Agroforestry opportunities for the United States of America*

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Abstract. Agriculture in the United States makes intensive use of large portions of the nation's arable landscape. This landscape is dominated by large fields of annual crops with few perennial buffering communities within them. Agroforestry systems such as riparian buffers, alleycropping, windbreaks, tree/pasture systems, and forest farming provide buffering opportunities within these landscapes. Riparian buffers and alleycropping systems provide two unique opportunities toward sustainable production by reducing nonpoint source pollution while increasing ecological diversity. The major impediment to agroforestry in the United States is a lack of identity. Agroforestry as a practice is not officially recognized by federal and most state agencies and thus does not qualify for cost-share support or funding for research and establishment of demonstrations. A recent white paper, prepared by representatives from government agencies, academic institutions, and nongovernment organizations, identified eight major actions that could provide the support for making agroforestry an acceptable alternative to nonsustainable agriculture.

Introduction

The agricultural landscape of much of North America is a mosaic of crop lands, pasture and/or rangeland, and human habitations superimposed on remnant natural ecosystems that formerly comprised prairies, wetlands, and forests. In most of the intensively farmed areas of North America, natural ecosystems, which once comprised the matrix of the landscape, have been cleared for agricultural purposes and are now only small remnant patches. In the state of Iowa, for example, 99% of the prairie and wetlands and more than 80% of the forests have been converted to other uses [Bishop and Van der Valk, 1982; Thomson and Hertel, 1981]. These natural plant communities were cleared to produce large rectangular fields, well suited to cultivation by large equipment. Trees within or along the borders of these fields have been removed because of concerns for shading and root competition for moisture. Fences have been removed as more and more livestock is raised in confined feedlots. Also, within the large rectangular fields, wet areas have been drained through the use of field tile and streams have been straightened.
to facilitate cultivation and to carry water from the land as rapidly as possible. Of these drastic plant community modifications, the clearing, cultivation, and/or overgrazing of riparian areas has been especially problematic for the agroecosystem.

The highly productive agricultural systems that replaced the native ecosystems have produced many intended benefits such as great quantities of high quality and relatively inexpensive food stuffs and industrial raw materials. The production-oriented function of the agricultural landscape, however, also has created unintended and undesirable environmental consequences that include the reduction of soil quality, nonpoint source (NPS) pollution of water, hydraulic alterations of waterways, and disruption of wildlife habitats and populations.

Of the above mentioned consequences, degradation of soil quality by tillage or grazing probably has the greatest impact on the agroecosystem. Soil quality is defined as the capacity of a soil to promote growth of plants, protect watersheds by regulating the infiltration and partitioning of precipitation, and prevent water and air pollution by buffering potential pollutants such as agricultural chemicals [National Research Council, 1993]. Degradation of soil quality can lead directly to reduced water quality by impairing the ability of the soil to regulate water flow through the watershed. Loss of this ability also leads to the loss of the soil's ability to buffer nutrients and pesticides from rapidly entering surface and groundwater systems [National Research Council, 1993].

The loss of soil quality has produced a serious nationwide NPS pollution problem of water resources. Soil sediment eroded from cropland and overgrazed riparian zones contributes about 1.4 billion Mg annually to our waterways. In total, over 2.7 billion Mg of soil enters water as NPS pollution each year [Welsch, 1991]. In Iowa, it is estimated that 240 million metric tons of rich topsoil enters the Missouri River each year [Kelley, 1990]. An Army Corps of Engineers reservoir in Central Iowa, Lake Red Rock, with four uncontrolled drainages entering its conservation pool, receives about 15,000 Mg of agricultural sediment per day [Kelley, 1990].

Because of poor soil quality and extensive field tile drainage in some parts of the North American agricultural landscape, pesticides and fertilizers also contribute NPS pollution to our nation's waters. Atrazine and alachlor, two pesticides used in row crop production, have been found in Midwestern surface waters for some time [Kelley, 1990]. It was estimated that in 1989, nearly 1 million Mg of P entered our Nation's waters. In 1980, an estimated 2.6 million Mg of nitrate-nitrogen became NPS pollution [Welsch, 1991]. Surface waters in agricultural landscapes have nitrate-nitrogen levels exceeding 10 mg L\(^{-1}\) and water flowing from tile lines entering various waterways may have nitrate-nitrogen levels of 70 to 80 mg L\(^{-1}\) [Kelley, 1990].