

Annex 12: Agriculture Sector Fact Sheet - Soil Conservation

Sector	Agriculture
Category	Infrastructure installation
Adaptation needs	Soil conservation provides adaptation benefits through the prevention of soil loss from erosion or reduced fertility caused by overuse, acidification, salinization or other chemical soil contamination. Soil conservation is the act of keeping the soil in place and healthy. Where erosion is taking place or the soil is becoming contaminated with metals, acids or through overuse, soil conservation is lost. This in turn means that an important source of nutrients, carbon dioxide fighting plants, shade and cover is lost.
Technology Name	Soil Conservation
How this technology contributes to adaptation	Soil conservation is the prevention of soil from erosion or reduced fertility caused by overuse, acidification, salinization or other chemical soil contamination. Slash-and-burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. Slash and burn is still widely practiced in Belize. Soil conservation is the act of keeping the soil in place and healthy. Erosion, contamination of soils with metals and acids due to excessive use of fertilizers and pesticides, and overuse, all result in loss of soil conservation benefits. This in turn means that an important source of food, carbon dioxide fighting plants, shade and cover is lost with it. Losses of soils and soil fertility have been identified as vulnerabilities due to climate change in the agriculture sector.

Background/Notes, Short description of the technology option sourced from ClimateTechWiki, Seminars, etc	Soils conservation is achieved through techniques such as contour farming, terracing, perimeter control, windbreaks, cover crops/crop rotation, and soils conservation farming which includes no-till, manures, and other soil enhancing practices. <i>Contour farming</i> orients crop furrows following the contour lines of the farmed area. Furrows move left and right to maintain a constant altitude, which reduces runoff. Contour farming is effective for slopes between two and ten percent. Contour plowing can increase crop yields from 10 to 50 percent, partially as a result from greater soil retention. (www.en.wikipedia.org/wiki/soil_conservation#contour_barriers). <i>Terracing</i> is the practice of creating nearly level areas in a hillside area. The terraces form a series of steps, each at a higher level than the previous. Terraced farming is more common on small farms and in underdeveloped countries, since mechanized equipment is difficult to deploy in this setting. <i>Perimeter runoff</i> control in the form of tree, shrubs and ground-cover are effective perimeter treatment for soil erosion prevention, by impeding surface flows and runoffs and encouraging infiltration of the slowed surface water. <i>Windbreaks</i> are rows of trees at the windward exposure of an agricultural field used to slow wind erosion. (www.en.wikipedia.org/wiki/soil_conservation#contour_barriers) Cover crops/crop rotation include crops such as legumes, radishes and other species are rotated with cash crops to blanket the soil year-round and act as green manure that replenishes nitrogen and other critical nutrients. Cover crops also help suppress weeds. Soil-conservation farming involves <i>no-till farming</i>, “<i>green manures</i>” and other soil-enhancing practices. Such farming methods can revive damaged soil, minimize erosion, encourage plant growth, eliminate the use of nitrogen fertilizer or fungicide, produce above-average yields and protect crops during droughts or flooding. The result is less labour and lower costs that increase farmers’ profits. No-till farming and cover crops act as sinks for nitrogen and other nutrients. This increases the amount of soil organic matter. (www.en.wikipedia.org/wiki/soil_conservation#contour) Repeated plowing/tilling degrades soil, killing its beneficial fungi and earthworms. Once damaged, soil may take multiple seasons to fully recover, even in optimal circumstances. <i>Soil organisms</i> - When worms excrete in the form of casts, a balanced selection of minerals and plant nutrients is made into a form accessible for root uptake. Earthworm casts are five times richer in available nitrogen, seven times richer in available phosphates and eleven times richer in available potash than the surrounding upper 150 mm (5.9 in) of soil. (www.en.wikipedia.org/wiki/soil_conservation#contour)
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Implementation assumptions, How the technology will be implemented and diffused across the subsector?	Soils conservation is implemented through techniques such as crop rotation, maintenance of cover crops, conservation tillage and planted windbreaks. The Ministry could assist small farmers with technical and financial support to introduce the technologies, while medium sized and large farmers could also be provide with incentives such as tax breaks to support their investments.
Costs	Capital costs depend on the technique being applied, whether tillage practice is being addressed, windbreaks, manure or terracing and contouring are the technique to be applied. There is no evidence of the latter being applied in Belize today although some cultural records indicate it might have been used by the early Maya residents. Some crop rotation is practiced by the Maya farmers in the Cayo District. The strategy proposed by the Ministry of Agriculture if for more efficient land use leading to increased and sustained productivity. The need in each region would have to be assessed and the applicable technology decided by the findings of the assessments.
Country social development priorities	• Growth and Sustainable Development Strategy 2014 – 2017 Under the GSDS period, the GOB will seek to improve agricultural production and efficiency through sustainable and climate smart best practices, and improve value added from agriculture through agro-processing. Agriculture productions need to be sustained if this is to be successful. • Horizon 2030. This national development framework recognizes that Agriculture is one of the pillars of the Belizean economy and is the individual sector that generates the most employment in rural Belize. It identified ten strategic interventions for the sustainability of the agriculture sector in rural Belize which includes increase public investment in technology, irrigation, development of seeds and green pesticides, and Improve access to land for farmers. Soil Conservation technology is suitable for both objectives.

Country economic development priorities – economic benefits	• The National Food and Agriculture Policy (2002-2020) The focus of this policy is accelerating the diversification of both local/export-oriented agriculture, promoting agro-processing and value adding as a means of expanding opportunities and increasing the income of the rural sector, promoting local and international market /trade expansion, increasing efficiency, profitability and competitiveness of the sector, and improving and conserving the natural/productive resource base to ensure long-term sustainable productivity and viability.
Country environmental development priorities --environmental benefits	• A National Strategy to address Climate Change in the Agriculture Sector in Belize (2015) The National Strategy to address Climate Change in the Agriculture Sector in Belize recognizes that the sector is very vulnerable to the adverse effects and the impacts of climate change and climate variability. Food security partially depends on soils quality for sustainable production, so this and other technology that preserve or enhance this quality is important for the sector.
Social benefits	Once the system is established, this can increase time available for additional farm work or off-farm activities for livelihood diversification. Enhanced or maintained soil fertility contributes to food security because products yields are maintained. Enhanced fertility on the same farm plot reduces the demand for land because the farmer does not have to resort to slash and burn to maintain productivity.
Other considerations and priorities (such as market potential)	Soil conservation techniques can be applied through communal farming or cooperatives to enable sharing of skills and equipment if necessary. Contour farming and terracing require some use of machinery but not as frequently as the traditional land preparation methods involving plowing and furrowing. Windbreaks can be created using natural vegetation cover that existed before or planting off other species with large foliage or commercial species that could be harvested at some time in future. Any of these techniques are applicable to various sizes of farms.

Capital costs (per facility)	The report on a 1981 study to develop a “Computerized System for Estimating and Displaying Short-term Costs for Soil Conservation Practices in Missouri” provides estimates ranging between US \$3.50 to US\$13.72 per acre for Conventional and no-tillage practices. The same report describes costs ranging between US\$37.00 and US\$ 42.00 per acre for terracing methods. The costs for Contour farming and terracing are determined as the difference in income derived from using the different techniques, resulting in different yields per acre. There are also differences in income depending on the crops. Estimates for Belize, using local labour, equipment rental (tractor with plow), and fuel prices, the cost of introducing soils conservation on an average farm (25 acres) was determined at US \$2,120.00.
Operational and Maintenance costs (per facility)	Again this depends on the crop, and the requirements for periodic treatment, which normally occur between crops. Contour farming will be suitable for Belize since many farmers use hillsides for cultivation. Operational cost is based on the 2010 total agricultural land used in Belize. The 2010 report stated that the total agricultural in Belize is 368187.02 acres (149,000 ha). Thus the annual operation cost for these acres based on a one-pass tillage (conservation tillage) would be \$16.23/acre or \$0.85/acre. This would result in a total operation cost annually of \$6,606,931.98 or \$3,303,465.99 US. Using the estimated derived for Belize, operational and maintenance costs were each estimated at 50 % of capital cost.
Daily supply capacity per facility	Not applicable Soil conservation has positive impact of crop yields because soil fertility is retained for longer periods.
Up scaling potential	Upscaling is easy on a per acre basis. Tillage is utilized by commercial/industrial scale farmers, so they can easily apply the practice to larger areas. Enhancing soils fertilization using manure and plant waste bears little cost except for distribution across the whole farm. This is also achieved naturally because of the location of the plants and movement of animals. This technology is applicable to any size of farm.