THEME 1

Application of the FAO Ex-ACT tool for carbon balance accounting in the agroecosystems of Tajikistan

***Olga Golubeva*, G. Kust , M. Ergashev , O. Andreeva**
Environmental Land Management Project, Committee for Environmental Protection; World Bank; Moscow Lomonosov State University

INTRODUCTION

For decision-making on the effectiveness of low-carbon technologies in the agricultural sector, it is important to know the overall carbon balance, taking into account the above-ground and below-ground carbon pools in the complex interrelated activities of the agricultural cycle. There is no single mechanism designed for accounting GHG emissions and carbon accumulation in agriculture. But there are mathematical models to assess the trends in the carbon balance change within different land management approaches. The Ex-ACT modelling tool developed by FAO (M. Bernoux, U. Grewer, L. Bockel, *et al.*; Ex-ACT Website: www.fao.org/tc/exact) to assess the carbon balance is among these models, and is based on the 'estimated quantities' in agricultural and forestry projects (Fig. 1 below).

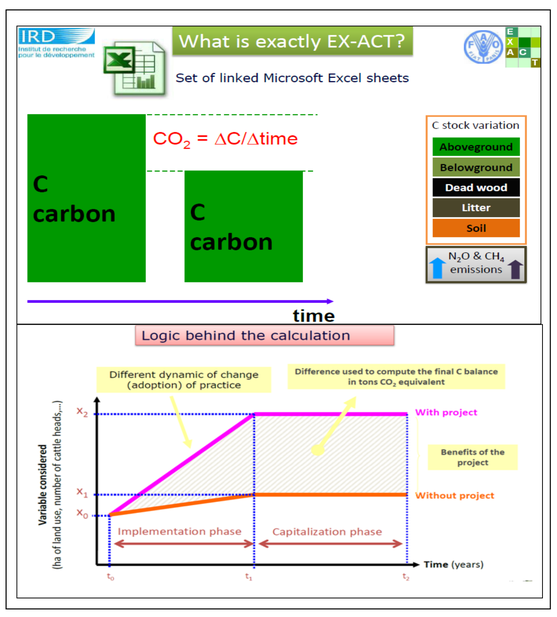

Fig. 1: The EX-ACT modelling tool

This tool was used to assess the "low-emission" efficiency of small-scale SLM activities within the project "Environmental land management and improving people's livelihoods in rural areas" in Tajikistan.

OBJECTIVES

The objectives were:
(a) Use of the "carbon-reduction" criterion for comparative assessment of agricultural technologies considering to be sustainable in different natural and socio-economic conditions;
(b) Testing applicability of the Ex-ACT method for the carbon balance control at the level of communities and small farmers. Data from about 800 local projects implementing in the rural area Tajikistan in 2015-2016 were treated in Ex-Act. Tajikistan is very attractive country in terms of the Ex-Act application. Different natural zones are presented here: from high mountains with predominantly pastoral use, to the foothills with a rapidly developing horticulture and rainfed agriculture on slopes, up to the lowlands with well developed but devastated irrigation systems, where the current active search for effective cost-effective crop rotation (to replace the pre-existing monoculture of cotton using water and soil conservation techniques) are taking place.

The complexity as a combination of multicultural planting in the farms with cattle breeding is the main feature and at the same time a basis of the small private farms in Tajikistan which serves as a good platform for testing the functionality and applicability of the Ex-ACT method.

MAIN RESULTS

It was discovered that the sensitivity of the Ex-ACT tool for small areas (less than 1 Ha) is low, because the values of the carbon balance do not exceed tenths or even hundredths tonnes of CO_2. In these cases the combination of similar projects in one can help, or alternatively more details in the description of the project are required, which is often beyond the scope of a standard questionnaire. With these modifications, the results obtained characterize the project activities as positive in terms of reducing carbon emissions. The most effective is the horticulture development (more than 34% of the total project activities, leading to carbon sequestration), the second is the perennial planting (about 24%), and the third is the rehabilitation of irrigation systems and canals, especially in arid regions (about 19 %).

Tab. 1: Carbon balance in the project's macro-regions

Macro-Region	Number of subprojects	Gross carbon balance	Average carbon balance per project	% of the total carbon balance	Carbon balance per year
Moist and semi-dry highlands (Tavildara and Jirgatol districts)	186	-42083	-226	63	-2077
Moist foothills (Baljuvon and Khovaling districts)	218	-12987	-60	19	-641
Dry lowlands (Farkhor and Kulob districts)	380	-11702	-31	18	-578
Total	784	-66771	-85	100	-3296

Tab. 2: Specific carbon balance for some key activities

Type of activity	Macroregion	Sequestration: t CO2-eq per hectare		
		Maximum	Mean	Minimum
Deforestation control	Midlands	-458	-255	-54
	Lowlands	-363	-312	-210
Horticulture	Highlands	-355	-176	-16
	Midlands	-183	-151	-64
	Lowlands	-153	-135	-92
Perennial meadows and pasture management	Highlands	-233	-63	-20
	Midlands	-44	-42	-32
	Lowlands	-26	-22	-16
New technologies for crop production	Highlands	-54	-39	-7
	Midlands	-54	-48	-44
	Lowlands	-30	-15	-4
Rehabilitation of irrigation canals	Highlands	-20	-19	-15
	Lowlands	-57	-24	-16
Water management	Highlands	-20	-19	-16
	Midlands	-21	-19	-17

Fig. 2: Rehabilitation of degraded soils in midlands

Fig. 3: Soil stabilization on slopes

Fig. 4: Horticulture and forage crops in lowlands

CONCLUSION

The mathematical models underlying the method of Ex-ACT are able to adequately describe the carbon fluxes within different land-use types, and can be used for the planning of environmentally effective activities in different biophysical conditions. The method helped to determine these most effective activities in the region (by the criterion of the annual carbon emission): deforestation control, horticulture, and pasture management. The stabling activities and infrastructure development and rehabilitation as well as greenhousing promote the largest carbon emissions. Among the local communities, who have been granted an independent right to choose the direction of the project activities, the most effective in the development and application of low-emission and low-carbon technologies are those who live and operate in high-altitude regions. Their efficiency is ten times higher compared with those communities living in lowland valleys.