisions release farms from production targets on cotton and wheat, eliminate administrative intervention in production and land allocation decisions, and allow farmers to decide where and how to sell their output (World Bank 2011). Implementation of the “freedom to farm” principles should enable small farms to maximize their relative advantage by specializing to a greater extent in labor intensive horticultural crops, which are ideally suited for small farms with their abundance of relatively cheap labor. Relaxation of production constraints should also lead to allocation of more land to feed crops, ensuring that livestock is supplied with enough feed to maintain reasonable milk yields.

### **Implementation of policy measures: upscaling of existing SLM practices**

Many examples of existing SLM practices in Tajikistan implement various aspects of the policy measures proposed for reducing the vulnerability of the rural population. These examples have been documented in the WOCAT online database ([www.wocat.net](http://www.wocat.net)).

**Table 5** lists 14 practices grouped by the main policy measures: expansion of land holdings, diversification of farm production, improvement of livestock productivity, and improvement of farm services. These practices were introduced by innovative individual farmers, by non-governmental organizations, or through programs in collaboration with the government. So far these are basically local initiatives, but they hold considerable potential for national roll-out.

### **Conclusions**

Tajikistan is characterized by limited availability of cultivable land and prevalence of smallholders – a situation representative of other mountain regions. The rural population is judged to be highly vulnerable to risk, including climate change and food insecurity risks, and policy frameworks are needed to build resilience, especially in mountain rural areas. Empirical evidence demonstrates that land and commercialization increase family well-being and thus reduce vulnerability. This evidence suggests four policy recommendations for increasing family income and reducing vulnerability: (1) expansion of land holdings, (2) improving livestock productivity, (3) increasing commercialization through improvement of farm services, and (4) diversification of income and farm production.

SLM case studies in Tajikistan demonstrate the existence of good practices implementing these policy recommendations, but their scope is limited to small areas. The information about successful experiences should be widely disseminated, e.g., by uploading standardized knowledge documentation to an online database (such as WOCAT). Knowledge dissemination will lead to wider adoption of the relevant practices by stakeholders.

**Table 5. Examples of WOCAT sustainable land management practices in Tajikistan in the context of proposed policy measures**

Policy measures	Practice category	Case title	Code*	URL suffix**
Expansion of land holdings and diversification	Agroforestry**	Orchard-based agroforestry	WT TAJ003	_id=166
		Rehabilitation of poor soils through agroforestry	WT TAJ113	_id=346
		Conversion of grazing land to fruit and fodder plots	WT TAJ004	_id=167
		Development of stony slopes for establishment of irrigated apricot orchard	WT TAJ365	_id=365
		Integrated Technologies for Household Plots	WT TAJ370	_id=370
	Financial support (startup capital for SML initiatives)	SLM small grant allocation mechanisms	WA TAJ044	_id=332
Increasing livestock productivity	Improved grazing land	Rotational grazing supported by additional water points	WT TAJ100	_id=148
		Growing of fodder grass on steep slope	WT TAJ103	_id=297
		Pasture improvement through Izen plantation	WT TAJ368	_id=368
		Perennial herbaceous fodder plants for intact canopy cover	WT TAJ009	_id=259
Commercialization to increase family well-being	User associations	Income generation activities of poor women in Muminabad	WA TAJ036	_id=323
Improving farm services	User associations	Creation of a seed association	WA TAJ024	_id=307
	Knowledge transfer	Technical advisory groups	WA TAJ024	_id=331
		Farmer field schools	WA TAJ108	_id=292

\*WT – WOCAT Technology; WA – WOCAT Approach.

\*\*Agroforestry involves combined cultivation of trees and annual crops.

\*\*\*To access the cases in the WOCAT online database, the URL suffix should be preceded by <http://cdewocat.unibe.ch/wocatQA/SummaryApproach.php?selected> for WA cases and by [http://cdewocat.unibe.ch/wocatQT/qt\\_summary.php?](http://cdewocat.unibe.ch/wocatQT/qt_summary.php?) for WT cases.

## REFERENCES

- Heltberg R, Bonch-Osmolovskiy M. 2011. *Mapping Vulnerability to Climate Change*. Policy Research Working Paper 5554. Washington: World Bank.
- Lerman Z, Sedik D. 2008. *The Economic Effects of Land Reform in Tajikistan*. Policy Studies on Rural Transition 2008-1, FAO Regional Office for Europe and Central Asia.
- NAPCD. 2000. *National Action Program to Combat Diversification* [in Russian]. Dushanbe: Ministry of Nature Protection of the Republic of Tajikistan.
- Oxfam. 2011. *Climate Change: Beyond Coping*. Oxfam Field Research.
- SOFI. 2010. *The State of Food Security in the World*. Annual publication, FAO and World Food Program.

Strategy. 2006. *Water Sector Development Strategy in Tajikistan*. Dushanbe: Ministry of Irrigation and Water Management/UNDP.

TAJSTAT. 2010a. *Agriculture in Tajikistan 2010*. Dushanbe: Tajikistan State Committee of Statistics.

TAJSTAT. 2010b. *Analysis of Poverty in Tajikistan* [in Russian]. Dushanbe: Tajikistan State Committee of Statistics.

TAJSTAT. 2011. *Demographic Yearbook of Tajikistan 2010*. Dushanbe: Tajikistan State Committee of Statistics.

UNECE. 2004. *Environmental Performance Reviews: Tajikistan*, New York and Geneva: UN Economic Commission for Europe.

UNICEF. 2009. *Tajikistan Standard of Living Survey 2007*. Dushanbe: Tajikistan State Statistical Committee and UNICEF.

WDI. 2010. *World Development Indicators*. Online database, Washington: World Bank.

World Bank. 2009. *Adapting to Climate Change in Europe and Central Asia*. Washington: World Bank.

World Bank. 2011. *Agriculture and Sustainable Land Management*. Tajikistan Pilot Programme for Climate Resilience Component A5: Phase 1, Draft report, Dushanbe.

## PREVIOUS DISCUSSION PAPERS

- 1.07 Joseph Gogodze, Iddo Kan and Ayal Kimhi – Land Reform and Rural Well Being in the Republic of Georgia: 1996-2003.
- 2.07 Uri Shani, Yacov Tsur, Amos Zemel & David Zilberman – Irrigation Production Functions with Water-Capital Substitution.
- 3.07 Masahiko Gemma and Yacov Tsur – The Stabilization Value of Groundwater and Conjunctive Water Management under Uncertainty.
- 4.07 Ayal Kimhi – Does Land Reform in Transition Countries Increase Child Labor? Evidence from the Republic of Georgia.
- 5.07 Larry Karp and Yacov Tsur – Climate Policy When the Distant Future Matters: Catastrophic Events with Hyperbolic Discounting.
- 6.07 Gilad Axelrad and Eli Feinerman – Regional Planning of Wastewater Reuse for Irrigation and River Rehabilitation.
- 7.07 Zvi Lerman – Land Reform, Farm Structure, and Agricultural Performance in CIS Countries.
- 8.07 Ivan Stanchin and Zvi Lerman – Water in Turkmenistan.
- 9.07 Larry Karp and Yacov Tsur – Discounting and Climate Change Policy.
- 10.07 Xinshen Diao, Ariel Dinar, Terry Roe and Yacov Tsur – A General Equilibrium Analysis of Conjunctive Ground and Surface Water Use with an Application to Morocco.
- 11.07 Barry K. Goodwin, Ashok K. Mishra and Ayal Kimhi – Household Time Allocation and Endogenous Farm Structure: Implications for the Design of Agricultural Policies.
- 12.07 Iddo Kan, Arie Leizarowitz and Yacov Tsur - Dynamic-spatial management of coastal aquifers.
- 13.07 Yacov Tsur and Amos Zemel – Climate change policy in a growing economy under catastrophic risks.
- 14.07 Zvi Lerman and David J. Sedik – Productivity and Efficiency of Corporate and Individual Farms in Ukraine.
- 15.07 Zvi Lerman and David J. Sedik – The Role of Land Markets in Improving Rural Incomes.
- 16.07 Ayal Kimhi – Regression-Based Inequality Decomposition: A Critical Review And Application to Farm-Household Income Data.

- 17.07 Ayal Kimhi and Hila Rekah – Are Changes in Farm Size and Labor Allocation Structurally Related? Dynamic Panel Evidence from Israel.
- 18.07 Larry Karp and Yacov Tsur – Time Perspective, Discounting and Climate Change Policy.
- 1.08 Yair Mundlak, Rita Butzer and Donald F. Larson – Heterogeneous Technology and Panel Data: The Case of the Agricultural Production Function.
- 2.08 Zvi Lerman – Tajikistan: An Overview of Land and Farm Structure Reforms.
- 3.08 Dmitry Zvyagintsev, Olga Shick, Eugenia Serova and Zvi Lerman – Diversification of Rural Incomes and Non-Farm Rural Employment: Evidence from Russia.
- 4.08 Dragos Cimpoei and Zvi Lerman – Land Policy and Farm Efficiency: The Lessons of Moldova.
- 5.08 Ayal Kimhi – Has Debt Restructuring Facilitated Structural Transformation on Israeli Family Farms?.
- 6.08 Yacov Tsur and Amos Zemel – Endogenous Discounting and Climate Policy.
- 7.08 Zvi Lerman – Agricultural Development in Uzbekistan: The Effect of Ongoing Reforms.
- 8.08 Iddo Kan, Ofira Ayalon and Roy Federman – Economic Efficiency of Compost Production: The Case of Israel.
- 9.08 Iddo Kan, David Haim, Mickey Rapoport-Rom and Mordechai Shechter – Environmental Amenities and Optimal Agricultural Land Use: The Case of Israel.
- 10.08 Goetz, Linde, von Cramon-Taubadel, Stephan and Kachel, Yael – Measuring Price Transmission in the International Fresh Fruit and Vegetable Supply Chain: The Case of Israeli Grapefruit Exports to the EU.
- 11.08 Yuval Dolev and Ayal Kimhi – Does Farm Size Really Converge? The Role Of Unobserved Farm Efficiency.
- 12.08 Jonathan Kaminski – Changing Incentives to Sow Cotton for African Farmers: Evidence from the Burkina Faso Reform.
- 13.08 Jonathan Kaminski – Wealth, Living Standards and Perceptions in a Cotton Economy: Evidence from the Cotton Reform in Burkina Faso.
- 14.08 Arthur Fishman, Israel Finkelshtain, Avi Simhon & Nira Yacouel – The Economics of Collective Brands.
- 15.08 Zvi Lerman - Farm Debt in Transition: The Problem and Possible Solutions.

- 16.08 Zvi Lerman and David Sedik – The Economic Effects of Land Reform in Central Asia: The Case of Tajikistan.
- 17.08 Ayal Kimhi – Male Income, Female Income, and Household Income Inequality in Israel: A Decomposition Analysis
- 1.09 Yacov Tsur – On the Theory and Practice of Water Regulation.
- 2.09 Yacov Tsur and Amos Zemel – Market Structure and the Penetration of Alternative Energy Technologies.
- 3.09 Ayal Kimhi – Entrepreneurship and Income Inequality in Southern Ethiopia.
- 4.09 Ayal Kimhi – Revitalizing and Modernizing Smallholder Agriculture for Food Security, Rural Development and Demobilization in a Post-War Country: The Case of the Aldeia Nova Project in Angola.
- 5.09 Jonathan Kaminski, Derek Headey, and Tanguy Bernard – Institutional Reform in the Burkinabe Cotton Sector and its Impacts on Incomes and Food Security: 1996-2006.
- 6.09 Yuko Arayama, Jong Moo Kim, and Ayal Kimhi – Identifying Determinants of Income Inequality in the Presence of Multiple Income Sources: The Case of Korean Farm Households.
- 7.09 Arie Leizarowitz and Yacov Tsur – Resource Management with Stochastic Recharge and Environmental Threats.
- 8.09 Ayal Kimhi - Demand for On-Farm Permanent Hired Labor in Family Holdings: A Comment.
- 9.09 Ayal Kimhi – On the Interpretation (and Misinterpretation) of Inequality Decompositions by Income Sources.
- 10.09 Ayal Kimhi – Land Reform and Farm-Household Income Inequality: The Case of Georgia.
- 11.09 Zvi Lerman and David Sedik – Agrarian Reform in Kyrgyzstan: Achievements and the Unfinished Agenda.
- 12.09 Zvi Lerman and David Sedik – Farm Debt in Transition Countries: Lessons for Tajikistan.
- 13.09 Zvi Lerman and David Sedik – Sources of Agricultural Productivity Growth in Central Asia: The Case of Tajikistan and Uzbekistan.
- 14.09 Zvi Lerman – Agricultural Recovery and Individual Land Tenure: Lessons from Central Asia.
- 15.09 Yacov Tsur and Amos Zemel – On the Dynamics of Competing Energy Sources.

- 16.09 Jonathan Kaminski – Contracting with Smallholders under Joint Liability (revised January 2012).
- 1.10 Sjak Smulders, Yacov Tsur and Amos Zemel – Uncertain Climate Policy and the Green Paradox.
- 2.10 Ayal Kimhi – International Remittances, Domestic Remittances, and Income Inequality in the Dominican Republic.
- 3.10 Amir Heiman and Chezy Ofir – The Effects of Imbalanced Competition on Demonstration Strategies.
- 4.10 Nira Yacouel and Aliza Fleischer – The Role of Cybermediaries in the Hotel Market.
- 5.10 Israel Finkelshtain, Iddo Kan and Yoav Kislev – Are Two Economic Instruments Better Than One? Combining Taxes and Quotas under Political Lobbying.
- 6.10 Ayal Kimhi – Does Rural Household Income Depend on Neighboring Communities? Evidence from Israel.
- 7.10 Anat Tchetchik, Aliza Fleischer and Israel Finkelshtain – An Optimal Size for Rural Tourism Villages with Agglomeration and Club-Good Effects.
- 8.10 Gilad Axelrad, Tomer Garshfeld and Eli Feinerman – Agricultural Utilization of Sewage Sludge: Economic, Environmental and Organizational Aspects. (Hebrew)
- 9.10 Jonathan Kaminski and Alban Thomas – Land Use, Production Growth, and Institutional Environment of Smallholders: Evidence from Burkinabe Cotton Farmers.
- 10.10 Jonathan Kaminski, Derek Heady and Tanguy Bernard - The Burkinabe Cotton Story 1992-2007: Sustainable Success or Sub-Saharan Mirage?
- 11.10 Iddo Kan and Mickey Rapaport-Rom – The Regional-Scale Dilemma of Blending Fresh and Saline Irrigation Water.
- 12.10 Yair Mundlak – Plowing Through the Data.
- 13.10 Rita Butzer, Yair Mundlak and Donald F. Larson – Measures of Fixed Capital in Agriculture.
- 14.10 Amir Heiman and Oded Lowengart – The Effect of Calorie Information on Consumers' Food Choices: Sources of Observed Gender Heterogeneity.
- 15.10 Amir Heiman and Oded Lowengart – The Calorie Dilemma: Leaner and Larger, or Tastier Yet Smaller Meals? Calorie Consumption and Willingness to Trade Food Quantity for Food Taste.
- 16.10 Jonathan Kaminski and Eli Feinerman – Agricultural Policies and Agri-Environmental Regulation: Efficiency versus Political Perspectives.



- 1.11 Ayal Kimhi and Nitzan Tsur – Long-Run Trends in the Farm Size Distribution in Israel: The Role of Part-Time Farming.
- 2.11 Yacov Tsur and Harry de Gorter - On the Regulation of Unobserved Emissions.
- 3.11 Jonathan Kaminski and Renata Serra-Endogenous Economic Reforms and Local Realities: Cotton policy-making in Burkina Faso
- 4.11 Rico Ihle and Ofir D. Rubin- Movement Restrictions, Agricultural Trade and Price Transmission between Israel and the West Bank
- 5.11 Yacov Tsur and Cees Withagen- Preparing for Catastrophic Climate Change.
- 6.11 Jonathan Kaminski- Subjective Wealth, Policy Change, and Political Opinions: Evidence from the Cotton Reform in Burkina Faso.
- 7.11 Zvi Lerman- Tajikistan's Vulnerability to Climate Change.
- 8.11 Zvi Lerman and Bettina Wolfgramm - Vulnerability to risk among small farmers in Tajikistan: results of a 2011 survey.
- 9.11 Zvi Lerman and Bettina Wolfgramm - Land use policies and practices for reducing vulnerability in rural Tajikistan.