Sector Overview

Romania is endowed with high quality natural resources and tops the EU ranking by the share of the agriculture sector in the economy. However, Romanian agriculture has low productivity, and rural areas are disproportionately poor. An important factor in low productivity is the large share of small agricultural holdings.

The recommended agriculture mitigation measures – minimum tillage and manure management – will require an expenditure of €516 million over 2015-2050, or just 0.01 percent of GDP. The recommended agriculture adaptation measures will cost €1.8 billion and generate revenue of almost four billion in the modest Green scenario; a more ambitious Super Green scenario will require over €11 billion while revenues will equal €26 billion.

The share of agriculture in total gross value-added is 6 percent (for comparison, the EU average is less than two percent), while agricultural employment constitutes 29 percent of Romania’s total employment (compared to the EU average of five percent).

The modest contribution to national output but a high share of employment points to the low productivity of the sector. In fact, average crop yields in Romania are 30-50 percent below the EU average, and labor productivity in farming is four times lower than the EU average.

Also, Romania has the lowest agricultural incomes in the EU, amounting to only 22 percent of the average EU farm income per unit of full time employment.

Romania’s rural population is poorer than the rest of the country: more than 70 percent of Romania’s poor live in rural areas, while the share of rural population is 45 percent.

Romania has the lowest average farm size in the EU, equaling 3.4 ha and a large number of very small agricultural holdings: its 3.7 million farms account for one-third of the total number of farms in the entire EU.

The ageing farm population and out-migration will likely trigger commercialization of the sector over time, but effective policies will be essential to address the risk of land abandonment and fragmentation.
The sector needs to consider adaptation to a changing and less favorable climate going forward, as well as mitigate GHG emissions.

Climate change will be the greatest environmental factor affecting future agriculture, and the farming sector is one of the most vulnerable sectors in the Romanian economy. With climate change, annual average temperature will rise while precipitation will decrease.

Depending on geographic location, the projected impact of climate change on agriculture in Romania can be positive or negative, but the overall country level impact is negative, resulting from increased incidence of floods, more frequent and longer droughts, and increased risk of soil erosion and desertification. Agriculture accounts for 17.4 percent of Romania's GHG emissions.

Although the sector stands at the bottom of the EU ranking of agriculture emissions intensity due to the low productivity of the sector, this performance will worsen once agriculture becomes more efficient, unless mitigation measures are taken. Romania's agricultural agenda is connected to the Common Agricultural Policy of the EU (CAP), which provides a framework for mainstreaming climate change mitigation and adaptation activities. A new direct payment scheme obliges member states to spend a minimum of 30 percent of their national envelope for “greening” activities: crop diversification, maintaining permanent grassland and maintaining the ecological focus areas. In addition, a minimum of 30% of Romania's funds within the National Rural Development Program 2014-20 have to be earmarked for climate change mitigation and adaptation measures in agriculture, but more funding is needed.

Methodology

The impact of green adaptation policies and investments on sectoral outcomes in agriculture and related costs were assessed through joint modeling of water and agriculture.

A suite of interlinked models was used in this analysis, including

- General Circulation Models (GCMs),
- the Water Evaluation And Planning (WEAP) model
- a climate runoff (CLIRUN) model
- an agricultural yield model (AquaCrop).

The models forecasted yields and prices of the crops that account for more than 50 percent of Romania's total agricultural production: maize, barley, potatoes, soybeans, sugar beets, sunflower, wheat, tomatoes, and alfalfa.

Several adaptation measures were assessed and the following most promising ones were selected for the green scenarios: rehabilitation of irrigation infrastructure, adjustment of crop varieties, and improvement of fertilizer application. In addition to modeling, analysis involved evaluation of infrastructure investment options for agriculture.
The projected decrease in water availability due to rising temperatures will push up the demand for water for irrigation, thus increasing the already existing demand-supply gap.

Green actions address this issue through several measures:

- increased efficiency of irrigation, e.g.
- lining irrigation canals and replacing flood irrigation by sprinklers;
- improved reservoir management; increased basin storage;
- transfer water from basin to basin;
- usage of surface and ground water interchangeably.

Water sector modeling analyzed the impact of climate change on yields of nine crops over 12 basins in the baseline scenario and found that rainfed yields mostly decrease under all climate scenarios, with a varying severity of impact among types of crops and increasing impact over time, while the irrigated crops' yields improve.

In particular, maize, barley, and winter wheat will experience the least damage and will even have higher yields with climate change in some basins, while sugarbeets, potatoes, and tomatoes will suffer the highest yield loss. The regions that are projected to have the largest declines in yields are South-East, South-Mutenia, and Bucharest-lifov. The pattern is different for irrigated crops: their yields increase due to climate change because the impact of higher temperatures is positive if not accompanied by reduced water availability.

Irrigation was found to be most significant adaptation measure providing the largest gains in yields.

Irrigation is necessary for the efficiency of crop farming for most of the crops and in all regions of the country. Also, selecting climate change resistant crops would be important for productivity of agriculture. In addition, optimizing fertilizer application will help achieve even higher yields.

Selection of climate resistant crops increases yields by up to 10 percent for rainfed crops, and fertilizer application optimization pushes the yields up by four to 70 percent depending on irrigation availability, region (climate), and type of crop.
What are the costs and benefits of the green adaptation scenarios?

A modest ‘Green’ scenario will require an expenditure of approximately €1.8 billion and generate revenue of almost four billion. In the more ambitious ‘Super Green’ scenario, costs rise to over €11 billion while revenues rise to €26 billion.

In both cases, benefits outweigh costs by more than a factor of two. The benefit-cost ratio is the highest for rehabilitated irrigation and enhanced fertilizer: fertilizer’s benefit-cost ratio is 2.4 in the Green Scenario and 2.33 in the Super Green scenario; while irrigation’s ratio is 2.59 in the Super Green scenario (a measure not included in the Green scenario).

Most of the costs are incurred later, with 43 percent falling in the last decade. In the first five years, 2015-2020, the implementation of the measures will require only €69 million or six percent of the estimated financing need for 2015-2050.

Two mitigation measures - both supported by the EU and the NRDP - are considered in the agriculture mitigation analysis using the marginal abatement cost curve (MACC): minimum tillage and manure management.

The ‘no tillage’ measure would replace the current practice of using full tillage in fields. Manure management measure would apply modern practices for collecting, storing, treating, and applying manure.

The two measures have a reasonably high abatement potential, amounting to 9 percent of the total from the following sectors: power supply, energy efficiency, transport, forestry, and agriculture (see Figure 1). The measures are relatively inexpensive, deliver high level of abatement, and are beneficial for sector development.

The total discounted net cost of both measures in the period 2015-2050 equals €516 million or 0.01 percent of GDP. The costs increase over the period significantly, and almost half of the total financing will be needed during the last ten years of the period.

![Figure 1. Measures evaluated for agriculture have low cost and relatively high abatement potential](Source: Romania: A Climate Change and Low Carbon Green Growth Country Assessment, World Bank, 2015, forthcoming)

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1Present value using a five percent discount rate; costs include investment and operations and maintenance.
2See cross-sectoral analysis in Chapter 9 of the following publication: Romania: A Climate Change and Low Carbon Green Growth Country Assessment, World Bank, 2015, forthcoming.
3Present value is calculated at five percent discount rate.
Conclusions and Recommendations

The most effective adaptation measures for Romanian agriculture are rehabilitated and modernized irrigation to restore irrigated production to currently rainfed areas and optimization of agronomic inputs accompanied by high-quality extension services.

In general, fertilizer programs show strong returns to investment throughout Romania, and for best results could be targeted for those farms of medium size (roughly 10 ha) to ensure that the measures encourage consolidation of the smallest farms while also avoiding providing an unnecessary subsidy to the largest farms, which are already quite productive. A targeted approach to new varieties is likely to be most successful.

Improvements in good farming practices, like manure management and minimizing erosion through afforestation, can also reduce vulnerabilities. 4

Other measures, such as promoting organic farming and renewable energy from biomass, helping farmers and rural communities adapt to climate change, and improving awareness and better management of risks in the agriculture sector, would complement the key investments in adaptation.

Financing needs for the two recommended mitigation measures--no tillage agriculture and manure management--are low and are highly beneficial from the point of view of sector efficiency.

Emissions reduction is also relatively high. The total discounted net cost of both measures during 2015-2050 equals €516 million or 0.01 percent of GDP.

Along with the key adaptation measures, all the measures proposed here are aimed at modernization of agricultural holdings as well as at climate action in agriculture. Therefore, sufficient investment support should be earmarked for these measures within the NRDP 2014-2020.

Strengthening policy and institutional capacity is vital to support the recommended interventions.

The capacity of current research and development should be broadened, e.g., to strengthen applied sciences on new climate-resilient crop varieties, but also to improve systematic monitoring of soil, surface water, groundwater, and overall biodiversity.

The EU- and national-funded support schemes should be revisited to review how to improve the uptake of all farmers participating in climate change mitigation and adaptation measures.

4Ibid.
For more information and the publications of the OPERA-CLIMA Program, please visit its webpage at: