Agriculture and Forestry have Major Impacts on the Environment

2

Agricultural production and forest management can have major impacts on the environment. For example, soil erosion affects all regional countries; in Turkey it generates 1 billion tons of sediment per year. The agricultural and forestry sectors are responsible for almost 60 percent of waterborne nitrogen input and 50 percent of waterborne phosphorus input into the Baltic Sea, which includes a number of transition countries in the catchment area.[5] These two pollutants are the major causes of the eutrophication problems that afflict the sea (HELCOM and NEFCO 2007). A similar situation exists in the Black Sea. Indiscriminate use of pesticides in the past in Central Asia has had major impact on human health. Forest fires can cause enormous economic damage and release huge amounts of greenhouse gases. At the same time, the future of agriculture and forestry depends on the sustainable management of the resource base, including land, water and climate. Table 2 lists the main issues of concern, their geographical scope, the nature of the threat, the availability of mitigation measures, and priorities for future action.[6]

Agriculture and forestry can also be important providers of environmental services. While the potential negative side effects of poor agricultural and forestry practices have become increasingly recognized over the past decades, largely unrecognized is the unique potential these sectors also have for making positive contributions to the environment. Environmental services provided can include sequestering carbon, managing watersheds and rural landscapes, and preserving biodiversity. But currently, many of these services are undervalued and unremunerated. The challenge, therefore, is not to constrain the development of agriculture and forestry, but to provide the right incentives to encourage the development of more sustainable production systems and the provision of environmental services.

The interactions between the agriculture and forestry sectors and climate change are perhaps more complex than with any other sectors, and deserve special attention. Together, agricultural production and deforestation account for up to 30 percent of greenhouse gas emissions, second only to the energy sector (World Bank 2007d). But the sectors also offer important opportunities for carbon sequestration, such as through afforestation or improved agricultural techniques like minimum tillage. However, much of this potential has not been realized due to a lack of incentives. The production of biofuels has also been put forth as an opportunity for reducing greenhouse gas emissions (although more work is needed to reduce the environmental footprint of biofuel production and increase its economic viability). At the same time, due to their dependence on weather and the resource base, agriculture and forestry are also highly sensitive to climate change. The increased frequency of heat stress, droughts and flooding events caused by

[5] Estonia, Latvia, Lithuania, Poland, and Russia are Baltic littoral countries, while Belarus, Czech Republic, and Ukraine are also located within the catchment.

[6] The information in Table 2 is intended to provide a broad, generalized picture of the whole region. There are many country exceptions, which will be described in Volume II of this study.

global warming will reduce crop yields and livestock productivity, while increased risks of fires and pest outbreaks will have negative consequences for forestry (Easterling et al. 2007). While aggressive mitigation of greenhouse gas emissions should continue to be a priority, most experts agree that climate change is already happening (IPCC 2007), and that countries should now be making serious efforts to reduce their vulnerability. The best way to do this is not to treat climate change in isolation, but to integrate climate change risk management into agricultural and forestry policies, programs and investments (World Bank 2006a). This is particularly important for poor farmers who are the most vulnerable.

The transition brought about major changes in agricultural production. Since the year 2000, countries of the region[7] have largely completed the wrenching transition from a socialist to a free-market economic model and, as a result, most have experienced relatively high levels of economic growth. The transition drastically changed production relationships in all sectors, none more so than agriculture. The most basic change has been the privatization of farmland, a process that is almost complete in SEE and some EECCA countries but continues in others. Evidence from elsewhere in the world[8] suggests that full private land ownership provides a powerful incentive for farmers to conserve their land and apply sustainable farming practices. In most countries, grazing land still belongs to the state and/or local communities, which presents a challenge for sustainable management.

Disruptions in the forestry sector have been perhaps more temporary in nature. Increased poverty and higher energy prices, together with a breakdown of law and order, led many rural people to exploit local forests for fuelwood and encouraged industrial-scale illegal logging in some countries. However, these problems are now being seriously addressed in many countries. Some forest land in SEE has been restored to the previous private owners,[9] while state ownership remains the norm in EECCA. Given the public-good nature of many forest benefits, state ownership of forest resources is compatible with sustainable management; the bigger challenge is to get the public-private balance right. Forest management in Europe has a long tradition of resource conservation that is now being reasserted, for example, in Croatia and Bulgaria. The forest health situation is more mixed, but most countries are taking action to control fires, pests, and diseases, including a major program in Russia that recently experienced serious difficulties as a result of a fast-track transition to decentralized fire management, as mandated by the new Forest Code (2007).

The transition to a market economy presents both a challenge and the opportunity to put in place policies and incentives that would minimize the environmental impact of increased output. The introduction of market prices for inputs, energy, and farm products has greatly altered production operations and has led to shifts in the crop mix and, often, to less input-intensive production—which has generally benefited the environment. For the same reasons, together with reduced consumer demand, livestock numbers and production have declined, putting less pressure on natural resources. For example, manure production in Russia has declined by two-thirds, or almost 400 million tons. However, there are indications that, as regional economies improve, input use and the demand for meat and dairy products will grow, eventually approaching levels now observed in Western Europe. For example, in the Baltic Sea

[7] Turkey is the exception, not being a transition country.

[8] See for example, World Bank. (2000). While it is generally rather early to observe private ownership leading to greater use of sustainable practices in EECCA, a study in Tajikistan did show that private cotton farmers were more likely to practice crop rotation (and obtain higher yields) than collective farms (World Bank. 2006b.)

[9] HELCOM and NEFCO. (2007). Projections from FAO, OECD and EFMA (2004).

Table 2: Summary of Issues

Issue	Occurrence	Nature of impact				Availability of mitigation measures	Response	Priority
		Human health	Economic productivity	Natural environment	Global commons			
Agriculture								
Soils management								
Soil erosion	Throughout the region					Technologies well understood but need to be adapted to local conditions.	Limited action, except in Turkey. Conservation tillage not widely practiced.	I
Poor structure and fertility; acidification	Throughout the region; fertility esp. in EECCA, acidification esp. in northern SEE					Technologies well understood.	Limited because of cost of amendments for poorer farmers.	II
Nutrient Conservation								
Eutrophication	Especially in the Baltic and Black Seas					Pilot projects in Russia, Turkey, Bulgaria, Romania, Serbia, Georgia, Moldova.	National program in Poland and beginning in Romania. Limited elsewhere.	I
Nitrates in drinking water	Throughout the region but esp. in Russia, Bulgaria, Croatia, Serbia, Romania					Mitigation expensive. Prevention better.	Accession countries implementing Nitrates Directive. Limited elsewhere.	I
Water Management								
Water use inefficiency	All countries with irrigated agriculture					Technologies well understood.	Projects with modest impact underway in all irrigation countries except Russia and Ukraine.	I
Waterlogging and salinity	Central Asia, Russia, Ukraine, Turkey					Basic technologies understood but more comprehensive approaches needed.	Projects with modest impact underway in all irrigation countries except Russia and Ukraine.	I
Pest Management								
Lack of pesticide regulation	Throughout the region					Technologies well understood.	Well addressed on paper; enforcement variable.	II
Non disposal of obsolete products	Throughout the region					Testing of lower cost approaches needed.	Inventories underway in most countries. Disposal projects underway in several countries, complete in three.	II
Lack of IPM	Opportunities throughout the region					Concept well accepted but much adaptive research needed.	Great success in cotton in Central Asia but limited elsewhere to high value and organic crops.	I
Rangeland deterioration	Throughout the region but esp. in Central Asia					Techniques well known but need adaptation to local conditions.	Pilot projects in Kazakhstan and Kyrgyz Republic.	II

(*continued on next page*)

Table 2: Summary of Issues (*continued*)

Issue	Occurrence	Nature of impact				Availability of mitigation measures	Response	Priority
Lack of watershed management	Upland areas					Good pilot projects that balance environmental, economic, and social factors.	Progress in Turkey and Tajikistan.	II
Threats to food safety	Throughout the region but esp. in food exporting countries					Technologies well known but systematic (and expensive) approach needed.	Good progress in most SEE and Caucasus countries.	I
Lack of organic farming	SEE, Ukraine, Georgia, Moldova					Technologies well known but economic and marketing factors may determine success.	Promising starts in most SEE countries plus Ukraine, Georgia, and Moldova.	II
Abandoned farmland	SEE and Kazakhstan					Afforestation alternative well understood.	Opportunities for economic use and/or carbon sequestration not yet widely taken. Conversion of cropland to rangeland in Kazakhstan.	II
Radioactive contamination	Belarus, Ukraine,Russia and Kazakhstan					Pioneering approaches in Belarus and Ukraine.	Chernobyl situation under control, with some land being returned to cultivation and strict standards for crops and timber. Scant action in Kazakhstan.	I
Forestry								
Unsustainable management	Throughout the region					Technologies well understood.	Annual cut less than incremental growth in all countries.	II
Threats to forest health	Throughout the region but episodic					Technologies generally understood.	Countries able to handle routine outbreaks of fire, pests, and diseases.	II
Illegal logging	Large scale in Russia, Ukraine, Albania, and Bulgaria; small scale in rest of region					Technologies being pioneered through FLEG, certification, etc.	Countries now making serious efforts; problem may be diminishing.	I
Climate Change								
Lack of mitigation	Throughout the region but especially in larger countries					Carbon sequestration technologies well understood but institutional and financial mechanisms still a challenge.	Only modest efforts in Moldovan, Romanian, and Russian forestry to date. Very large scope in the region.	I
Lack of adaptation	Throughout the region, but especially in the south					Along with knowledge on likely impacts, ideas on adaptation are being developed. Important for both agriculture and forestry.	Almost nothing has been done to develop and implement explicit adaptation action plans. Awareness being raised now.	I

Key: box with dark shade = major impact; box with light shade = lesser impact.

Notes:

1. The categorization of impacts was adapted from World Bank/OECD (1998). A category, global commons, was added to reflect the growing importance of trans-boundary impacts.
2. The rating of impacts, assessment of responses, and setting of priorities are qualitative and partly subjective, for which the authors take responsibility. Priorities for future action were assessed by balancing the seriousness of the threats (while giving greater weight to the impacts on human health) with the effectiveness of possible responses.

region, current nutrient runoff from the EU15 is significantly higher than from the EU8 or Russia. However, this situation will change as transition economies continue to grow. For example, by 2015, pig meat production is expected to increase by over 70 percent in the EU8, and poultry production is expected to increase by over 50 percent in Russia, leading to significant increases in manure. By 2016, nitrogen fertilizer use is expected to increase by 30 percent in Poland (HELCOM and NEFCO 2007). As a result of these developments, by 2020, surpluses of nitrogen and phosphorus are expected to grow by 63 percent and 84 percent, respectively, in the EU8, while they will shrink by 12 percent and 25 percent in the EU15.[10]

Countries have had to adjust to the changing role of the state in agricultural production. Instead of directing every step of the production process, ministries of agriculture now support and regulate the emerging private sector. Several countries have not yet completed that transition, and numerous vestiges of the old system remain.[11] Although many of the impacts of agriculture and forestry on the environment and on the economy in the region are similar to those observed elsewhere in the world, some may be traced to the historical legacy of this region. For example, the emphasis on food self-sufficiency in Albania during socialism led to cultivation of unsuitable land, which exacerbated soil erosion and diminished forest areas. The "virgin lands" scheme in Kazakhstan, which aimed to promote cereal cropping, had a similar motivation and caused extensive damage to the resource base.

The economic impacts may be so significant due to the long-term nature of many of these problems. To continue with the erosion example, the economic damage it causes each year may be small but the cumulative impact after 10 or 20 years may be extremely significant. In the Anatolia region of Turkey, a watershed rehabilitation project is working to restore the resource base and increase household incomes. The resulting reduction in erosion, increases in yields, and flood control are expected to generate an economic rate of return of 19 percent, even if other environmental benefits are excluded. Another impressive example of economic damage is salinity in Uzbekistan, which is estimated to cost that country $1 billion per year.[12] An ongoing World Bank project (World Bank 2003) aimed at reducing salinity over an area of 100,000 ha and enhancing wetlands is expected to give an economic rate of return of 24 percent. In neighboring Kazakhstan (World Bank 2001), restoration of the northern part of the Aral Sea is beginning to generate substantial environmental benefits but also major economic benefits in the form of fish production, with an estimated economic rate of return of 20 percent. Finally, going back to the example of eutrophication in the Baltic Sea, the upper bound on the costs of eutrophication caused primarily by agriculture and forestry is estimated at Euro 4.5 billion (HELCOM and NEFCO 2007).

Solutions to environmental issues related to agriculture and forestry are often known, as evidenced by the number of times that "technologies well understood" appears in Table 2. Western countries have faced the same issues listed in the table, with the possible exception of radioactive contamination; thus an array of policy and technical measures is available—for example, manure management to minimize nutrient outflows (Box 6) or conservation tillage and buffer strips to reduce soil erosion. Nevertheless, such technologies are often not implemented, perhaps because they usually need to be adapted to local conditions through research or pilot projects. Most of the region's countries are still at this stage on most of the issues. Table 3 shows trends with respect to

[10] HELCOM and NEFCO. (2007). Projections from EEA (2005).

[11] In a few countries, such as Belarus, Turkmenistan, and Uzbekistan, major parts of the old system, such as "state orders" and managed prices, have not been dismantled and are a major impediment to private entrepreneurship.

[12] World Bank staff estimates.

Table 3: Reported Trends of Selected Mainstreaming Indicators in EECCA and SEE Countries since 2000

	EECCA												SEE								
Indicator	ARM	AZE	BEL	GEO	KAZ	KYR	MOL	RUS	TAJ	TRK	UKR	UZB	ALB	BiH	BUL	CRO	KOS	MAC	ROM	SER	TUR
Agriculture																					
Soil Protection	↓	↓	↑	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Nutrient Conservation	↑(a)	...	↑	↑(a)	…	…	↑ (a)	↔	↑	↔	↑(a)	…	↔	↔	↔(a)	↑	…	↔	↑(a)	…	↔
Water Use Efficiency	↑(b)	↔	…	↑	↑(b)	↑(b)	↑(b)	↔	↑	↔	↔	↑+	↑(b)	↔(a)	…	…(b)	…(b)	↑	↑+	↔	↑
IPM Coverage	↔	↔	↔	↔	…	…	↔	↔	↑	↑	↑	↑↑	↔	↑(a)	…	↔	↑(a)	↑(a)	↔	…	↑(a)
Forestry																					
Protected Areas	…	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑	↑	…	↑
Forest Health	↑	↔	↑	↑	↑	↑	↑	↔	↓	↔	↔	↑	↑	↑	↑	↑	↑	↑	↑	↑	↓
Certification	↑	…	↑	↔	…	…	↔	↑	↔	↑	↑	…	…	↑	…	↑↑	…	…	↑	↑	↔
Sustained Yield ©	↓	↑	↑	↑	…	…	…	↑	…	↑	↑	↑	↑	↑	↑	↑	…	↑	↑	…	…

Note: Given the difficulties in presenting quantitative data for indictors included in this table, trend indicators (up or down arrows) have been used as proxies. Trends reported here refer to the period 2000–2006. When available, data reported in local specialists' reports, supplemented by parallel qualitative analysis by the Bank team working on this study, were used to derive these trends. See Annex 3 for a detailed list of indicators and an explanation of how they were used to define mainstreaming trends.
↑= positive trend; ↑↑ = very positive trend; ↓ = negative trend; ↔= no change; …= no data or none.

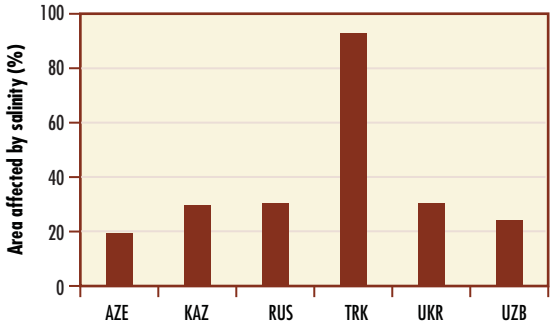
(a) Pilot level work only.

(b) Projects to rehabilitate irrigation and drainage systems will have some impact on water use efficiency, but have generally not yet focused on this objective.

(c) An "up" arrow indicates that annual harvesting is less than incremental growth but may mask factors such as over-harvesting of more accessible or higher-value forests.

DISCLAMER: The mainstreaming trends reported in this table are pending full review and validation by the respective national governments.

Figure 1: Share of Irrigated Area Affected by Moderate to Severe Soil Salinity, Select Countries (%)



Source: GEF (2003). Also, local consultant reports for this study.

selected mainstreaming indicators. How the indicators were selected is explained in Annex 2. The limitations of the table should be borne in mind: the data are of variable quality, and "up" arrows do not mean the issue is being fully addressed.

The outlook is more positive for forestry than for agriculture. As reflected in the trends reported in Table 3, harvested timber volumes are less than the incremental growth in all countries for which data are available, protected forest areas are increasing throughout the region, and certification of forest products is gaining momentum. For example, certification covers more than 90 percent of Croatia's forests, is growing rapidly in Russia (which accounts for 93 percent of the region's forests), and is starting in Armenia, despite its limited financial resources. The status of forest health is more mixed; trends are difficult to discern, but most countries are taking action to manage fires, pests, and diseases, including a major program in Russia. In agriculture, the most disturbing finding is that soil erosion is generally not being addressed—with the exception of several projects in Turkey—and is consequently getting worse across the region. Positive results are being achieved in nutrient management and IPM, although mostly on a small scale. The most progress on IPM has been made in Central Asia. As for water management, most countries with extensive irrigation systems (Russia and Ukraine being major exceptions) are acting to rehabilitate those systems, with some likely, albeit modest, improvements in water use efficiency and salinity control (see Figure 1). It should be noted that differences between the two sub-regions are relatively minor at this level of aggregation.

In each country, questionnaires were used to assess progress, especially on institutional issues and government services.[13] Results show that, in most EECCA countries, the latest agricultural and forest strategies incorporate environmental targets (see Annex 2). There are ongoing reforestation or afforestation programs in all EECCA countries, and most SEE countries have agricultural and forestry research systems that address environmental and sustainability issues. Common areas of good practice in the agricultural sector in the region as a whole include: good inter-ministerial cooperation in most countries; nutrient management research programs and pesticide regulations established; environmental impact assessments of farm operations and investments; and programs to improve water use efficiency and soil management.[14] In the forestry sector, mainstreaming efforts are more prevalent than in the agricultural sector. The main weaknesses reported were in the following areas: environmental capacity in the ministries of agriculture; extension services; programs to manage manure and capture methane; integrated pest management; support to organic farming; forest certification; the use of strategic environmental

[13] This work was initiated by OECD for its study *Progress on Environmental Management in Eastern Europe, Caucasus and Central Asia*, 2007, and expanded under the present study to include SEE. However, the results should be interpreted with caution as the respondents in the OECD study were government officials and, in the case of the World Bank questionnaire in SEE, a different consultant in each country. Comparability between countries may therefore be limited.

[14] However, these innovations are often on a small scale.

assessment of policies; and lack of cooperation between ministries of agriculture and ministries of the environment on strategy development.

Many of the impacts noted are trans-boundary or global in nature. As already mentioned, agriculture and forestry are major generators of greenhouse gases, and most of the emissions from these sources come from developing and transition countries. It is beyond the scope of this report to provide a comprehensive assessment of the impact of climate change on agriculture and forestry in transition countries.[15] However, given the growing concern on this issue and on finding ways to mitigate the release of greenhouse gases, the study did consider the potential in forestry and agriculture for carbon sequestration and methane capture (Table 2 and Boxes 2, 9, and 10), as well as the importance of adaptation to climate change. Nutrient pollution often impacts downstream water bodies, which is why early actions have focused on the Danube-Black Sea and Baltic Sea basins (Boxes 5 and 6 and para. 5.3 and 7.1). Salinization of irrigated land is widespread and increasingly trans-boundary in nature, especially in Central Asia; efforts to combat salinity in the future will require more cooperation at the river basin level (Table 2, paras. 2.6 and 4.5, and Annex 5). Programs to improve food safety (Table 2, Boxes 1 and 5, and paras. 3.1 and 6.6) or combat avian influenza also have important trans-boundary dimensions that require international cooperation.

[15] The report "Climate Change 2007: Impacts, Adaptation and Vulnerability" (2007), the Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, does consider the impacts of climate change on "food, fibre and forest products" (Ch. 5), as well as the implications for Europe (Ch. 12). A forthcoming World Bank report will look specifically at adaptation in the ECA region.