Chapter III

Technologies That Benefit Agriculure and Wildlife

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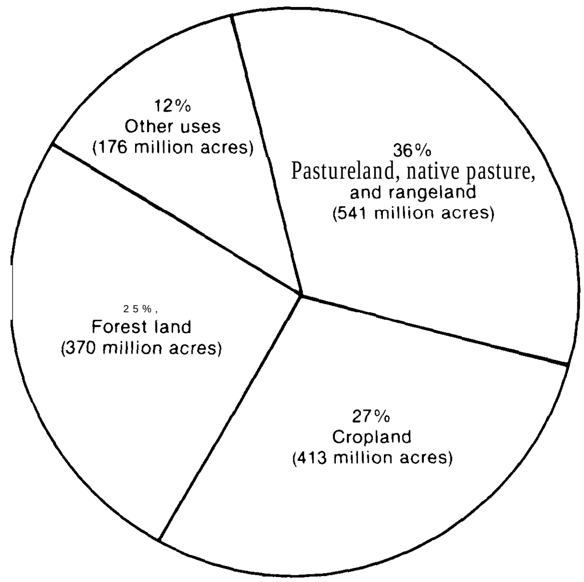
INTRODUCTION

Agriculture and wildlife professionals disagree as to whether sufficient information exists to manage wildlife habitats in concert with agricultural operations on agricultural lands, Most wildlife biologists believe enough information is available currently to integrate wildlife habitat considerations with agricultural production but are unaware of landowner constraints to adopting techniques where the sole beneficiary is wildlife and fish. In addition, many agricultural and wildlife professionals seem to know little about the necessary tradeoffs in land management practices that would be most beneficial to wildlife while sustaining agricultural productivity,

Despite the incomplete information currently available on complementary agriculture and wildlife interactions, a number of techniques described at the OTA workshop and some in the published literature hold promise for benefiting both agricultural productivity and wildlife habitat. Technological categories that benefit agriculture and wildlife include specific practices, integrated management systems, and methods of information transfer. These technologies in general emphasize wildlife habitat as a complementary, not a secondary land use associated with the primary land use on croplands, rangelands and pastures, and forest lands.[1] Figure 1 and 2 show the acreages of non-Federal land in each of the major agricultural land uses and the agricultural regions of the country, respectively.

Figure 1.—Use of Non-Federal Land
Includes United States, Puerto Rico, and Virgin Islands
Excludes Alaska (SCS, 1981a)



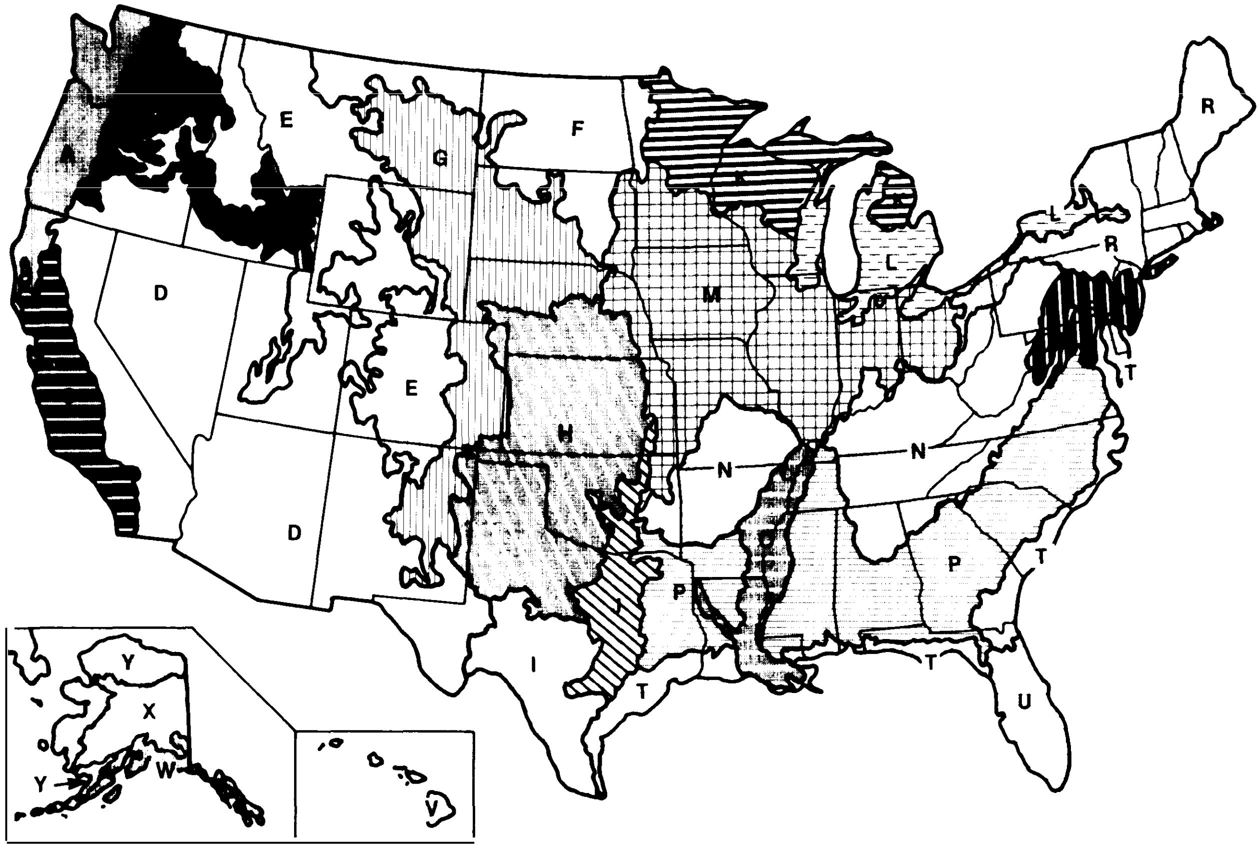
[1]**Croplands**—Any land used primarily for the production of adapted, cultivated, fruit or nut crops for harvest, alone or in association with sod crops.

Rangelands—Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs or shrubs suitable for grazing or browsing use. Includes lands re-vegetated naturally or artificially that are managed like native vegetation.

Pastures—Areas intensively managed for the production of forage, introduced or native, and harvested by grazing or mowing (OTA, 1982).

Forest Lands—Areas where the predominant plant community is trees and other woody vegetation, growing more or less closely together (SAF, 1971).

Figure 2.—Land Resource Regions of the United States (SCS, 1981b)



A Northwestern Forest, Forage, and Specialty Crop Region
B Northwestern Wheat and Range Region
C California Subtropical Fruit, Truck, and Specialty Crop Region
D Western Range and Irrigated Region
E Rocky Mountain Range and Forest Region
F Northern Great Plains Spring Wheat Region
G Western Great Plains Range and Irrigated Region
H Central Great Plains Winter Wheat and Range Region
1 Southwest Plateaus and Plains Range and Cotton Region
J Southwestern Prairies Cotton and Forage Region
K Northern Lake States Forest and Forage Region
L Lake States Fruit, Truck, and Dairy Region
M Central Feed Grains and Livestock Region

N East and Central Farming and Forest Region
O Mississippi Delta Cotton and Feed Grains Region
P South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region
R Northeastern Forage and Forest Region
S Northern Atlantic Slope Diversified Farming Region
T Atlantic and Gulf Coast Lowland Forest and Crop Region
U Florida Subtropical Fruit, Truck Crop, and Range Region
V Hawaii Region
W Southern Alaska Region
X Interior Alaska Region
Y Arctic and Western Alaska Region

SPECIFIC TECHNIQUES

Undercuttor Plow

The undercutter plow is a farm implement currently used for weed control on many farms in the winter wheat/fallow region of the Great Plains States and the Intermountain West. Undercutter are large (3 to 7 feet wide) V-shaped blades or sweeps that are pulled by tractors through a field 3 to 6 inches under the soil surface. Using an undercutter instead of a disc can control weeds, retain soil moisture, and save many bird nests and flightless birds present in the stubble while providing adequate weed control. In situations where mulch treaders are used in combination with undercutter, however, wildlife habitat benefits are lost. Mulch treaders consist of rotating blades designed to knock down and mix residue into the soil,

Farmers in water-limited winter wheat areas try to maintain surface stubble after harvest to reduce soil erosion and to increase soil moisture retention for subsequent crop growth. Spring use of the undercutter can kill emerging weeds in the wheat stubble while retaining stubble on the soil surface (Rodgers, 1984).

Some evidence exists that undercutter are more fuel efficient than discs on a single pass through the field (Smika, 1976). In addition, the undercutter plow reduces mortality to bird nests by 40 to 50 percent in the wheat stubble compared to 100 percent mortality with surface tillage equipment, such as mulch treaders (Rodgers, 1984).

The undercutter plow has the greatest utility in the drier parts of the winter wheat areas where the abundance of stubble is low, such as western Kansas and Nebraska and central Washington. Farmers in the drier parts of the central and southern Great Plains already use the undercutter plow for some aspect of their tillage operations, and the number of undercutter are becoming more prevalent in these areas. Undercutter are not used often for initial tillage and weed control in high rainfall areas where high yields of stubble are produced after harvest (i.e., eastern Kansas and Nebraska and eastern Washington), because, in these more humid areas, the present undercutter are ineffective at breaking up crop residue. In continuous cropping areas, the extensive surface residue retained when using undercutter also can harbor crop disease and may contribute to clogging of conventional drills used to plant seeds.

Root plow

Another farm implement which has potential to maintain wildlife habitat and improve land productivity is the root plow. The root plow is a heavy-shanked chisel instrument which can be attached to a tractor and pulled along field borders or windbreaks to cut roots and reduce competition between border vegetation and the field crops for soil moisture and nutrients, thus reducing an incentive to destroy these habitats (Kansas Fish and Game Commission, undated). The root plow has received some attention in Europe and its use is promoted in Kansas where a renewed effort exists to retain windbreaks and border strips for wildlife benefits and soil erosion control.

Root plow tests in Kansas show that the plow reduces competition between field crops and osage orange or Chinese elm hedgerow trees. The plows can be borrowed by farmers free of charge from the Kansas Fish and Game Commission. However, the demand for the root plows far exceeds the available supply in Kansas. Farmers are encouraged to devise their own form of root plow using other farm equipment, such as a bulldozer with a ripper blade.

The root plow is most effective at reducing competition between shallow rooted hedgerow species and grain crops such as sorghum, corn, and soybeans. Deeper rooted windbreak species provide less competition to adjacent shallow rooted crops,

Hedgerows, Shelterbelts, Field Border Strips, and Riparian Zones

Hedgerows, shelterbelts, and field border strips consist of fast-growing, resilient, herbaceous, and woody vegetation planted between fields to trap snow on fields or to prevent snow from collecting in vehicle travel lanes. They are located commonly along field edges, fencerows, and tractor paths, respectively. Riparian zones consist of vegetation typically adapted to seasonal periods of submersion and drying out.

Hedgerows, shelterbelts, field border strips, and riparian zones have been promoted since the 1930s as valuable tools to reduce soil erosion from wind and water and to buffer streams to maintain or improve local water quality. For wildlife, hedgerows, shelterbelts, and field border strips break up the monotony of the planted fields by creating both vertical and horizontal diversity in the landscape. The landowner benefits directly from the application of these conservation practices through: reduction in heating bills from a well-placed wind buffer, increases in soil moisture for improved crop yields, and livestock protection from the wind during winter, reducing the potential for animal weight losses (USDA Soil Conservation Service, 1974; USDA Forest Service, 1962). In addition, properly located windbreaks or shelterbelts prevent snow drifting and allow access to farm buildings during heavy snowfall.

Riparian zones planted along cultivated fields are considered one of the most important conservation practices to benefit local fish populations and improve water quality (Cooper, 1984). Agricultural nonpoint sources of pollution could be minimized by the establishment or retention of riparian border vegetation (Schlosser and Karr, 1981). Streamside vegetation helps moderate water temperature fluctuations, acts as a sieve for excessive amounts of chemicals and nutrients that could destroy native fisheries (Cooper, 1984), and sometimes provides a substrate for fish spawning and breeding. Riparian corridors also are considered critical for many wildlife species because the corridors offer a habitat component usually unique to the surrounding landscape, particularly in arid and semi-arid regions. These corridors are important for movement of wildlife populations from one area to another. The benefits for the landowner would be similar to those obtained from hedgerows, shelterbelts, and field border strips (above).

The farmer or rancher faces trade-offs in establishing and maintaining hedgerows, field borders, or riparian zones. As mentioned earlier, these conservation practices create competition with adjacent fields for soil moisture and nutrients. Retention of hedgerows or windbreaks is not consistent with the emphasis advanced in the early 1970s to increase agricultural production from fence to fence. These tree and shrub strips also can be considered obstructions to the growing number of agricultural center-pivot irrigation systems, although low growing shrubs or strips of tall stiff grass may be needed to control soil blowing on irrigated fields.

Terraces and Waterways

Other specific soil conservation practices that have some potential to improve wildlife habitat and agricultural land productivity include grassed terraces and grassed waterways (Brady, 1984; OTA, 1982). Again, these conservation practices have been promoted since the 1930s to reduce soil erosion and provide a buffer for agricultural runoff and sediment flowing toward local lakes and streams. Farmers benefit from soil stabilization for sustained crop production. Terraces and waterways can be designed to benefit wildlife. For example, planting of specific grass mixtures provides food and cover and increases available wildlife habitat types. The Soil Conservation Service Plant Materials Centers and the Agricultural Research Service currently are evaluating plant species best suited for wildlife food and cover (Fryrear, 1984; USDA Soil Conservation Service, 1979).

Terrace and waterway construction may not benefit wildlife if wildlife considerations are not included in the planning and implementation of these techniques. Narrow terraces or waterways that are managed with wildlife in mind can provide nesting and escape cover for local wildlife populations. If cool-season grasses are planted on the terrace or in the waterway, any wildlife benefits will be reduced if the area is mowed during the peak nesting season. Nest success of ground nesting birds also tends to be low in narrow strip cover that is searched easily by predators (Gates and Hale, 1975).

Terrace and waterway establishment tends to be expensive and requires, in some cases, significant soil disturbance that results in high costs to the farmer. Vegetation along terraces and waterways may require maintenance to sustain the wildlife benefits and to control possible weed outbreaks. Narrow-based terrace construction costs in Illinois are about $300 to $400 per acre (Brady, 1984). Even with the Agricultural Stabilization and Conservation Service (ASCS) cost-sharing 60 to 75 percent of the terrace and waterway construction, many farmers find the construction cost and soil disturbance prohibitive (Cook, 1984). Farmers also face an economic trade-off between using an area for conservation purposes or using it for production of cash crops. Consequently, these practices are not in widespread use.

INTEGRATED MANAGEMENT SYSTEMS

Many of the above individual techniques are not new. However, resource managers seem to be shifting away from using individual techniqueshechnologies to address specific problems towards using a total land management approach. This approach incorporates a landowner's entire property into a system which makes the most use of the available resources for agriculture productivity and resource conservation. This approach to land management is characterized by the Resource Management System.

A Resource Management System (RMS) is a land management technique proposed and developed by the Soil Conservation Service (SCS). The RMS combines multidisciplinary input to develop a farm management and conservation plan coupling the landowner's goals for use of the resources and SCS goals of reducing erosion and nonpoint source pollution. SCS provides technical assistance to the farmer in developing such farm plans. The farmer then decides whether to apply all or part of the plan on his land. This approach to farm management links agricultural production and conservation with varying degrees of emphasis given to wildlife and fish concerns.

The RMS has high potential to integrate wildlife and fish considerations into farm system management. Whether or not the RMS approach proves useful in this regard still is not known. SCS has yet to evaluate the effectiveness of the RMS approach in meeting their goal of reducing erosion or nonpoint source pollution. Nor is there any information on the degree to which wildlife is incorporated into the farm plans. A recent survey of farmer adoption of the RMS indicates that only 30 percent of the farmers with an RMS had achieved 100 percent implementation of the recommendations (Buhena, et al., 1984). The degree of adoption of the RMS recommendations seemed to be related to the age of the plan; plans developed in the last 5 years had a lower percent implementation compared to older plans.

Potential benefits for wildlife and fish habitat depend entirely on the landowner's willingness and ability to implement the plan. Thus, the lack of landowner compliance obligations might be the major obstacle to meeting the stated goals of the landowner or SCS. The different disciplines also may have difficulty coordinating decisions on the specific practices which should be adopted to meet the overall stated objectives.

The following discussion, organized according to different land uses, describes selected integrated systems that also may be elements of an RMS.

Croplands

Conservatioa Tillago

Conservation tillage is any cropping system which leaves at least 32 percent of the mulch or stubble from crop harvest above the soil surface. These cropping systems, which include no-till, mulch till, and ridge till, are being implemented in many regions of the country (Brady, 1984; OTA, 1982). The systems are designed to reduce soil erosion and to aid in soil moisture retention while allowing sustained yields of farm crops. (For further discussion of conservation tillage, see Brady, 1984; Papendick and Elliot, 1984.)

Currently, benefits to wildlife and fish from conservation tillage are being evaluated on different sites across the country (Best, 1984; Castrale, 1984; Duebbert, 1984; Madsen, 1984). Preliminary research results indicate that nesting upland game birds and migratory birds are more abundant in conservation tilled fields when compared to conventionally tilled fields (Best, 1984; Madsen, 1984). A study in Iowa showed that small mammal population densities do not change significantly between the two systems, indicating that problems with increased rodent "pests" may not exist in conservation tilled fields, at least in some areas of the country (Best, 1984). Conservation tilled fields provide food, nesting, and winter cover not associated with "clean" fields.[2] The reduction in tillage allows increased nest building and production of some nesting birds compared to conventional tilled fields.

The adoption of conservation tillage systems still faces certain obstacles. The landowner may need to replace his current farm equipment with new machinery designed to plant into stubble or mulch. Further, the farmer will need to develop new weed control strategies that are effective under reduced tillage. Increases in applications of herbicides and possibly fertilizers may be required to sustain crop yields; changes that require "up-front" capital costs for chemical purchases. The potential increase in chemical use could have negative effects on fish populations. Perhaps the greatest obstacle to adoption of conservation tillage techniques is the farmer's reluctance to change from a "clean farming" approach to accepting a stubble-laden field.

Today, not enough is known about the effects of conservation tillage on wildlife and fish habitat to endorse this technique without reservation. The increase in chemical applications associated with some conservation tillage operations may have significant adverse impacts on wildlife or fish populations and their habitats. The erosion-reducing capabilities of conservation tillage may encourage farmers to farm marginal lands that previously were too erosion-prone to cultivate using conventional farming techniques. Lands currently not in production, generally because of low productive capability, are considered by wildlife biologists to be far more valuable as wildlife habitat than conservation tilled acres or clean acres, because they usually are undisturbed (Cacek, 1984).

Biological Farming

Another land management system that has generated much interest in the United States is biological farming, also known as alternative farming, organic farming, sustainable agriculture, or regenerative farming (Papendick and Elliot, 1984). The U.S. Department of Agriculture (USDA) defines biological farming (organic farming) as a production system which avoids or largely excludes the use of synthetic compounds, relying instead on crop rotation, residues, manures, and mechanical cultivation to maintain soil productivity and tilth, to supply plant nutrients, and to control pests (USDA, 1980). This system is attractive because of its potential to reduce capital costs significantly in farm operations as well as to reduce soil erosion. Some evidence exists to show that biological farming techniques can cut operation costs without a significant decrease in net profit (Youngberg, et al., 1984).

The transition from conventional, chemical intensive farming operations to biological farming initially may pose a risk to farmers.

[2] No surface litter or waste grain after harvest.

The risk is a decrease in profits and yields, and temporary increases in weed and insect infestations, With a greatly accelerated interest in reducing inputs into farming operations, particularly in light of high chemical and fuel costs, biological farming may be readily acceptable to farmers once the risks and problems associated with this system, particularly the transition phase, are clearly identified (Papendick and Elliot, 1984). The Agricultural Research Service (ARS) is currently developing a small-scale project on biological farming systems that includes evaluating the risks and problems associated with the transition from conventional farming operations to those of biological farming (Papendick, 1984).

The potential to improve wildlife and fish habitat and net profit with biological farming in some farming systems exists, but insufficient information is available at present about beneficial or adverse habitat impacts from this land management system. Only a few studies have attempted to evaluate the wildlife response on biologically farmed fields compared to conventionally farmed fields (Dahlgren, 1983; Ducey, et al., 1980). These studies conclude that breeding bird densities and diversity of wildlife increase dramatically on biologically farmed fields. Benefits to wildlife include a reduction in chemical contaminants in the ecosystem, an increase in habitat diversity associated with crop rotations and the use of mulches, a decrease in sediment runoff, and an increase in wildlife winter cover. However, for ground nesting birds, the gains in nesting habitat under biological farming may be offset by the increased tillage required for weed and other pest control,

Rangolands and Pastures

Federal land managing agencies (i.e., U.S. Forest Service, Bureau of Land Management) have taken an active role in trying to coordinate wildlife habitat needs into other agricultural operations on Federal lands (Maser, 1984). A great deal more research has focused on wildlife populations on rangelands and forestlands compared to croplands. This is due in part to the mandate in the National Forest Management Act (Public Law 94-588) and the Federal Land Policy and Management Act (Public Law 94-579) to maintain “viable” wildlife populations and establish multiple use of the public domain, including wildlife.

Biologists and range managers disagree among themselves as to whether wildlife habitat can be maintained in areas where the primary land use is livestock production. Improvements in range quality only benefit some wildlife. Wildlife can be affected adversely by grazing if livestock are present in a pasture during the bird nesting season or are competing with native ungulates (i.e., deer, antelope) for food supplies, especially in the winter. Livestock also may destroy riparian habitats along watercourses, thus damaging or eliminating important wildlife and fish habitat.

However, some rangeland management technologies exist which improve livestock production and enhance habitat for some species of fish and wildlife. In the semi-arid regions of Texas and Montana, rest-rotation grazing systems benefit both livestock and some species of wildlife (Egan, 1984; Bryant, et al., 1981), Rotating livestock between two or three pastures promotes forage growth in the “rested” area, improves overall range quality from the dispersal of intensive livestock use, helps to increase animal weight gain, and increases the number of animals that can use the same range. Ungulates, in particular deer and antelope, benefit from the improvement in range quality and the increase in food supply. It is likely that ground nesting birds also may benefit from the increased cover found in the rested areas.

Short Duration Grazing Systems or the Savory Grazing System (SGS) are receiving increased interest in the Great Plains and western United States because of the potential to improve forage production and livestock production. These systems currently are under evaluation for the potential benefits to wildlife (Drawe, 1984; Kruse, 1984).

Another grazing approach with potential benefits for wildlife is under research in South Dakota (Linder, et al., 1984). Grazing or mowing prairie pothole wetlands during certain seasons may provide additional food sources for livestock and open up dense wetland vegetation to enhance migratory bird habitat and use in early spring. Wetland vegetation appears to be palatable and to have some nutritive content for cattle, providing an alternative to grazing upland areas during midsummer to late summer. However, livestock operators may need to plan their livestock grazing operation to restrict use during the nesting season and promote use later in the summer in order for wildlife benefits to be realized.

Yet another technique to provide improved forage for livestock and benefit wildlife may be the establishment of native warm-season grasses in pastures currently planted to cool-season grasses. Warm-season grasses mature later in the spring and produce forage throughout the summer months when cool-season grasses generally have a lull in productivity. Warm-season grasses also are more tolerant of moisture stress and salt stress compared to their cool-season counterparts, thus making them more adaptable to poor quality soils. Each of these factors indicates the landowner would improve his forage production using warm-season grasses or a warm-seasordcool-season grass mixture compared to cool-season grasses alone. Depending on local seed availability, warm-season grasses are considered to be applicable to most regions of the country (Jung, 1984).

The overall benefits of warm-season grasses over cool-season grasses for livestock currently are being evaluated. Because warm-season grasses are structurally different from cool-season grasses, the standard laboratory techniques for determining digestibility and nutritive content are inconclusive as yet (Jung, 1984). The benefits to wildlife are better understood. Field studies suggest that warm-season grasses provide better winter cover for wildlife in contrast to cool-season grasses that can tolerate closer grazing. Most warm-season grasses should be grazed no shorter than 8 to 10 inches that, as a consequence, leaves more cover for wildlife overwinter and into early spring than cool-season grasses. The reduction in livestock on warm-season grass pastures during early spring when the grasses are in a slow-growth phase also eliminates some damage by cattle to wildlife nesting cover and food (Wooley, et al., 1982).

Today, landowners may have difficulty locating sufficient native seed stocks to establish warm-season grass pastures. Farmers/ranchers also would face an initial capital cost in transforming pastures from one grass type to a mixture of grasses or to a different grass type.

Forest Lands

Forest management systems can benefit selected wildlife populations through habitat enhancement while maintaining timber productivity (Thomas, 1979). Different timber harvesting schemes are under study for their ability to sustain timber production and yet enhance wildlife habitat for certain species. Wildlife response to different harvesting patterns varies among species and geographic locations. Timber harvesting techniques that retain seed producing trees or patches of forest appear to produce more beneficial habitat for some wildlife species than the technique of clearcutting large areas. However, the landowner generally finds it cheaper in the short-term to clearcut the land compared to cutting trees selectively (Ursic, 1984).

Some woodland owners, particularly non-industrial woodlot owners in the Northeast, are not managing their woodlands for lumber production. Instead, they place a high priority on wildlife habitat management (Alexander and Kellert, 1984). Many biologists and resource managers have focused on these areas as high potential wildlife habitat for selected wildlife species. In the Northeast for example, habitat can be enhanced by creating small openings in the forest canopy, retaining snag trees and dead materials, and encouraging the growth of shrubs and trees that provide wildlife foods (Gutierrez, et al., 1979). This and other tree stand manipulation can help the landowner meet the objective of enhancing wildlife habitat while implementing management practices that will generate some income from the timber resources.

REGIONAL AGRICULTURE MANAGEMENT

The regional approach to agriculture land management is a new and emerging technology. It involves the development of "landscape mosaics" to integrate conservation and wildlife considerations and agricultural production objectives. The approach can include matching a site with an appropriate land use activity. Thus, the most productive soils are used for agriculture, shifting gradually into more intensive wildlife habitat management on poorer soils and sites (Harris, 1984). Habitat mosaics could be connected with existing natural reserves and parks, developing habitat "corridors" among natural areas, along stream courses or through productive agricultural areas to provide passageways for wide-ranging species such as large, predatory wildlife (Harris, 1984).

Landscape mosaics require careful planning and landowner concurrence to make optimal use of the available land base for both agriculture production and wildlife habitat. Interagency cooperation would be one means of coordinating these different activities, helping to create a mosaic of habitats across a particular region.

Significant institutional obstacles exist in coordinating Federal, State, and local agencies and private interests to meet mutual objectives on a large land area. Landowner attitudes toward wildlife habitat management range from complete intolerance of wildlife to encouraging wildlife populations. The disparity in attitudes could be a major obstacle to regional implementation. Thus both the landowners and the agencies involved might need to be convinced that wildlife can, in fact, coexist in a beneficial way with agriculture.

An example of a regional approach to land management is Wisconsin's Dodge County Interagency Project. The Project was initiated under a cooperative agreement between the Wisconsin Department of Natural Resources (DNR), SCS, ASCS, U.S. Fish and Wildlife Service, University of Wisconsin Extension, and the Wisconsin Department of Agriculture, Trade, and Consumer Protection to coordinate wildlife habitat objectives with water quality enhancement, soil erosion control, and maintenance of farmer income through incentives and cost-share payments (Frank, 1984). SCS is providing the individual farm plans, ASCS is providing cost-sharing assistance, Extension will be involved in education and evaluation efforts, and DNR is coordinating the project and providing additional cost-sharing assistance for wildlife habitat enhancement. The Fish and Wildlife Service is involved in wildlife management recommendations and the Dodge County Land Conservation Committee supplies local advice and support.

The landowners expect to benefit from the availability of technical assistance and the long-range planning. Personal risk from implementing new land management techniques or from reducing crop yields will be offset by the incentive and cost-share payments borne by the Federal Government and the State. Some indication exists that landowners benefit from seeing how their individual management plan fits into a broader regional scope, thus providing the landowner with a justification and social motivation to do his or her part in the overall plan. Wildlife populations are expected to increase from the enhancement of specific habitats and the idled lands that will be made available for food and cover.

The Dodge County Project will serve as a field evaluation of the techniques currently known: 1) to enhance wildlife habitat on farmlands, primarily ground nesting birds and waterfowl, and 2) to control soil erosion and

[3]Institutions define what individuals can and cannot do, assign rights to resources, define roles and govern individual and collective ownerships. Institutions include, but are not limited to, agencies, professional or citizen organizations, and the court system.

runoff into waterbodies (Frank, 1984). The Project, if successful, will serve as a demonstration of regional management for multiple objectives. The first field season for implementation of specific techniques and incentive payments is 1985. The Project is expected to run through 1990 when results will be available on the effestiveness of this approach.

INFORMATION TRANSFER

To facilitate technology adoption, information on technology use, costs, and benefits must be made accessible to the landowner. Public education programs are needed to establish credibility for the coexistence of environmentally and economically sound management on agricultural lands (Cooper, 1984). Information transfer is a key element in the eventual acceptance of different land management practices.

A list of the most successful techniques available to transfer information to other professionals, landowners, and the general public in regard to integrating agriculture and wildlife was developed by the OTA workshop participants. The list[4] includes: 1) media (radio and television), 2) direct contact to the landowners through small groups or one-on-one technical assistance; 3) demonstration or pilot projects; 4) formation of interagency committees of Federal, State, and local agencies; and 5) the use of "opinion leaders" in the community to provide information to their peers. These techniques are used frequently by the Extension Service and the State Cooperative Extension Service to reach landowners with a wide array of information.

Demonstration projects are one of the most effective techniques to disseminate information to private citizens and other professionals. The appealing aspect of demonstrations is their ability to show, on the ground and within a community, exactly how different techniques can be applied to the resource base and the trade-offs for that particular area.

One recent demonstration project for integrating wildlife and fish concerns with agriculture occurred in Talbot County, Maryland, under a cooperative agreement with SCS, National Marine Fisheries Service (NMFS), and Talbot County Government (Goodger, 1984). The demonstration was aimed at landowners who were suffering moderate soil erosion along Chesapeake Bay as a result of unstable shorelines. Participants were shown how to use aquatic vegetation for shoreline stabilization and made aware of certain ecological benefits. The traditional approach has been construction of retainment structures that were costly, destroyed the native intertidal vegetation, and reduced fisheries habitat along the shoreline. To date, approximately 50 projects establishing marsh vegetation along the shoreline have been completed throughout the county (Goodger, 1984).

The Shoreline Stabilization Demonstration Project also provides an example of how different agencies can pool resources to meet common objectives. However, cooperation among different agencies with different objectives may be difficult to establish. In addition, a demonstration aimed at those participants most likely to benefit from the technique will require sophisticated technical expertise.

Another example of interagency demonstration is the use of Best Management Practices (BMP) for nonpoint source pollution control. This project is in the planning stages in Talbot County, Maryland. The Model Farm project hopes to pool the collective expertise of NMFS, SCS, University of Maryland, Maryland Department of Natural Resources, and the Talbot County Government (Goodger, 1984). While the specific BMPs for runoff control have yet to be established, the project may serve as a model on how interagency cooperation can develop a specific management system to reach the common goal of nonpoint source pollution abatement.

[4]Not ranked, and discussion will cover only (3), (4), and (5).

Another demonstration project, the Coverts Project, is underway in Vermont and Connecticut. This unique Project is designed to bring together opinion leaders in the woodlot-owning communities for an education series on how to manage woodlots for wildlife and personal timber needs (McEvoy, 1984a). The opinion leaders are given a broad range of information on managing woodlots which, in turn, they can provide to other members of their communities. Instead of presenting a specific management technique, like the Talbot County project above, the Coverts Project draws upon numerous techniques that individuals can apply to their woodlots based on each owner's objectives. Opinion leaders in Connecticut will be provided information on management of woodlots for wildlife as one of several management alternatives for the property. The focus in Vermont is on management of the entire property for wildlife and personal benefits (McEvoy, 1984b).

Information transfer by local opinion leaders has been successful in the past to meet predetermined objectives. In Champaign County, Illinois, for example, a local opinion leader in the community, the Chairman of the Soil and Water Conservation District, invited all the landowners of a particular township to a meeting, At the request of the SCS and the Chairman of the District, many of the landowners agreed to set aside or manage pieces of their prime farmland for wildlife and soil erosion control (Brady, 1984). SCS believes they achieved a high level of success in this township because of the motivation from the local opinion leader.

The Coverts Project coordinators currently are evaluating the criteria used to identify opinion leaders in a community. The workshops and demonstrations are planned for 1985. During the life of the Project, the effectiveness of using opinion leaders as quasi-extension personnel to reach landowners and the ability of the coordinators to identify opinion leaders will be evaluated (McEvoy, 1984a). The Project could serve as a model among Extension personnel for using local people to help others and for increasing the number of landowners that the Extension Service is capable of reaching with needed information.

The Project's success will depend on the opinion leader's ability to reach others with accurate information. Accurate character assessment of community opinion leaders in the Coverts Project will be useful for future efforts of this nature.

The use of opinion leaders may be most effective in groups having similar interests and motivation, such as the northeastern woodlot owners. Since landowners in many parts of the country hold different views of wildlife, the task of disseminating information and providing technical assistance to areas outside of New England will have to be tailored to those particular landowners and their interests and needs.

SUMMARY

The technolog es discussed above are only a sample of those available to integrate wildlife and fish habitat needs with agricultural production needs. These technologies generally tie wildlife and fish habitat considerations with efforts to control erosion, improve soil moisture content, or improve water quality. Each of these factors aids the long-term productivity of the resource base and, hence, agricultural production. For example, undercutters help farmers reduce weeds and soil erosion and increase soil moisture while improving the survival of bird nests and flightless young in wheat stubble.

Technologies to sustain the resource base for agriculture and wildlife are receiving renewed interest among a growing number of land resource managers. Old techniques are being refined to correspond to current agricultural needs (e.g., biological farming). Innovative appreaches are being developed to apply traditional techniques (i.e., Coverts Project). Each technique can be used in some specific region ef the country or be applied to specific agricultural operations. The differences among regions, land types, and landowner attitudes preclude across-the-board application of most of the technologies presented here.