Many of our natural resources are either owned or influenced by farmers. Our 2.4 million farms occupy over 900 million acres. Use of these lands influences the appearance of our Nation’s rural landscape, the quality of our water and air, as well as the amount and type of our wildlife.

In short, farms are an important part of the ecosystem we depend on. Not only do farmers influence our natural resources; the quality, quantity, and price of natural resources influence farmers’ profits and ultimately their ability to continue in farming.

The farm sector is extremely diverse. A tobacco farm in the Virginia Piedmont bears little relationship to an irrigated vegetable farm in California’s Imperial Valley or to a dryland wheat farm in the Palouse country of Washington State.

A 65-cow dairy farm in New York may scarcely resemble a corporation-owned drylot enterprise with 10,000 cows in Arizona.

Still, each of these farms influences and uses our Nation’s resources: Agricultural land, water, energy, and wildlife.

Beliefs and Practices

To a farmer, agricultural land is an input in a production process; land is needed to produce crops or graze animals. Yet the meaning of land to many farmers—perhaps most—transcends its production capacity. The land is a storehouse of wealth, a heri-
Farming in the United States is extremely diverse. A dryland wheat farm here in the Palouse of Washington State, for instance, bears little relationship to an irrigated vegetable farm in the Imperial Valley of California or to a tobacco farm in the Piedmont of Virginia.

tage from the previous generation, and a bequest to the next. To many farmers, land is something special and precious.

But farmers have to be business-minded to succeed. Thus farmers may hold strong beliefs on the wisdom of land stewardship and also farm in such a way as to cause considerable soil erosion.

Erosion remains a national problem despite a half-century of government programs to combat it. The U.S. Department of Agriculture estimates that cropland erosion still occurs at an estimated rate of 2 billion tons of soil a year. Although measuring soil loss is difficult, widely used tools show that four regions have severe water-caused erosion problems:

1) The Palouse and Nez Perce areas and the Columbia Plateau of western Idaho, eastern Washington, and north-central Oregon
2) The cropland soils of Nebraska, Kansas, Iowa, and Missouri
3) Uplands of the southern Mississippi Valley, and
4) Cultivated areas in Aroostook County, Maine.

Furthermore, almost 70 percent of the erosion exceeding 5 tons per acre is on less than 8.6 percent of the total cropland acreage.
Erosion Can Cut Yields

Erosion reduces the depth of topsoil, impairs the soil's capacity to retain water, and thwarts infiltration of water and air into the soil. As a result, soil erosion can ultimately reduce crop yields.

But measuring yield reductions due to soil erosion is difficult because, over time, farmers may substitute increasing amounts of fertilizers or use other technologies to enhance the soil's natural fertility. Also, erosion effects on crop yields differ by soil type, crop, and management practices.

Studies indicate, however, a relationship between erosion and reduced yields on many soils. If erosion has reduced the soil's water-holding-capacity, the rooting depth available to the plant, or the water infiltration rate, adding fertilizer may not offset the yield-reducing effects.

Erosion also affects air and water quality. Agriculture is considered the main source for that part of the Nation's water pollution that comes from diffuse (nonpoint) sources. Sediment in water runoff carries along fertilizer residues, pesticides, dissolved minerals (such as salts), and animal wastes (with associated bacteria).

Excessive sedimentation can clog navigation channels and can dirty drinking water, adding costs to rectify both, and can reduce recreational opportunities. Also, in some areas, sediment is rapidly filling inland lakes and reservoirs. soil erosion is considered a problem because it can ultimately reduce crop yields. The sediment in water runoff is
no less of a problem—contributing substantially to the Nation's water pollution problems.
Managing Natural Resource Systems

The Profit Factor

If erosion reduces yields, water, and air quality, why don’t all farmers practice conservation? A major reason is many conservation practices do not pay for themselves. However, this is not because the practices are ineffective.

Farmers can choose among many soil conservation techniques such as changing the characteristics of a field’s topography with terraces, planting only the least erosive lands, rotating crops, strip cropping, planting on the contour, retaining crop residues on the field surface after harvesting, constructing waterways, or using methods such as no-till.

No-till is a technique that eliminates almost all tillage, and chemicals—rather than conventional plowing—are used to control weeds. On some croplands this can reduce erosion rates 60 to 95 percent.

Many of the techniques are not profitable, however, or not perceived to be so. A business-minded farmer—who must be competitive to remain in farming—is not interested in practices that don’t pay. Even a farmer with a strong land ethic and a desire to practice soil conservation may find it financially impossible to do so.

Mining the Soil or Not

For the business-minded farmer, a decision to maintain, improve, or deplete soil is largely an investment decision.

For some tracts of land, conservation may be economical for the farmer when the land is first cultivated. This might be true on fairly flat land where the topsoil is shallow but highly productive, and the subsoil of substantially poorer quality. In this situation, losing an inch of topsoil could reduce yields dramatically. Erosion could be reduced inexpensively if, for example, contour plowing or residue retention were used.

On other tracts where conservation requires major land-moving technologies to form terraces and where straight-row, highly erosive cropping patterns can bring a high dollar return, private economics may dictate mining the soil. This is particularly true where the original topsoil is very deep.

Other financial factors also influence the farmer’s decision on conserving soil. The lower the price of soil substitute, such as fertilizers, the less likely the farmer is to conserve. Also, the lower a farmer’s current net income, the less likely he or she is to conserve, since substituting future income for present income is financially impossible.

While many soil conservation practices may not be economical investments for farmers, there are exceptions, such as conservation tillage, contour plowing, and leaving residue on the field after harvest. In some areas these practices are effective in reducing erosion and may even increase profits.
Farmers can choose among many soil conservation techniques. On this cropland in southwestern Iowa, the farmer has chosen to plant on the contour and use conservation tillage. These practices are effective in reducing erosion and in some areas of the Nation may even increase profits.

The Nation’s policymakers currently are considering changes in conservation programs to make them more effective in reducing soil erosion on croplands. If incentives are provided so farmers will conserve the soil when and where it is appropriate, substantial progress can be made in both retaining soil for future production and improving water and air quality.

**Cropland in Use**

Erosion influences the quality of our farmland. Another dimension is the quantity of farmland. The amount of land in crops was relatively stable from 1920 through 1950, varying between 360 to 380 million acres. That was followed by a decline to a 1962 low of 331 million acres, mainly due to tremendous advances in yields per acre during the 1950’s.

Next there was a relatively stable period when land used for crops averaged about 330 million acres until 1972. Then the land used for crops began to increase, reaching a new high of 391 million acres in 1981.

Considerable regional shifts occurred in the use of cropland. Over a third of the cropland decline took place in the Northeast, Southeast, Appalachia and the southern Plains. Other regions increased their cropland acres. Recent rises were mainly in the Mississippi Delta States, the northern Plains and the Corn Belt.
Cropland in Actual Production

Land used for crops (millions of acres)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
<td>320</td>
<td>340</td>
<td>360</td>
<td>380</td>
<td>400</td>
<td>380</td>
<td>360</td>
<td>340</td>
</tr>
</tbody>
</table>

Source: USDA

Land Shifts Too Big?

These trends and changes have led many to question whether too much land is being converted from agricultural to nonagricultural uses.

Numerous studies have been made of the physical adequacy of our total cropland base relative to future land requirements. Many researchers concluded there will not be land shortages endangering food and fiber production, although there may be some increases in the real costs of production.

These aggregate statistics do not mean there should be no concern about conversion of agricultural lands to nonagricultural uses, however.

First, many communities enjoy the visual, cultural and financial benefits from a viable agricultural industry. Thus, some communities are willing to forego benefits from whatever alternative uses would have replaced agriculture in the region. Therefore they are interested in reducing the incentives for farmers to sell their land to nonagriculturalists.

Second, some farmlands have unique characteristics for producing specialty crops—such as cherries in the Great Lakes States; citrus in the warmer regions of California, Texas, and Florida; or wine grapes in the coastal States.

If these lands are converted to nonagricultural uses, replacing their production within the Na-
tion could prove expensive. More controlled environments might have to be provided, production costs could rise, or yields decline. Furthermore, producing these specialty crops may give a region a unique cultural attribute the community wishes to preserve.

**Agri-Urban Patterns**

Thus many communities are looking for techniques providing farmers with incentives to continued farming. The search for viable techniques is not easy since frequently the communities most interested in retaining agricultural land already have a land-use pattern best described as "agri-urban."

Agri-urban is an intermixture of farm and rural residential uses with no clearly defined boundaries for either use. This usually means the demand for land for development and recreational purposes is strong, property taxes are high, and friction between neighbors over normal farm practices and suburban uses is great. Therefore, farmers may have many incentives to sell their land.

**Irrigation Use**

Use of water for irrigated agriculture has tripled since 1940. This growth has been possible in part because of low energy prices for water pumping and Federal subsidies that have kept the cost of water low. Irrigation now accounts for over a fourth of the value of the Nation’s crops.

Much of the growth in water use has been concentrated in the midwest, in States overlying a vast underground lake—the Ogallala Aquifer. Farmers have used wells to raise water from the aquifer to grow sorghum, corn, and alfalfa, some of which has been fed to cattle.

However, the era of both low cost water and low cost energy appears over. Where farmers rely on ground water such as the Ogallala Aquifer, declining ground-water tables coupled with rising pumping costs make irrigation water more expensive.

High energy costs make it less attractive to pump surface water over long distances as in transferring water from one river basin to another. Also, western surface water sources are, for the most part, already fully appropriated, so new users increasingly will have to bid water rights away from present users.

This combination of falling water tables and rising energy costs means, long term, that ground-water irrigation will decline. Farmers are adjusting to higher irrigation costs by adopting water conservation measures; still, the relative profitability of irrigated farming to dryland farming has dropped.

**Salinity Problem**

Increased irrigation not only impacts on water supplies, but may result in rising soil and water salinity. Some researchers estimate that as much as 25 to 35 percent of irrigated lands in the West have a salinity problem.
Maintenance of wetlands, careful application of chemicals, and maintenance of border strips at the edges of fields are all measures farmers can—and do—take to provide the quality of habitat necessary for wildlife.

Salinity can result in significant loss in yields and profits, and farmers are seeking ways to reduce the problem. One way, drip-irrigation, reduces the amount of water needed to irrigate effectively. Another involves recirculating water. The least salty water is used first on the crops most adversely affected by salt. As the water gets saltier, subsequent uses are on less sensitive crops.

**Role of Chemicals**

Most farmers rely on chemicals to raise crop yields: fertilizers, herbicides, and insecticides. While these chemicals have many beneficial effects, some—if they find their way into water bodies or the food chain—have been implicated as posing threats to human or animal health.

Chemicals are very expensive inputs, and farmers do not like to see off-farm chemical losses any more than the general public. The problem exists in part because stopping the movement of chemicals to inappropriate places is also expensive.

Techniques exist for curtailing use of chemicals without cutting
yields. One—integrated pest management—in some cases substitutes biological and other methods for chemical control. In other instances it involves using chemicals as effectively as possible so not as much is required. Organic farming methods may cut chemical needs without reducing net farm income.

**Energy, Wildlife**

Historically, the farm sector has responded to relatively low energy prices by substituting chemicals and fuel for labor and land. Fuel, for example, can be used to irrigate crops and offset vulnerability of the harvest to bad weather. Energy—through chemicals—can protect crops from pests.

Energy has been used not only to improve yields, but to curb crop spoilage risks after harvest—by drying or refrigeration.

Still, energy is a small proportion of total production costs; 3 percent of total energy use in 1974 was for food production. So farmers do not make dramatic adjustments to rising real costs of energy. Changes are occurring, however, to reduce the use of energy for irrigation via water conservation measures such as irrigation scheduling, or reducing chemical use with more fertilizer-sensitive plants, recycling animal wastes, or integrated pest management.

Besides producing food and fiber, cropland, pastureland and rangeland are—if managed correctly—excellent habitat for many wildlife species. Border strips at the edge of fields, carefully applying chemicals, and maintaining wetlands can provide the quality of habitat needed.

In contrast, converting wetlands to cropland, planting fence row to fence row, and removing windbreaks all may have harmful effects on wildlife. What’s more, irrigation expansion can bring river systems below the water level needed to support fish and other water-dependent species.

While in some cases protecting wildlife habitat will mean tradeoffs in agricultural production, often relatively minor changes in farm operations can avoid detrimental wildlife impacts or increase positive effects.