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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

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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 Engineer 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 waterways. 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].

An increasing concern over environmental degradation, economic diversification, and expected rising energy costs has opened the way for the integration of forestry and farming. It is also recognized that there is a need to increase the resistance of farming systems to erosion and runoff and to make greater use of field and landscape buffer zones in the agricultural landscape [National Research Council, 1993]. Agroforestry offers many opportunities to meet these challenges. Agroforestry is an intensive land-management system that optimizes the benefits from the biological interactions created when agricultural- and forestry-based land-use systems are intentionally integrated to provide tree and other crop products, and at the same time protect, conserve, diversify, and sustain vital economic, environmental, human, and natural resources [Garrett and Rietveld, 1994]. An important key to the success of agroforestry systems in North America is that they can provide both ecological and economical benefits from the interactions between the woody-, perennial-, and annual crops, and livestock components [Lundgren and Raintree, 1982].

Sustainable agroforestry systems

Traditional agroforestry systems, including agrisilvicultural (trees with crops), silvopastoral (trees with pasture), and agrisilvopastoral (combinations of the preceding) have been used in tropical countries for centuries [Nair, 1989] but only recently have begun to be tested in temperate areas. However, some examples of agroforestry uses of trees in the agricultural landscape that are different from the tropical agroforestry systems have been used in North America. These systems include field-, farmstead-, and livestock windbreaks, riparian buffer strips, plantings designed for wildlife habitat which may include trees, shrubs, grasses, and feedgrains, and woodlots and fuelwood plantations that provide products such as timber, chip, and fuelwood products as well as specialty items such as Christmas trees, nuts, and fruits. When considered in this broader context, agroforestry in North America can be defined as including all systems with 'working trees' – the right trees and shrubs planted and/or managed in the right place to do a specific job in the agroecosystem (USDA Forest Service National Agroforestry Center, Lincoln, Nebraska). Agroforestry systems for North America can therefore be divided into the following five categories: 1) riparian buffer strip systems which regulate nonpoint source pollution of waterways and provide fish and wildlife habitat; 2) tree-agronomic crop systems such as alleycropping or intercropping which can increase and/or diversify farm incomes while reducing soil erosion and nutrient loading of agricultural watersheds; 3) tree-animal systems in which forages are managed in forests to enhance grazing while providing wildlife opportunities, fire protection, and forest management benefits, especially in the south and western United States; 4) windbreak/shelterbelt systems in the Great Plains and west that modify microenvironments for improved crop and livestock production; and 5) forest farming systems which produce specialty crops from natural or plantation forests [Garrett et al., 1994].

Some of the multiple benefits that may accrue from agroforestry systems include increasing crop and livestock production, decreasing wind and water erosion, decreasing nonpoint source pollution of streams and lakes, increasing biodiversity, sequestering carbon for reduced global warming, providing renewable energy feedstock, and improving the human environment. In the process of producing a more sustainable agriculture, agroforestry systems can diversify farm income by producing a wider range of market and non-market products from the same land unit [Betters, 1988]. Successful acceptance of agroforestry systems by agricultural landowners lies in our ability to clearly document the relative values, potential products, and trade-offs associated with them [Ssekabembe, 1985].

The increasing acceptance and use of agroforestry in North America can be seen in the number of surveys of agroforestry practices that have been completed for different regions of North America and the increasing attendance at the biennial North American Agroforestry Conferences that were initiated at the University of Guelph, Canada in 1989, followed by ones held at the University of Missouri in 1991, and at Iowa State University in 1993 [Lawrence et al., 1992; Henderson and Maurer, 1993; Rule et al., 1994]. For the eight-state Midwestern Region of the United States, Rule et al. [1994] found 46 'traditional' agroforestry systems (28 agrisilvicultural, 12 silvopastural, and 6 agrisilvopastoral) and 61 'nontraditional' systems including shelterbelts/windbreaks, tree-shrub intercropping, boundary plantings, and 97 other specialized forest farming systems, involving trees and nonwood products such as maple syrup, mushroom, honey, and ginseng as well as promoting wildlife habitat. These results are consistent with reports by Garrett and Kurtz [1983] and Gold and Hanover [1987] for the region.

In a survey of agroforestry practices of Washington State's nonindustrial private forest land owners, Lawrence et al. [1992] found that 57% of all respondents indicated they were practicing agroforestry. Thirty-nine percent were practicing forest grazing, 34% windbreaks, 12% were harvesting special products from the forest, 8% were using livestock enrichment plantings for forage and shelter, 5% were practicing orchard grazing, 2% orchard intercropping, and 0.3% Christmas-tree grazing.

Two traditional agroforestry systems that have been practiced in North America for some time include grazing in forests of the west and forest plantations of the southern United States and multicropping (alleycropping) with black walnut (*Juglans nigra* L.) in the central United States [Pearson, 1984; Garrett et al., 1991]. Numerous nontraditional practices such as grazing in Christmas tree plantations and windbreak/shelterbelt plantings also have been practiced for many years.

Agroforestry systems based on short-rotation woody crops (SRWC)

The use of SRWC as an alternative farming system has been studied for some time in the central United States and is being used in agroforestry systems [Colletti et al., 1991; Schultz et al., 1991a; Hall et al., 1989; Hall, 1982]. The SRWC systems consist of fast growing tree species, planted at close spacing, and harvested on short rotations, typically of 6–10 years. About 2.2–4.5 dry mT ha^{-1} yr^{-1} (conservatively, 42–86 million GJ ha^{-1} yr^{-1}) of biomass can be produced each year without fertilization [Colletti et al., 1991]. Once cut, these trees resprout from the stump or roots (coppice) and are likely to yield more biomass per year in the following rotations than they did in the first. This expected production increase also reduces the cost of successive crop establishment thereby improving overall economics [Colletti et al., 1991; Rose et al., 1981]. Energy-producing forage crops and intensive rotations of traditional crops that can be integrated with SRWC into agroforestry systems also are being studied [Anderson et al., 1992]. Work has been done with alfalfa, reed canary grass, big bluestem, switchgrass, sweet sorghum, Caribbean corn, double crops of rye and sweet sorghum and rye and forage sorghum, and interplanting of alfalfa and sorghum, and reed canary grass and sorghum. In addition, intensive rotation systems of 5-m-wide strips of corn, soybeans, oats and/or rye, and sweet sorghum have been tested. Yields from all of these systems have compared favorably to traditional corn and soybeans.

Combinations of these two systems are being developed for use in the agricultural landscape of the Great Plains and Midwestern United States. These projects include traditional SRWC energy plantations, shelterbelt-strip-cropping systems, alley-cropping systems for treating municipal sludge and livestock manure, feedlot buffer systems, and restored multi-species riparian buffer strips. A number of these systems are designed to mitigate water quality problems in the agroecosystem.

Alleycropping systems to treat municipal sludge and livestock manure are being developed. These systems are intended to respond to the increasingly more restrictive regulations of land application of treated municipal sludge to food chain crops, and land disposal of large amounts of livestock manure from large livestock confinement facilities. These SRWC alleycropping systems provide numerous windows for sludge and manure application throughout the year, produce biomass for energy production, and provide a cost-effective means of environmentally safe disposal.

Alleycropping/SRWC

A model of this system utilizes treated municipal sludge as a 'fertilizer' to increase the productivity of SRWC and herbaceous crops [Colletti et al., 1991, 1994b]. Fast-growing trees and herbaceous crops are being grown in alternating strips as an 'agroforestry energy system' to produce renewable biomass for energy feedstock. Tree species such as cottonwood hybrids (*Populous* × *euramericana*), silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and willow species (*Salix* spp.) can be grown with agricultural crops such as 'Cave-in-rock' switchgrass (*Panicum virgatum*), experimental Caribbean (tropical) corn (*Zea maize*), and sweet sorghum (*Sorghum bicolor*) in alleys as shown in Fig. 1. The tree strips consist of 6 rows planted in three sets of closely spaced rows. Spacing between the two rows is 2.4 m and between double-row sets 5.0 m to allow access for the sludge application vehicle. Within-row spacing for the trees is 1.2 m. The herbaceous strips are about 15 m wide.

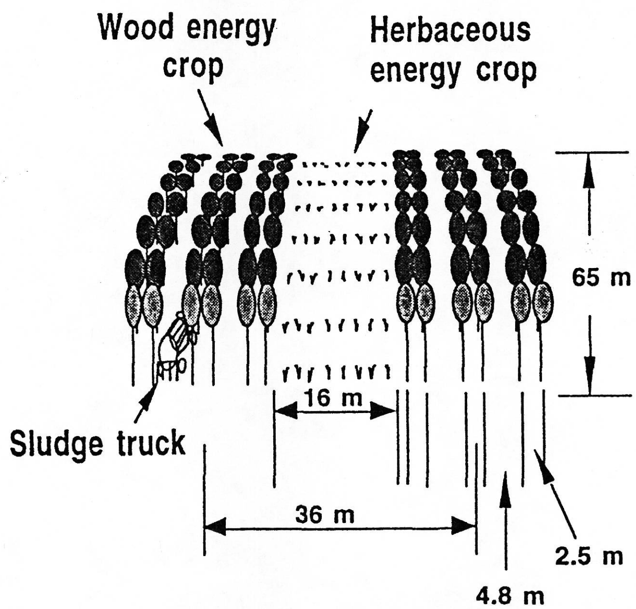

Fig. 1. Design of the agroforestry alleycropping sludge treatment system. Trees are planted on 2.5 m and 4.8 m spacing. The wider spacing is used to allow the sludge application truck to move through the trees to surface apply the sludge.

The specific arrangement of alternating strips should produce greater yields than if each crop was grown individually. The trees benefit the agricultural crop by reducing wind, thereby increasing CO_2 levels immediately above the crop for increased photosynthesis. Less wind also reduces crop evapotranspirational losses. The strips of herbaceous crops increase the amount of sunlight reaching into and along the edges of the tree canopy. This allows development of more leaves on the trees, increasing potential productivity. A net result of the rapid growth of the crops in the agroforestry system is increased utilization of applied sludge.

Sludge treated trees can show increases in growth of up to 40% over those that receive no sludge. Switchgrass and crops can almost double their dry matter production with the application of sludge. The advantage of this agroforestry system is that it provides more sequestering of potential pollutants, which can be concentrated when the biomass is converted to energy, than traditional herbaceous crops. With proper application rates, heavy metals and high concentrations of nitrogen and phosphorus can be treated by the ecosystem before they enter the surface or groundwater.

Similar kinds of responses could be expected if livestock manure were applied to the agroforestry system. The recent development of large corporate swine and cattle producing facilities has raised questions about the disposal of the large amounts of manure that these systems produce. Additional advantages of using agroforestry systems for manure application include the use of the system for odor management and windbreaks around the production facilities. Redirecting the wind can reduce the movement of odor from the facilities as well as reduce the heat loss from them during the colder seasons of the year.

Riparian buffer/SRWC

Restored multi-species riparian buffer strips have the broadest application and potential impact on water quality of any agroforestry system. It has been demonstrated that wooded riparian buffer strips are effective at reducing nonpoint source pollution from reaching stream channels [Lowrance, 1992]. However, in many agricultural landscapes, natural riparian vegetation has been replaced by row crops, or with cool season pasture grasses to support streamside grazing. In the five Corn Belt states of the United States (Illinois, Indiana, Iowa, Missouri, Ohio) there are more than 130,000 lineal km of streamside riparian zones without trees or shrubs [Garrett et al., 1994]. In typical watersheds in central Iowa, about 50% of the total length of stream channels may be cultivated with corn and/or soybeans within 20 m of the creek. Another 30% of the length may be in pasture, much of which is overgrazed [Bercovici, 1994]. In these kinds of landscapes perennial vegetation buffer strips should be restored to help mitigate the nonpoint source pollution problems associated with upslope agriculture. For restored buffer strips to be effective a mixture of vegetation types and species is more effective than a single vegetation type.

One model of a restored multi-species riparian buffer strip provides an agroforestry system that combines SRWC with native shrubs and prairie grasses. The objective is to provide a multi-functional buffer strip that not only traps above-ground sediment and reduces agrichemicals in the soil water, but also provides terrestrial wildlife habitat, modifies the in-stream ecosystem, increases streambank stability, slows the peak flows of flood waters, and provides biomass for energy or wood products [Schultz et al., 1991b, 1993, 1995]. Beginning at the crop field edge and moving toward the stream, the buffer strip design includes a 7 m wide strip of native prairie grass, two rows of shrubs (rows 2 m apart and ~ 1.7 m between shrubs within rows), and 4 rows of trees (rows 2.5 m apart and ~ 2 m between trees within the row) (Fig. 2).

Plant species are carefully selected to perform specific functions within the structure of the buffer strip as well as provide potential economic products.

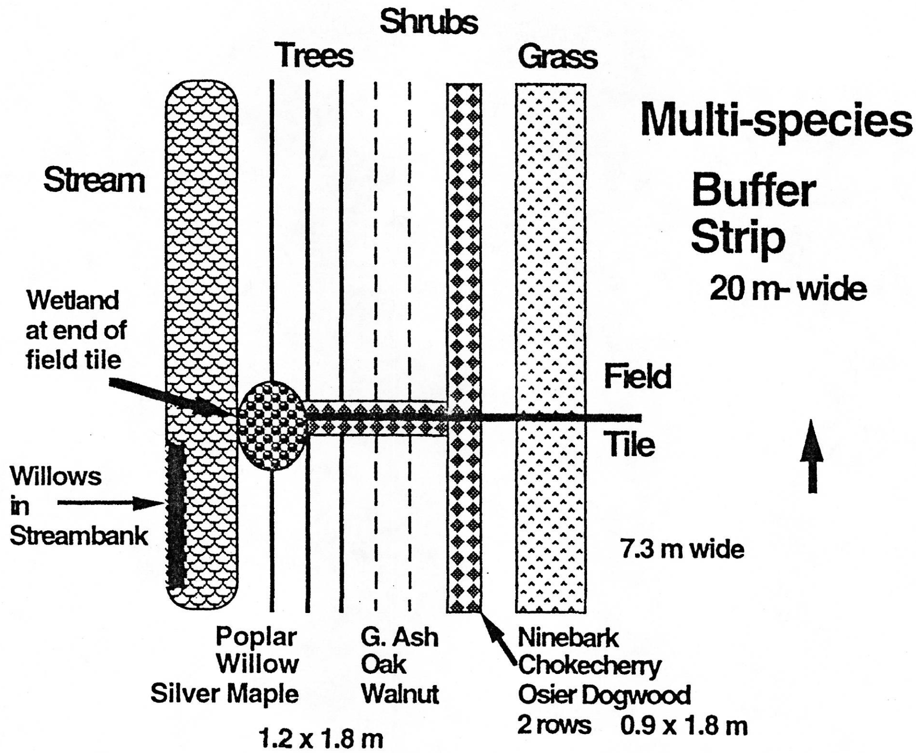

Fig. 2. Layout for a multi-species buffer strip riparian zone management system that includes an in-stream willow planting and a small wetland at the end of a field tile.

Most species are selected for rapid growth thus allowing restoration of a functioning riparian community in the shortest possible time. Willow species (*Salix* spp.), cottonwood hybrids (*Populus* clones), and silver maple (*Acer saccharinum*) are planted closest to the stream to improve streambank stability and provide agrichemical uptake and sequestering. These fast growing trees should be harvested on an 8–12 year rotation and resprout from the stump leaving the root system intact and the soil undisturbed.

Slower growing, high quality hardwoods such as green ash (*Fraxinus pennsylvanica*), oak species (*Quercus* spp.) and black walnut (*Juglans nigra* L.) are planted in the outside row(s), depending on soils and owner objectives, to provide timber products on a sixty-year rotation. Conifer species such as eastern red cedar (*Juniperus virginiana*) can be included to enhance wildlife habitat. These slower growing species also provide long-term sequestering of carbon and agrichemicals. The key to the buffer strip design is to plant the two or three rows nearest the stream to fast-growing species so that streambanks can be stabilized as quickly as possible.

The shrub rows are included because they develop a perennial root system and their multiple stems function to slow flood flows when the stream water leaves its channel. They also provide added biodiversity and wildlife habitat to the restored community. Shrub species are selected based on the soils and their intended use. In most cases wildlife suitability is a major consideration, but some species, such as hazel can produce a potential nut crop for human consumption. Shrubs which may be suitable are red-osier dogwood (*Cornus stolonifera*), gray dogwood (*Cornus racemosa*), Nanking cherry (*Prunus tomentosa*), chokecherry (*Prunus maackii*), hazelnut (*Corylus colurna*) ninebark (*Physocarpus opulifolius*), speckled alder (*Alnus rugosa*), service-berry (*Amelanchier arborea*), hawthorn (*Crataegus crusgalli*), pin cherry (*Prunus pensylvanica*) peachleaf willow (*Salix amygdaloides*), and viburnum (*Viburnum* spp.).

Native, nonbunch, prairie grasses, such as switchgrass, are used because their dense, stiff stems provide a high frictional surface which intercepts concentrated and overland flow from the crop fields. This serves to reduce the energy in the flow, allowing sediment to drop out before it enters the stream as NPS pollution.

The native prairie grasses and woody plants penetrate the soil with deep, extensive root systems that not only can stabilize streambanks, but also help restore soil structure. Improved structure allows increased infiltration of runoff, and the root turnover can provide large amounts of soil carbon which serve as a substrate for microbes involved in agricultural chemical transformations.

The ability of this riparian plant community to modify soil, trap sediment, sequester carbon and agrichemicals, and provide wildlife habitat is far superior to riparian zone communities consisting of annual crops, such as corn or soybeans, or pastures composed of cool season grasses. Initial soil water quality data indicate that the restored multi-species buffer strip produces a zone of agrichemical concentrations along the creek that are well below the US Environmental Protection Agency's maximum contaminant levels.

In many areas of the Corn Belt the potential pathways of agrichemicals into the stream are complicated by existing field drainage tiles which carry water rapidly under and through the buffer strip. To address this problem small cattail wetlands, sized at a ratio of 1:100 for the drainage area of the tile line, can be constructed at the end of field tiles. These wetlands can remove as much as 80% of the nitrate from tile water before the water enters the stream (Isenhart, unpublished data).

Soil bioengineering also can be used to gain control of certain eroding streambanks along a restored multi-species buffer strip. Large vegetative propagules termed willow posts, and smaller willow cuttings can be installed into the bottom of the stream and the sidewalls of the streambank where they will root and grow. Along vertical streambanks, bundles of dead trees can be staked into the streambank and willow posts and cuttings planted among them. The tree bundle revetments act to temporarily protect the eroding bank while the live willows become established.

Streambank soil bioengineering, tile wetlands, and restored multi-species buffer strips are integral parts of an effective riparian zone management system which is a viable agroforestry system for much of the North American farm and rangelands. The system can be adapted to fit many specific landscapes and owner objectives (Fig. 3).

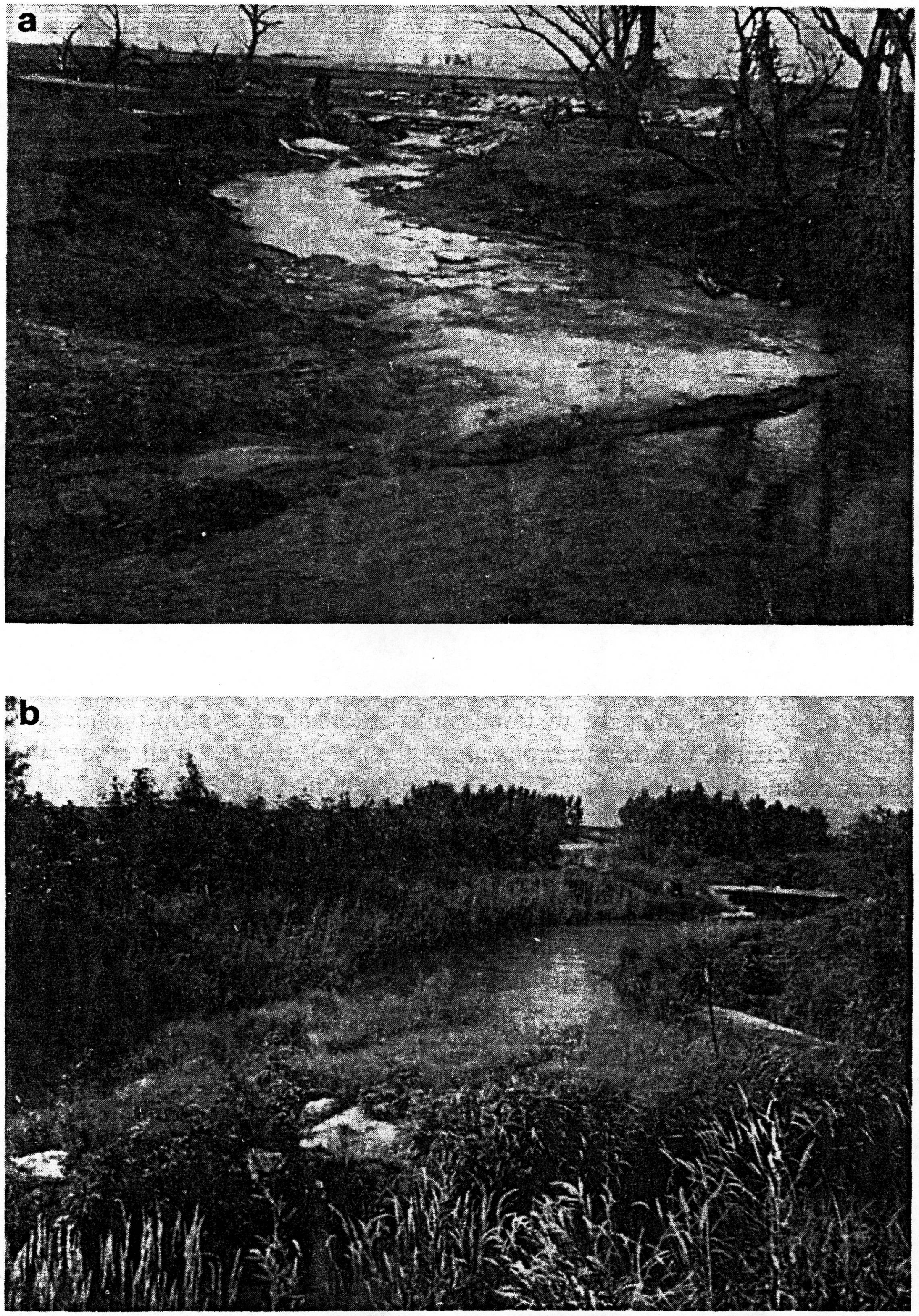

Fig. 3. Before and after photos of the multi-species buffer strip response after four growing seasons. Photo a was taken in March, 1990 just before the buffer strip was planted. Photo b was taken May, 1994. Besides the ash and poplar hybrids along the left bank notice the willow cuttings that were planted in the streambank on the left side.

The alleycropping and restored multi-species riparian buffer strip systems demonstrate the successful integration of the SRWC system into agroforestry. This integration provides potential economic benefits from biomass for energy to the landowners. Although markets for these products are presently not well established the future for these markets looks bright [US Department of Energy, 1986; Ranney et al., 1987; Chum et al., 1991; Hall, 1994].

Potential for agroforestry in the United States

Available land

The recent Resource Conservation Act Agroforestry Appraisal for the USDA Natural Resources Conservation Service (NRCS) [Garrett et al., 1994] estimated the land area that is potentially available for agroforestry practices in the United States. The assumption was made that the increased interest in sustainable agriculture and the impact of agriculture on the environment will provide opportunities for land owners to consider agroforestry options. The report suggests that more than 45 million hectares of nonfederal cropland, across the nation, with an erodibility index greater than 8 are suited for agroforestry practices. Approximately 32 million hectares of pasture and rangeland in the United States also have a medium potential of being converted to cropland, and therefore are potential land for agroforestry. This pasture and rangeland does not include the sensitive streamside riparian zones which are available for buffer strip restoration (~ 1 million linear km without trees or shrubs). Silvopastoral opportunities also exist on nearly 40 million hectares of forest land in the southern United States, and on nearly 1 million hectares of forest land in the Pacific Northwest and Mountain States of the West. Even prime agricultural land may become available for agroforestry systems for windbreaks and for livestock manure disposal sites near large confinements.

Hindrances and solutions to widespread adoption

Several major obstacles stand in the way of rapid, widespread acceptance of agroforestry in the United States. These vary from landowner perceptions of agroforestry, to lack of governmental policies and program support, to a lack of well developed markets, and a lack of research and technical information on agroforestry systems.

For decades farmers have, for the most part, been trying to get rid of trees in their cultivated fields. They have drained these fields and straightened the streams that run through them. Trees were perceived as weeds. Many farmers now are sensitive to some of the adverse results of these actions. They recognize, among other things, that there is a NPS pollution problem, a lack of wildlife, and a global warming problem [Colletti et al., 1994a]. However, before they are willing to accept agroforestry systems on their farms they must be convinced that they fit their present farming machinery and field patterns, that they do not reduce the yield of their traditional crops, that there are markets for the new products, that present governmental programs will not be voided by adoption of these systems, and that the agroforestry systems will not take significantly more work than their present systems. Farmers must be shown agroforestry systems that grow rapidly like the annual crops that they produce. Using only slow growing trees in an agroforestry system may cause the whole effort to be abandoned before it becomes well established. Incorporating SRWC into the design not only makes the system biologically and physically functional in a shorter time period, but also shows the land owner that properly selected trees can grow rapidly.

Establishment of agroforestry systems in the United States must rely on mechanization. Conventional tillage equipment, multi-row tree planters, herbicide control of weeds, and mechanical harvesting must be part of the system. It is imperative that agroforestry systems be demonstrated on regional private farms so that landowners have an opportunity to see the systems in practice, and can talk with farmers who are using them.

Diversity of the products of an agroforestry system must be stressed. Multiple species of woody plants should be used to provide not only biomass for energy but also fiber and high quality timber products, and specialty crops along with wildlife habitat. Depending on the space required by the agroforestry system, immediate markets are not always necessary for the products. Especially when dealing with riparian buffer strips, landowners recognize that much of the land along the meandering streams has not been cultivated in the past, and frequently are satisfied with the potential for wildlife habitat as the major 'product' of the system. Many landowners also are interested in simply diversifying the visual quality of the row crop landscape.

At present there is no clear federal governmental policy concerning agroforestry in the United States. Numerous price-support and cost-share programs exist to help farmers and provide stability for specific commodity products. Most of these programs, however, do not officially recognize agroforestry systems, and several of them actually negate the possibility of using them [Garrett et al., 1994]. For example the Conservation Reserve Program restricts a number of joint products being produced from the same piece of land. If there is to be a widespread adoption of agroforestry by farmers then federal and state programs will have to be supportive of those systems.

The lack of markets often plagues innovative practices. Because of the bulk associated with many agricultural products, including some associated with agroforestry systems, local markets may not be available even though those markets exist in other parts of the country. The value of timber products is bound to increase as the timber industry must rely more on private forests than on federal forests for raw material [Garrett et al., 1994]. This may help to develop markets for agroforestry-produced woody fiber. In the renewable energy arena, greater net energy benefits can be derived from perennial and woody crops than from annual crops [Hall, 1994]. Development of specialty crop markets often requires a critical mass of producers to be located in a concentrated area and then to develop cooperatives for marketing the product. With the help of rural development agencies such markets could be established.

Finally, for agroforestry systems to be adopted there must be a strong research base of information, and a strong technology transfer program which disseminates that information to the farmers [Prinsley, 1992]. In those cases where agroforestry systems are not considered as viable alternative production systems, the landowners often reply that there is a lack of documentation from research and on-ground testing of a specific system for their area, and there is no good economic data for the system (Zinkhan, unpub.). Agroforestry research in North America has developed despite a lack of identifiable resources specifically earmarked for agroforestry [Garrett et al., 1994]. Conducting agroforestry research is complex in that it is both long-term and requires extensive interdisciplinary cooperation. Funding for such projects is usually unavailable and programs must be supported by piecing together funds from a wide range of sources. Agroforestry also is hampered by a lack of clearly identifiable jobs for trained professionals, which stems partly from a lack of recognition of agroforesters by public agencies.

Recently, a group of federal, state, and academic professionals in the agroforestry field met to draft a position paper identifying the needs for getting agroforestry recognized by the federal government (Workshop to 'Develop a Framework for a Coordinated National Agroforestry Program', June 29–30, 1994, Nebraska City, Nebraska). They supported most of the RCA appraisal by the USDA-NRCS. Specifically they called for: 1) the need to establish an agroforestry subtitle in the 1995 Farm Bill addressing agroforestry's unique opportunities, needs and challenges; 2) establishing a USDA interagency coordinating committee and national coordinator for agroforestry to identify needs, set priorities, and help to develop and coordinate new agroforestry programs; 3) Association for Temperate Agroforestry (AFTA) to help establish regional agroforestry organizations that would provide linkages within each major agricultural region of the United States; 4) establishing a national interagency agroforestry advisory council with representatives from federal and state agencies, academic and research institutions and grassroots non-government organizations (NGO's); 5) establishing a national interagency agroforestry center and clearinghouse for agroforestry cooperation by converting the existing Center for Semiarid Agroforestry/National Clearinghouse for Agroforestry Cooperation and Promotion which was authorized in The Food, Agriculture, Conservation and Trade Act of 1990 into an interagency joint-venture; 6) providing focused funding for agroforestry research, development, applications, demonstrations, technology transfer, and training by identifying specific research funds from the federal competitive grants programs such as the National Research Initiative Competitive Grants Program and the USDA Cooperative State Research Service Competitive Grants Program, by providing funding to the SCS, Extention Service and State Forestry Agencies to develop

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