An Overview of Soil and Water Management: The Challenge of Enhancing Productivity and Sustainability

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During the greater part of its existence on earth, the human species subsisted as roving bands or clans engaged in hunting, gathering, and scavenging. From its origin in Africa, the species known as *Homo sapiens* gradually spread to all other habitable continents, adapting to the various ecological conditions and to the vicissitudes of changing climates. The momentous transition from the traditional nomadic mode of life to sedentary farming first took place in the Fertile Crescent, part of the region known today as the Near East, during the so-called Neolithic Age, which began some ten millennia ago.

Subsequently, agriculture in various forms has developed and spread throughout most of the habitable continents. The attainment of relative food security by means of farming and grazing (along with sanitation and medical advances) has enabled the gradual growth of population, from perhaps a few million in Neolithic times to well over six billion today. Current and foreseeable trends are projected to increase the globe’s population to some nine or even ten billion by the middle of this century. So far, food production has managed to keep pace, by and large, with population growth (although not in all regions—notably not in parts of Sub-Saharan Africa).

However, the increase of food production has been achieved at a great ecological cost: the progressive encroachment on extensive land and water resources and the eradication of their native biota. Agriculture has indeed appropriated a goodly fraction of the terrestrial domain’s net primary productivity, leaving less and less of it to sustain natural ecosystems. Among the most egregious processes of degradation resulting from the spread of agriculture are land denudation and soil erosion, nutrient depletion, salination, and waterlogging, as well as diversion and pollution of surface and subsurface water resources. All these processes amount to an unsustainable exploitation of the Earth’s natural resources and its biotic communities. Now looms the prospect of anthropogenic climate change, which threatens to further disrupt established patterns of food production.

The future of agriculture hangs in the balance. What can be done to rectify the destructive practices of the past and present and to ensure the sustainability of agriculture in the face of rising demands, a changing climate, and the growing scarcity and cost of conventional energy sources?

The first requirement is to intensify production on lands that can be improved and managed efficiently, while relieving the pressure on vulnerable or fragile lands that are not, or cannot be, so managed. As currently practiced, much of the world’s agriculture is unsustainable, as well as exceedingly inefficient in terms of its energy balance, conservation of resources, and...