

# Green Technologies for a More Sustainable Agriculture

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## Introduction

Agriculture plays a unique role in sustainability, providing food at a reasonable cost to current and future generations. To assess whether U.S. agriculture is sustainable, all the costs of agricultural production to current and future generations must be considered. These costs include the impact of agricultural production on the environment and stocks of natural capital (e.g., farmland, aquifers, lakes, rivers, estuaries, and wetlands). This view of agricultural sustainability is consistent with the USDA policy on sustainable development:<sup>1</sup>

*USDA will balance goals of improved production and profitability, stewardship of the natural resource base and ecological system, and enhancement of the vitality of rural communities.— From USDA Secretary’s Memorandum on Sustainable Development (SM 9500-6).*

This report highlights the role of agriculture in the sustainability debate. However, due in large part to data constraints, no universally accepted indicator of agricultural sustainability has been developed. For example, adjusting current measures of farm income for the environmental impacts of agricultural production cannot be done completely because many environmental services lack market prices, and data regarding changes in the physical amount of many types of natural capital is limited (Hrubovcak,

LeBlanc, and Eakin, 1995). Therefore, to evaluate the sustainability of U.S. agriculture, we review trends in several indicators (productivity, soil erosion, ground-water quantity, surface- and ground-water quality, and wetland conversion rates).

We use these trends to assess the contribution of technological change in furthering the sustainability of agriculture. For example, historically, to meet the growing demand for food, new technologies developed through agricultural research and development were employed in agriculture. These technologies have contributed to a tremendous surge in agricultural productivity and output. The empirical accounting framework used to measure productivity and output, however, accounts only for conventionally measured agricultural inputs and outputs. Services from the environment and the use of natural resources are currently treated as gifts of nature. In addition, any off-farm economic costs attributed to agricultural production are not taken into consideration. For U.S. agriculture to continue along a sustainable path of economic development, further increases in output must be generated by technologies that add to both the profitability and the environmental performance of agricultural production.

To assess the potential for research and development to contribute to sustainability, we highlight four practices that are considered more sustainable and have the potential for widespread diffusion in the agricultural sector. These practices include: integrated pest management, conservation tillage, enhanced nutrient management, and precision agriculture. From our experiences with these practices, we draw lessons regarding potential impediments to the adoption and diffusion of more sustainable technologies.

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<sup>1</sup>The impact of agricultural production on the vitality of rural economies is outside the scope of this report.