



5-1963

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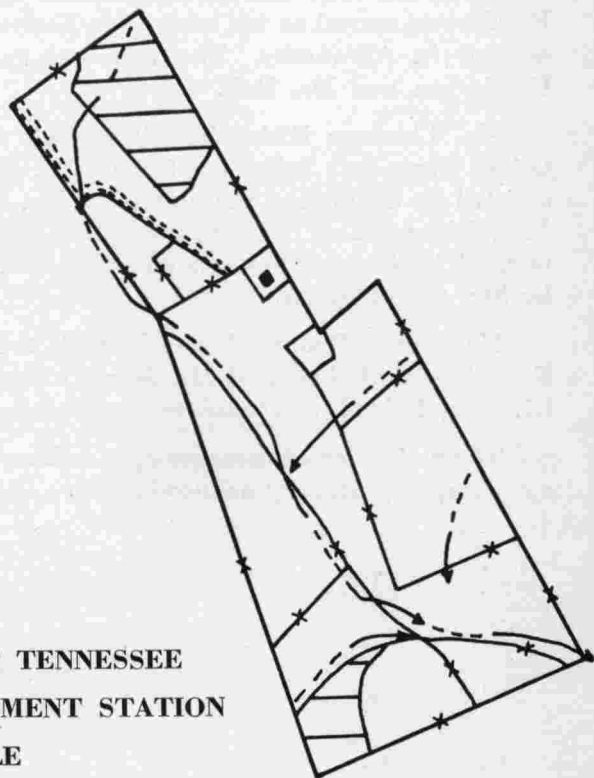
# Economics Of Farming Systems For Conservation

## ON A LOW-PRODUCTION FARM IN THE UPPER EAST TENNESSEE VALLEY

by  
H. A. Henderson  
Frank F. Bell  
and  
Marvis D. Cunningham

THE UNIVERSITY OF TENNESSEE  
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KNOXVILLE

COOPERATING WITH  
FARM ECONOMICS DIVISION  
ECONOMIC RESEARCH SERVICE  
U. S. DEPARTMENT OF AGRICULTURE



## ACKNOWLEDGMENTS

Part of this material was originally presented in a Masters Thesis at the University of Tennessee by Mr. Cunningham. Mr. Henderson served as his advisor in Economics and Mr. Bell as his advisor in Agronomy. The text was extensively revised by Mr. Henderson and Mr. Bell.

Mr. Clarence Richards, Work Unit Conservationist, and Mr. Oliver Rice, Soil Scientist of the U. S. Soil Conservation Service, assisted in estimating the soil loss. Mr. Richards and W. P. Corbett, Management Agronomist, developed the conservation systems. The farming systems and economic budgets were developed by Mr. Cunningham.

Mr. David Brown, formerly with the Tennessee Agricultural Experiment Station, and Mr. Max Tharp, of the Farm Economics Division, helped to stimulate undertaking of the work.

The assistance of these men, as well as others of the cooperating agencies, is gratefully acknowledged.

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# Economics Of Farming Systems For Conservation

## ON A LOW-PRODUCTION FARM IN THE UPPER EAST TENNESSEE VALLEY

by

H. A. Henderson, Frank F. Bell, and Marvis D. Cunningham <sup>1</sup>

### INTRODUCTION

Since the early 1930's, "soil conservation" has become a common word to farmers and agricultural policy makers. As incentives to promote soil conservation, farmers may receive technical and financial assistance in many forms. Yet with all this assistance available there are wide variations in conservation practices of farmers, especially in the low-income areas of the South.

Conservation of soils is usually promoted with the hope of improving, maintaining, or minimizing reductions of soil productivity for benefits in future years, to protect others lo-

cated in the flood plains, or for other public goals.<sup>2</sup> Yet, individual farmers cannot be expected to substantially reduce their own current income to achieve the goals of other individuals or of the public.

In low-income farm areas, such as parts of the Upper East Tennessee Valley, land resources are often so limited that farmers need current incomes as great as their soils can produce. Any land-use plan which causes a reduction in current income in the hope of future income is even more critical on these farms than on farms with more adequate resources.

### Objective of the Study

The many conservation systems that have been developed differ as to costs of application, resources required for operation, and returns to the operator.

<sup>1</sup> Agricultural Economist, Farm Economics Division, U. S. Department of Agriculture; Professor of Agronomy, University of Tennessee; and formerly Assistant Resource Development Specialist, Tennessee Agricultural Extension Service, respectively.

<sup>2</sup> For an example of the application of the economics of conservation farming to one public goal, see Marvis Doyle Cunningham, *An Evaluation of Soil Conservation Systems in the Lick Creek Watershed*, Masters Thesis, University of Tennessee, 1959.

The purpose of this study was to determine for the Upper East Tennessee Valley the relationship of level of practices used for conservation on the farm to 1) costs and returns of

farm operation; 2) profitable enterprise combinations; and 3) the requirements for resources to operate a representative low-production farm.

## Procedures and Scope

The first step was to find a farm that was fairly representative of low-production farms in the area. It was selected on the basis of data from a previously-reported survey of 506 rural households in the Upper East Tennessee Valley that was completed in 1958.<sup>3</sup> Several farms were selected from the average and/or modal group of farms in the above survey, based on such characteristics as age of operator, size of labor force, capital position, size of farm, proportions of the farm in different land classes, and type of farming. Local agricultural leaders then visited these farms and selected one representative of many farms in the area.

No actual farm is likely to be either average or modal for all characteristics of all farms. It is expected that it will be enough like many farms, however, that conclusions about it may be adapted to other farms in the area.

The farm selected is referred to both as a "part-time farm," and a "full-time farm," depending on whether the farm family is assumed to continue off-farm work or to con-

sider its employment wholly to this farm. The household selected, as is true of over 75% of the rural households in the 1958 survey and about 60% of all farms in the area, had members who worked off the farm.

Soil management systems with low, medium, and high levels of practices for conservation were planned for the representative farm by local personnel of the U. S. Soil Conservation Service. The medium system is the one the local planner, in his routine work, would have suggested for the farmer to adopt. The high-level system was subjectively estimated by him to be more conserving and the low-level system less conserving than the medium one. After the soil management systems were developed, the soil loss for each was estimated.<sup>4</sup>

After deciding on the soil management systems to be used, different enterprises and combinations of enterprises were developed to fit these systems.

Input-output data for use in the economic analysis were developed from published and unpublished ma-

<sup>3</sup> Henderson, H. A., *Resources and Incomes of Rural Upper East Tennessee People*, Tennessee Agricultural Experiment Station Bulletin No. 312, 1960. The sample was drawn from the rural areas of Grainger, Greene, Hamblen, Hawkins, Jefferson, Sullivan, and Washington counties of Tennessee.

<sup>4</sup> A soil-loss-predicting equation in an unpublished handbook of the Tennessee Agricultural Experiment Station, the U. S. Agricultural Research Service, and the U. S. Soil Conservation Service was used to estimate the tons of soil that would be lost annually from the entire farm with each of the proposed systems. The basic plans were first prepared with subjective measures of high, medium, and low conservation, after which the soil-loss-predicting equation was applied. Tons of soil lost by erosion is only a partial measure of soil deterioration.

terial at the Tennessee Agricultural Experiment Station.<sup>5</sup> A level of technology presently available for use, but more advanced than the present system on the farm, was used for all budgets.

A budget analysis was then made to determine the costs and returns of these different systems of farming, and what effect they would have on net farm earnings. In developing the budgets, any change in soil management systems that made the high-level system more conserving or the low-level system less conserving was incorporated if it raised current income. No material change in the conservation level was considered for the medium-conservation budget. By cal-

culating net farm earnings associated with the three systems of farming, an attempt was made to establish the general relationship of conservation effort to net farm earnings within the range of plans used.

For establishing the conservation levels, conservation is defined as "maintaining potential soil productivity over time." It is a measure of soil condition only and has no inherent economic or moral connotations.<sup>6</sup> A brief description of the combinations of practices used for this purpose is given for each system. No implication that these practices or combinations are recommended for general use is intended.

## PRESENT SITUATION OF REPRESENTATIVE FARM

### Topography

The topography of the land on the selected farm is rolling with a slope range of 2% to 30%. A small stream that runs through the farm provides drainage for the slopes to each side. This stream presents a problem since

it overflows in times of heavy rainfall. The upland fields are rather small, with short, steep slopes, and are not suited to strip cropping, terraces, or long contour rows (Fig. 1).

### Soils<sup>7</sup>

The soils on the selected farm include Hamblen, Leadvale, Whitesburg,

Dandridge, and Needmore. Hamblen is a bottom-land soil near the streams

<sup>5</sup> The pasture and crop-yield estimates were obtained independently from five agronomists; likewise, estimated production of dairy cows was obtained from five dairy husbandmen. All estimates were averaged and the rounded average used in the budgets.

<sup>6</sup> From an economic viewpoint, conservation is the allocation of resources between time periods. For soil conservation problems, it includes holding soil loss by erosion at a low level in an early period as well as improving or maintaining the physical and chemical conditions needed for future crop production. Economic problems arise when the management for high incomes in one period reduces incomes in other time periods.

For a more detailed discussion of the meaning of soil conservation, see Joe A. Martin and Eugene Gambill, *Soil Conservation and the Public Interest*, University of Tennessee Farm Economics Bulletin No. 7, October, 1954.

<sup>7</sup> For a more detailed description of the soils and topography, see Max J. Edwards *et al.*, *Soil Survey of Greene County, Tennessee*, U. S. Department of Agriculture, Washington: 1958.





drained soil formed from local alluvium derived chiefly from calcareous shale. It is in narrow strips along small streams. Crops that are suited to it include corn, soybeans, pasture, and hay (other than alfalfa).

Needmore soils have calcareous shale directly under them in many places; in other places they are weathered to depths of 3 to 4 feet. Production of crops on this soil is limited by its low water-supplying capacity. It is well suited to small grains and to legumes and grasses, but on slopes it is easily eroded and must be kept in sod if extensive erosion is to be prevented.

Depth of the Dandridge soils to shale bedrock ranges from 6 inches to 2½ feet, depending upon the amount of erosion. The soils are medium-acid where deep, and slightly alkaline

where shallow. They are not suited for row cultivation but will provide good grazing part of the year if pastures are well fertilized. Yields of pasture in summer are limited by the very low water-supplying capacity.

Soil mapping units are small and have irregular shapes. This makes it difficult to lay out fields of efficient size with uniform soil conditions. As a result, as crops are rotated considerable fluctuation in crop yields occurs.

The farm has 56 acres of land, of which 24 are on the gentle slopes and bottom land, 26 on rolling land, and 6 on steep land. The size of the farm and the kinds, amounts, and combinations of land classes are typical of other farms in the area. About a fourth of the farms in the area are between 40 and 69 acres in size.

## Labor Force

The labor force of the selected farm consisted of the operator, age 47, his wife, age 47, their 15-year-old daughter, and 17-year-old son. In 1958 the operator and son were each available for about 100 days of farm work. They spent the remainder of

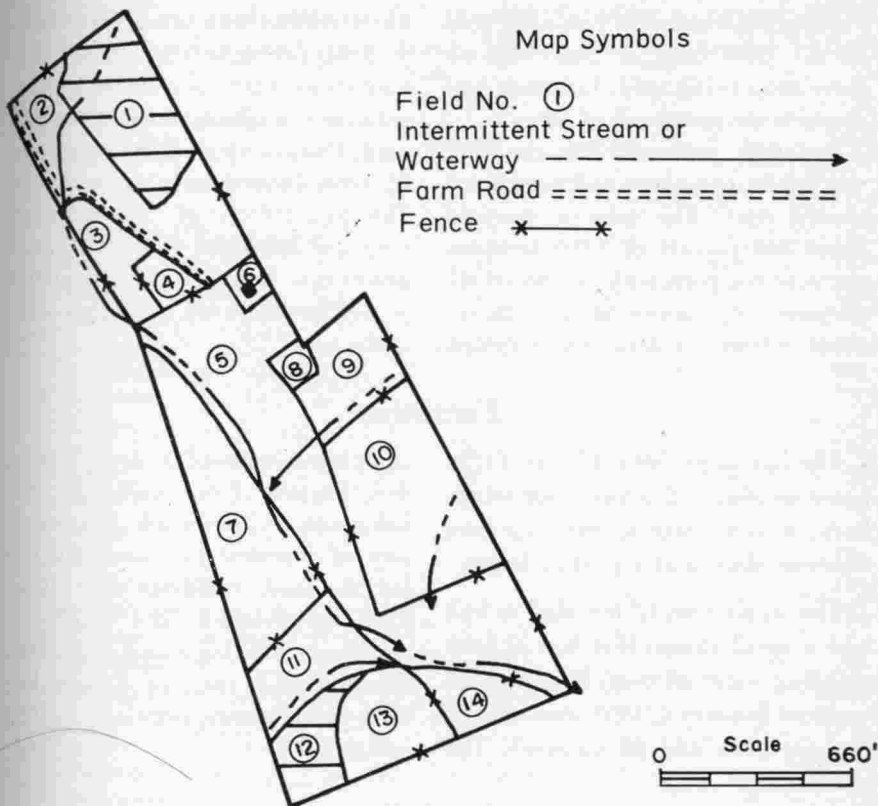
the time working part-time on other farms and at nonfarm jobs.

One-fourth of the farm operators in the area are between 45 and 55 years of age. Nearly half of the households have four or more members, but only one-fifth have as many as four who are 14 years of age or older.

## Present Farm Organization

The present farming operation appeared to be at a very low level from both profit and conservation considerations. The only land cultivated consisted of a garden, which the operator made, and 0.6 acre of tobacco and 1.4 acres of sorghum, both rented out (Fig. 2). The modal group of tobacco allotments in the area is 0.60 to 0.69

acre, and represents about one-fifth of all farms in the area. The remaining land on this farm was used as follows: 41 acres for unimproved pasture, consisting of lespedeza, wild grasses and weeds; 7 acres for woodland which was grazed, and which received little woodland management; 1 acre as homestead; and 5 acres idle.



| Field number | Size in acres | Land use           |
|--------------|---------------|--------------------|
| 1            | 5             | Woodland           |
| 2            | 5             | Idle               |
| 3            | 1.4           | Sorghum cane       |
| 4            | .6            | Tobacco            |
| 5            | 13            | Unimproved pasture |
| 6            | 1             | Homestead          |
| 7            | 6             | Unimproved pasture |
| 8            | 1             | Unimproved pasture |
| 9            | 4             | Unimproved pasture |
| 10           | 10            | Unimproved pasture |
| 11           | 2             | Unimproved pasture |
| 12           | 2             | Grazed woods       |
| 13           | 3             | Unimproved pasture |
| 14           | 2             | Unimproved pasture |
| Total        | 56 acres      |                    |

Figure 2. Present layout and cropping plan of a representative low-production farm, Upper Tennessee Valley, 1958.

Tobacco was continued year after year on the same tract of land with no cover crop being used. Livestock had access to the pasture at all times.

Soil tests indicated that the land was low in phosphate and potash and needed lime. The tobacco received about 800 pounds of 3-9-6 fertilizer per acre per year, with an annual application of manure at the rate of about 5 tons per acre. The sorghum

was fertilized with about 100 pounds of 3-9-6 per acre. The tobacco yield was about 1,200 pounds of leaf per acre, and sorghum about 2 tons per acre. Pasture yields were very low—41 acres carried only 3 animal units. The productivity of this farm was very low compared with its potential production, based on soil capabilities, as well as compared with other farms in the area.

## Facilities

The buildings other than the farmhouse consisted of a tobacco-livestock barn, a combination corn crib and machine shed, and a poultry house.

The water supply included a well and a small stream that had at least standing water all year. The livestock on hand January 1, 1958, consisted of 3 dairy cows and 50 chickens. The

equipment included a 2-row tractor, disk harrow, 2-row cultivator, hay baler and 1½-ton truck. The inventory of investments showed \$10,000 for the land, buildings and fences, \$225 for livestock, and \$2,775 for machinery, making a total of \$13,000. Of all farms in the area, a fourth had farm investments between \$10,000 and \$16,000.

## Costs and Returns

Total receipts for the farm in 1957 were \$1,127, of which \$624 consisted of home-used products. The total expenses amounted to \$808, which left \$319 as the net earnings for the farm. In addition, the receipts for off-farm work amounted to \$3,000, with an associated expense of \$616, leaving a net off-farm income of \$2,384. The total net receipts for the farm and

off-farm work, therefore, amounted to \$2,703 (Table 1).

In most characteristics observed, the farm operator and his resources were fairly typical of those found in the area. This was indicated by the data of the survey and by the judgment of professional agricultural workers in the area.

## FARM ORGANIZATION FOR FULL-TIME FARMER

### Soil Management Systems for Different Levels of Conservation

For the plans that follow, the land area and labor force were assumed fixed. The amount of credit was con-

sidered unlimited as long as it returned 5% or more. Farm enterprises and combination of enterprises were

**Table 1. Cost and returns for present farming program for a representative low-production farm, Upper East Tennessee Valley, 1957**

| Item  | Amount           | Unit | Rate  | Value            |
|---|------------------|------|-------|------------------|
|   |                  |      | \$    | \$               |
| <b>A. Receipts</b>                                  |                  |      |       |                  |
| 1. Cash receipts from farming                       |                  |      |       |                  |
| Tobacco   | 234 <sup>1</sup> | lb.  | 0.60  | 140 <sup>1</sup> |
| Dairy calves  | 3                | each | 75.00 | 225              |
| Fryers  | 25               | each | .60   | 15               |
| Eggs  | 308              | doz. | .40   | 123              |
| Total farm cash receipts                            |                  |      |       | 503              |
| 2. Perquisites                                      |                  |      |       |                  |
| Dwelling  |                  |      |       | 240              |
| Milk  | 50               | cwt. | 3.40  | 170              |
| Butter  | 50               | lb.  | .50   | 25               |
| Eggs  | 200              | doz. | .40   | 80               |
| Poultry   | 15               | each | .60   | 9                |
| Garden  |                  |      |       | 100              |
| Total perquisites                                   |                  |      |       | 624              |
| Total farm earnings                                 |                  |      |       | 1,127            |
| 3. Off-farm custom work                             |                  |      |       |                  |
| Hay baling  |                  |      |       | 250              |
| Hauling (truck)                                     |                  |      |       | 2,750            |
| Total off-farm receipts                             |                  |      |       | 3,000            |
| <b>B. Expenses</b>                                  |                  |      |       |                  |
| 1. Direct cash costs                                |                  |      |       |                  |
| Crop expenses <sup>2</sup>                          |                  |      |       | 7 <sup>2</sup>   |
| Livestock expenses                                  |                  |      |       | 105              |
| Custom work and fuel cash costs                     |                  |      |       | 200 <sup>3</sup> |
| Total cash costs                                    |                  |      |       | 312              |
| 2. Fixed costs                                      |                  |      |       |                  |
| Equipment depreciation and repairs (\$2,775 @ 10%)  |                  |      |       | 277              |
| Building depreciation and repairs (\$4,000 @ 3%)    |                  |      |       | 120              |
| Fence depreciation and repairs (\$500 @ 7%)         |                  |      |       | 35               |
| Taxes   |                  |      |       | 30               |
| Interest on land, buildings, fences (\$10,000 @ 5%) |                  |      |       | 500              |
| " " equipment (\$2,775 @ 5%)                        |                  |      |       | 139              |
| " " livestock (\$225 @ 5%)                          |                  |      |       | 11               |
| Total fixed costs                                   |                  |      |       | 1,112            |
| Total all costs                                     |                  |      |       | 1,424            |
| Total off-farm share of costs                       |                  |      |       | 616              |
| Total farm share of costs                           |                  |      |       | 808              |
| <b>C. Net Earnings</b>                              |                  |      |       |                  |
| Net farm earnings                                   |                  |      |       | 319              |
| Net nonfarm earnings                                |                  |      |       | 2,384            |
| Total net earnings                                  |                  |      |       | 2,703            |

<sup>1</sup> This farm is not typical in that the tobacco was rented out.

<sup>2</sup> Most crop expenses paid by tenant.

<sup>3</sup> Used for off-farm work and custom work on other farms.

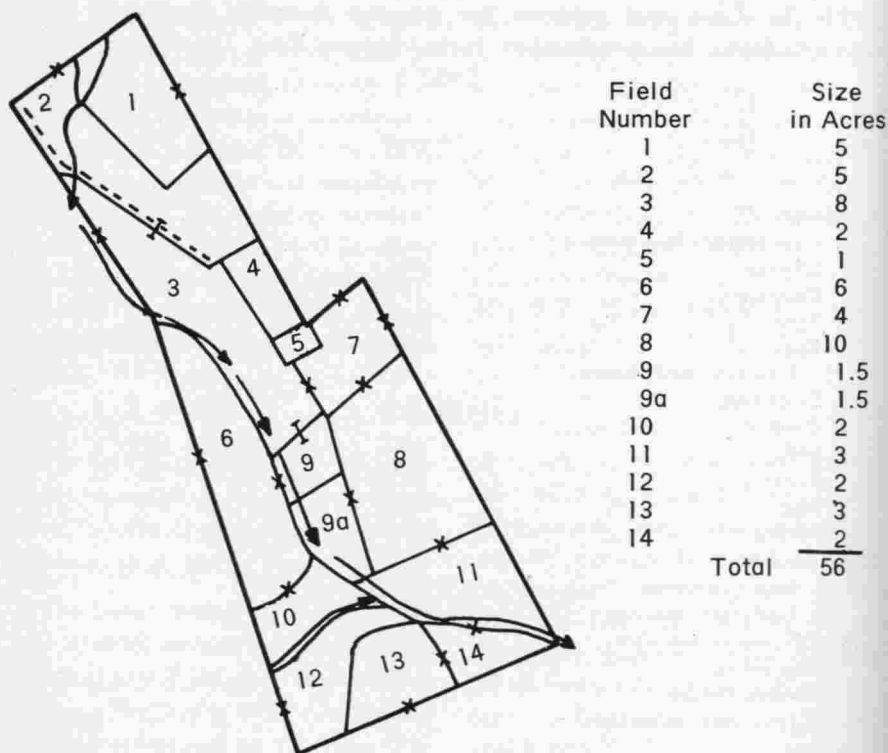


Figure 3. Field layout for alternative soil management systems, low-production farm, Upper East Tennessee Valley, 1962.

developed to conform to the land use, labor, and capital in a way that would maximize current net income. The maximum tobacco acreage was fixed by allotment, the number of chickens was fixed at present levels, and the number of hogs at the number needed for home use. A farm map with new field arrangements is given in Figure 3.

Field 4 was used for the homestead in all plans.

### Low Level of Conservation

*Cultivated land.* Field 9A (1.5 acres) will be used each year for tobacco and garden for a period of

10 years, after which time it will be established in sod.

Fields 10, 11, and 14 (7 acres) will be used each year for corn production.

Fields 2, 3, and 8 (23 acres) will be farmed in a 3-year rotation of corn, wheat (lespedeza hay), lespedeza hay.

*Pasture.* Fields 5, 6, 7, and 9 (12.5 acres) will be established and maintained in permanent pasture consisting of fescue and white clover. After a period of 10 years, field 9 will be used for tobacco and garden.

Field 13 (3 acres) will remain in unimproved pasture.

*Woodland.* Fields 1 and 12 (7 acres) will remain in woodland.

## Medium Level of Conservation

*Cultivated land.* Fields 9 and 9A (3 acres) will be farmed in a 4-year rotation of tobacco and sod crop. One field will be established in fescue and Kenland red clover. The other field will be used for tobacco and garden, followed by a cover crop of vetch and oats each fall. Then after a 4-year period, the uses of the fields will be reversed.

Fields 10, 11, and 14 (7 acres) will be used each year for corn, followed each fall by a cover crop of vetch and oats.

*Pasture and hay land.* One acre of woodland of field 1 and all of field 12 will be clear cut; field 12 will be used for pasture and part of field 1 for meadow.

Part of field 2 (3 acres) will be established and maintained in timothy and Kenland red clover and will be used for hay. Two acres of field 2, plus fields 5 and 7 (7 acres) will be established and maintained in alfalfa and orchardgrass for hay.

Fields 3, 6, 12, and 13 (19 acres) will be established and maintained in fescue and white clover pasture. As the white clover stand begins to thin out, fields 6, 12, and 13 will be overseeded with Kobe lespedeza. Field 8 and the cleared part of field 1 (11 acres) will be established and main-

tained in orchardgrass and Ladino clover pasture.

*Woodland.* The remainder of field 1 (4 acres) will remain in woodland and will receive protection.

*Mechanical measures.* A drainage ditch of 200 feet will be constructed and maintained between fields 9 and 6, 9 and 10, and 11 and 14.

## High Level of Conservation

*Cultivated land.* Only the tobacco and garden will be cultivated and these will have winter cover. This is field 9 (1.5 acres), which will be rotated with field 9A (1.5 acres), which is in meadow.

*Pasture and hay land.* Field 1 will be cleared of trees and established in permanent pasture. The conservationist planned this because the woods formed a barrier to the line of view from the house and also the well-managed pasture would be about as soil conserving as the woodland.

Fields 1, 2, 3, 5, 6, 7, 8, 10, 11, 13, and 14 (49 acres) will be established and maintained in permanent pasture consisting of fescue and Ladino clover.

*Woodland.* Field 12 (2 acres) will be clear cut and set to pine seedlings.

*Mechanical measures.* An open drainage ditch of 500 feet will be constructed and maintained as with the medium system. A farm pond will be constructed and maintained in field 7.

## Farming Systems for Different Levels of Conservation

### Low Level of Conservation

The full-time farmer with the low level of practices used for conserva-

tion will have a relatively intensified system of farming. Land use will consist of 14 acres of corn for grain, 8

acres of wheat for grain double-cropped with lespedeza, 8 acres of second-year lespedeza hay, 12.5 acres of permanent and 3 acres of unimproved pasture, 7 acres of woodland, 0.9 acre for garden, and 0.6 acre for tobacco (Table 2).

The livestock will include 5 dairy cows, 1 heifer over a year old, 1 heifer under a year old, and 50 chickens and 2 hogs for home use.

### **Medium Level of Conservation**

The row crops for the full-time farmer with the plan for medium level of practices used for conservation will consist of 7 acres of corn for grain, 0.9 acre for garden, and 0.6 acre of burley tobacco. All cultivated crops will be followed each fall by a winter cover crop of vetch and oats. For hay and pasture there will be 4.5 acres of meadow of which 1.5 acres will be rotated each 4 years with the garden and tobacco land. In addition to the meadow for hay, there will be 7 acres of alfalfa and orchardgrass, and 30 acres of permanent pasture. The woodland will consist of 4 acres, which will receive improved protection and management (another 3 acres will be cleared for pasture and meadow). The mechanical measures will consist only of 200 feet of channel improvement along the stream. Fertilizer and

lime will be applied according to needs indicated by soil tests.

The livestock system will have double the number of dairy cows and heifers planned for the low-level system, or 10 cows, 2 heifers, and 2 heifer calves.

### **High Level of Conservation**

At the high level of practices for conservation the farming system will be primarily grassland. There will be only 1.5 acres of meadow, but there will be 49 acres of permanent pasture used for hay. Land clearing will be done on 6 acres, and these will be established in permanent pasture. There will be only 2 acres of woodland; the timber now on this land will be cleared out and pine seedlings will be set. Fertilizer and lime will be applied according to needs indicated by soil tests. The tobacco and garden will be the only cultivated crops (1.5 acres).

The livestock system will be the same as for the medium level. An alternate farming system was developed to include 15 dairy cows. It was discarded because it required more labor and investment but did not increase family earnings.

A more detailed account of the crops and livestock for the full-time farmer is given in Table 2.

## **Economic Implications of Farming Systems for Different Levels of Conservation**

After land use plans for the three levels of conservation were made, a budget analysis was made of each plan to determine the costs, returns, and resources that would be associated with each plan if it were applied. The relation between net earnings and the level of practices for conservation was then analyzed.

**Table 2. Cropping and livestock systems for full-time farmer**

| Item                    | Unit     | Practices for conservation levels |                    |                    |
|-------------------------|----------|-----------------------------------|--------------------|--------------------|
|                         |          | Low                               | Medium             | High               |
| A. Crop selection       |          |                                   |                    |                    |
| Burley tobacco          | acre     | 0.6                               | 0.6                | 0.6                |
| Garden                  | acre     | 0.9                               | 0.9                | 0.9                |
| Corn (for grain)        | acre     | 14                                | 7                  |                    |
| Wheat (for grain)       | acre     | (8) <sup>1</sup>                  |                    |                    |
| Alfalfa hay             | acre     |                                   | 7                  |                    |
| Lespedeza hay           | acre     | 16                                |                    |                    |
| Meadow                  | acre     |                                   | 4.5                | 1.5                |
| Winter cover crop       | acre     |                                   | (8.5) <sup>1</sup> | (1.5) <sup>1</sup> |
| Permanent pasture       | acre     | 12.5                              | 30                 | 49                 |
| Unimproved pasture      | acre     | 3                                 |                    |                    |
| Woodland                | acre     | 7                                 | 4                  | 2                  |
| Homestead               | acre     | 2                                 | 2                  | 2                  |
| B. Land use             |          |                                   |                    |                    |
| Rotation crops          | percent  | 56                                | 15                 | 3                  |
| Sod                     | percent  | 28                                | 74                 | 90                 |
| Woodland                | percent  | 13                                | 8                  | 4                  |
| Homestead               | percent  | 3                                 | 3                  | 3                  |
| C. Mechanical measures  |          |                                   |                    |                    |
| Drainage ditch          | feet     | 0                                 | 200                | 500                |
| Ponds                   | no.      | 0                                 | 0                  | 1                  |
| D. Soil loss from farm  | tons/yr. | 150                               | 50                 | 20                 |
| E. Livestock selection  |          |                                   |                    |                    |
| Dairy cows              | head     | 5                                 | 10                 | 10                 |
| Heifers (over 1 year)   | head     | 1                                 | 2                  | 2                  |
| Heifers (under 1 year)  | head     | 1                                 | 2                  | 2                  |
| Hens                    | head     | 50                                | 50                 | 50                 |
| Chicks (raised)         | head     | 50                                | 50                 | 50                 |
| Hogs (home use)         | head     | 2                                 | 2                  | 2                  |
| F. Crop yields per acre |          |                                   |                    |                    |
| Corn                    | bushed   | 46                                | 80                 |                    |
| Hay                     | ton      | 1.5                               | 2.5                | 2.0                |
| Pasture                 | cow days | 76                                | 104                | 120                |
| Tobacco                 | pounds   | 1,800                             | 2,000              | 2,000              |

<sup>1</sup> ( ) Double cropped—not in total.

## Low Level of Conservation

The income from the system with the low level of conservation will be derived from the sale of tobacco, corn, wheat, and milk from a 5-cow grade B dairy and from the perquisites. The total gross family earnings are estimated to be \$3,687 with net earnings of \$1,283 (Table 3). The

labor requirements are 1,965 hours, giving an hourly labor earning of \$0.65. There will be an added investment of \$925, which makes a total of \$13,925. The annual return to investment above the 5% interest rate amounts to 9.2% if no allowance is made for the payment of labor. There is no return to capital if labor is paid \$1.00 per hour.



## Medium Level of Conservation

At the medium level of practices for conservation, the system is estimated to provide a gross return to the family of \$5,409 and a net of \$2,407. The income is from corn and a 10-cow grade B dairy, woodland products, and perquisites. The total labor needed is 2,267 hours, which gives an hourly labor earning of \$1.06. The added investment will be \$2,575, which makes a total of \$15,575. The annual return to investment will be 15.2% above the normal interest rate if no charge is made for labor. If labor is charged at \$1.00 per hour, there is still 7% return to capital.

## High Level of Conservation

The gross earnings for the system at the high level of practices for conservation are estimated to be \$4,912, and net family earnings of \$1,248. The income will be obtained from the same source as with the medium level, except that there will be no corn for sale. The labor requirement consists of 2,010 hours, which will have a return of \$0.62 per hour. The added investment will be \$3,450, or a total of \$16,450. The annual return to investment will be 7.6% above the 5% interest rate if no charge is made for labor. If labor is charged at \$1.00 per hour there is no return to capital.

**Table 3. Financial summary of farming systems at three levels of conservation, full-time farmer**

| Item  | Practices for conservation levels |                |              |
|---|-----------------------------------|----------------|--------------|
|   | Low Dollars                       | Medium Dollars | High Dollars |
| Cash income   | 2,730                             | 4,427          | 3,880        |
| Perquisites and other income  | 957                               | 982            | 1,032        |
| Total income  | 3,687                             | 5,409          | 4,912        |
| Cash expenses   |                                   |                |              |
| Crops   | 752                               | 915            | 734          |
| Livestock   | 162                               | 280            | 1,084        |
| Other   | 309                               | 491            | 477          |
| Total cash expenses   | 1,223                             | 1,686          | 2,295        |
| Other expenses  |                                   |                |              |
| Noncash expenses  | 427                               | 513            | 513          |
| Fixed expenses  | 754                               | 803            | 856          |
| Total other expenses  | 1,181                             | 1,316          | 1,369        |
| Total expenses  | 2,404                             | 3,002          | 3,664        |
| Net family labor earnings   | 1,283                             | 2,407          | 1,248        |
| Added investment above present system                                       | 925                               | 2,575          | 3,450        |
| Total investment  | 13,925                            | 15,575         | 16,450       |
| Annual return to dollar of investment <sup>1</sup>                          | 0.092                             | 0.152          | 0.076        |
| Labor charge at \$1/hour  | 1,965                             | 2,267          | 2,010        |
| Labor earnings per hour <sup>1</sup>  | 0.65                              | 1.06           | 0.62         |
| Annual return to dollar of investment above labor charge of \$1.00 per hour | -0.001                            | 0.070          | -0.004       |

<sup>1</sup> Above normal cost of interest (5%), but no charge for labor.

## Maximum Returns

In summary, investment and costs are directly related to the conserva-

tion level, but income (gross, net, and per unit) is highest for the medium system. See Table 3 for a more detailed account of costs and returns.

# FARM ORGANIZATION FOR PART-TIME FARMER

## Soil Management Systems for Different Levels of Conservation

### Low Level of Conservation

*Cultivated land.* Field 9A (1.5 acres) will be used for tobacco and garden each year for a period of 10 years, after which it will be established in lespedeza; field 9 will then be used for tobacco and garden.

*Pasture and hay.* Fields 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, and 14 (45.5 acres) will be established in lespedeza for pasture and hay.

*Woodland.* Fields 1 and 12 (7 acres) will remain in woodland.

### Medium Level of Conservation

*Cultivated land.* Fields 9 and 9A (3 acres) will be farmed in a 4-year rotation of tobacco and sod crop. One field will be established in fescue and Kenland red clover. The other field will be used for tobacco and garden, followed by a cover crop of vetch and oats each fall.

*Pasture and hay land.* Part of field 2 (3 acres) will be established and maintained in timothy and Kenland clover for hay.

The upper two-fifths of field 2 and 1 acre of field 1, plus fields 5, 7, and 8 (18 acres) will be established and maintained in orchard-grass and Ladino clover pasture.

Fields 3, 6, 10, 11, 13, and 14 (24 acres) will be established and maintained in fescue and white clover pasture. As the clover begins to leave in fields 6 and 13, Kobe lespedeza will be overseeded.

*Woodland.* Part of field 1 and field 12 (6 acres) will remain in woodland.

*Mechanical measures.* A drainage ditch of 200 feet will be constructed and maintained between fields 9 and 6, 9 and 10, and 11 and 14.

### High Level of Conservation

*Cultivated land.* The only cultivated land will be tobacco in part of field 9 (0.6 acre). This will be followed by a cover crop each fall.

*Pasture and hay land.* Fields 2, 3, 5, 7, 8, part of 9, 9A, 10, 11, and 14 (37.4 acres) will be established and maintained in permanent pasture consisting of fescue and Ladino clover. These fields will be used for pasture and hay.

*Woodland.* Field 1 (5 acres) will remain in woodland. Field 12 will be clear cut, and fields 6, 12, and 13 (11 acres) will be set to pine seedlings.

*Mechanical measures.* An open

drainage ditch of 500 feet will be constructed and maintained between fields 3 and 6, 9 and 6, 11 and 10, and 11 and 14.

A farm pond will be constructed in field 7.

Field 4 (2 acres) will be used by all systems for the homestead.

## **Farming Systems for Different Levels of Conservation**

### **Low Level of Conservation**

In the system with the low level of practices for conservation practically all the cropland, or a total of 45.5 acres, will be used for lespedeza for pasture and hay for sale. There will be an annual fertilizer application of 200 pounds of 0-20-20 fertilizer; the land will also receive 2 tons of lime per acre each 5 years. The only row crops grown will be 0.6 acre of tobacco and 0.9 acre for garden. The present 7 acres of woodland will remain and will receive no management or protection.

There will be no mechanical conservation measures taken. The only livestock on the farm will be 50 chickens and 2 hogs for home use.

### **Medium Level of Conservation**

At the medium level of practices for conservation the farming system will be primarily grassland. There will be a total of 42 acres of permanent pasture: 18 acres of orchard-grass and Ladino clover and 24 acres of fescue and white clover. The woodland will consist of 6 acres of hardwoods, which will receive improved management and protection. The re-

maining land will consist of 4.5 acres of meadow, 0.6 acre of tobacco, and 0.9 acre for garden (Table 4).

The livestock system will include 10 dairy cows, 2 heifers and 2 calves, 50 chickens, and 2 hogs. Fertilizer and lime will be applied according to needs indicated by soil tests.

### **High Level of Conservation**

At the high level of practices for conservation, the farm operation will include 37.4 acres of fescue and white clover for permanent pasture. The extra pasture will be cut for hay. The woodland will include 5 acres of old hardwoods, which will receive improved management and protection; 2 acres of pines, for which the land will be clear cut, and an additional 9 acres of pines to be planted. There will be 0.6 acre of tobacco. Fertilizer and lime will be applied according to needs indicated by soil tests.

As in the medium-level system, there will be 10 milk cows, 2 heifers, and 2 calves, but there will be no chickens or hogs.

See Table 4 for a more detailed account of the crops and livestock for the part-time farm under each system.

**Table 4. Cropping and livestock systems of part-time farmer**

| Item                    | Unit     | Practices for conservation levels |                 |                  |
|-------------------------|----------|-----------------------------------|-----------------|------------------|
|                         |          | Low                               | Medium          | High             |
| A. Crop selection       |          |                                   |                 |                  |
| Burley tobacco          | acre     | 0.6                               | 0.6             | 0.6              |
| Garden                  | acre     | 0.9                               | 0.9             |                  |
| Lespedeza hay           | acre     | 45.5                              |                 |                  |
| Meadow                  | acre     |                                   | 4.5             |                  |
| Winter cover crop       | acre     |                                   | (1.5)           |                  |
| Permanent pasture       | acre     |                                   | 42              | 37.4             |
| Woodland                | acre     | 7                                 | 6               | 16               |
| Homestead               | acre     | 2                                 | 2               | 2                |
| B. Land use             |          |                                   |                 |                  |
| Rotation crops          | pct.     | 3                                 | 3               | 1                |
| Sod                     | pct.     | 81                                | 83              | 67               |
| Woodland                | pct.     | 13                                | 11              | 29               |
| Homestead               | pct.     | 3                                 | 3               | 3                |
| C. Mechanical measures  |          |                                   |                 |                  |
| Drainage ditch          | feet     | 0                                 | 200             | 500              |
| Ponds                   | no.      | 0                                 | 0               | 1                |
| D. Soil loss from farm  |          |                                   |                 |                  |
|                         | tons/yr. | 60                                | 10 <sup>1</sup> | <10 <sup>1</sup> |
| E. Livestock selection  |          |                                   |                 |                  |
| Dairy cows              | head     |                                   | 10              | 10               |
| Heifers (over 1 year)   | head     |                                   | 2               | 2                |
| Heifers (under 1 year)  | head     |                                   | 2               | 2                |
| Hens                    | head     | 50                                | 50              |                  |
| Hogs                    | head     | 2                                 | 2               |                  |
| Chicks (raised)         | head     | 50                                | 50              |                  |
| F. Crop yields per acre |          |                                   |                 |                  |
| Hay                     | ton      | 1.5                               | 2.0             |                  |
| Pasture                 | cow days |                                   | 120             | 130              |
| Tobacco                 | pounds   | 1,800                             | 2,000           | 2,000            |

<sup>1</sup> This estimation assumes that woodland and pasture have the same soil loss rates. The soil-loss-predicting equations have not been established for woodland.

## Economic Implications of Farming Systems for Different Levels of Conservation

### Low Level of Conservation

At the low level of practices for conservation, farm income will be derived from the sale of lespedeza hay and tobacco, and from perquisites.

The estimated gross earnings are \$2,960, with a net of \$1,026. The labor amounts to 922 hours, giving an hourly return of \$1.11. Total investment is \$12,825, or \$175 less than

in the present system (Table 5). The return to investment is 8% above the normal interest rate if no charge is made for labor. If labor is charged at the rate of \$1.00 per hour there is a capital return of almost 6%.

### Medium Level of Conservation

Income will be derived from the 10-cow grade B dairy, tobacco, and

**Table 5. Financial summary of farming systems for part-time farmer**

| Item  | Practices for conservation levels |         |         |
|---|-----------------------------------|---------|---------|
|   | Low                               | Medium  | High    |
|   | Dollars                           | Dollars | Dollars |
| Cash income   | 2,223                             | 3,746   | 3,338   |
| Perquisites and other income  | 737                               | 1,032   | 709     |
| Total income  | 2,960                             | 4,778   | 4,047   |
| Cash expenses   |                                   |         |         |
| Crops   | 514                               | 681     | 544     |
| Livestock   | 160                               | 884     | 924     |
| Other   | 158                               | 503     | 359     |
| Total cash expenses   | 832                               | 2,068   | 1,827   |
| Other expenses  |                                   |         |         |
| Noncash expenses  | 364                               | 513     | 509     |
| Fixed expenses  | 738                               | 800     | 839     |
| Total other expenses  | 1,102                             | 1,313   | 1,348   |
| Total expenses  | 1,934                             | 3,381   | 3,175   |
| Net family labor earnings   | 1,026                             | 1,396   | 872     |
| Added investment above present system                                 | —175                              | 2,525   | 3,300   |
| Total investment  | 12,825                            | 15,525  | 16,300  |
| Annual returns to dollar of investment <sup>1</sup>                   | .080                              | .089    | .054    |
| Labor charge at \$1/hour  | 922                               | 2,056   | 1,771   |
| Labor earnings per hour of labor <sup>1</sup>                         | 1.11                              | .68     | .49     |
| Annual returns to dollar investment, labor charged at \$1.00 per hour | .058                              | .007    | —0.005  |

<sup>1</sup> Above normal interest of 5% and no labor charge.

perquisites, at the medium level of practices for conservation.

Gross earnings are estimated to be \$4,778, with a net of \$1,396. The labor amounts to 2,056 hours, with a return of \$0.68 per hour. The added investment is \$2,525, making a total investment of \$15,525. The annual return on investment is 8.9% above normal interest if no charge is made for labor. If labor is charged at \$1.00 per hour there is less than 1% return to capital.

### High Level of Conservation

The gross earnings at the high level of practices for conservation amount to \$4,047, with a net of \$872. The total labor needed is 1,771 hours,

with a return of \$0.49 per hour. The added investment is \$3,300, making a total of \$16,300. The annual return on investment is 5.4% above the normal cost if no charge is made for labor. If labor is charged at \$1.00 per hour, there is no return to capital.

Income is derived from a 10-cow dairy herd, tobacco, hay, conservation assistance payments, and perquisites. There are no chickens or hogs.

### Maximum Returns

For the part-time farmer the income (gross and net) was highest for the medium practices for conservation system. The return per hour of labor and per dollar invested was highest

for the low-level system. The high-level system had the highest invest-

ment, but the costs were highest for the medium-level system (Fig. 4).

# SOIL CONSERVATION PRACTICES BENEFIT MANY PEOPLE

Practices for soil conservation on farms may benefit many people other than the operators of the farms who adopt the practices and pay for them. Others who benefit may include downstream farmers living on flood plains, sportsmen who desire clean streams for recreation, passing motorists who like to see a countryside covered with certain kinds of vegetation, owners of

downstream reservoirs who wish to minimize silting, city dwellers and businessmen who desire a clean source of water from streams, and all who are interested in preserving resources for future generations.

These benefits are in effect services produced by the farm. If they have a sale value—other than that based on conservation payments and techni-

## NET FARM EARNINGS

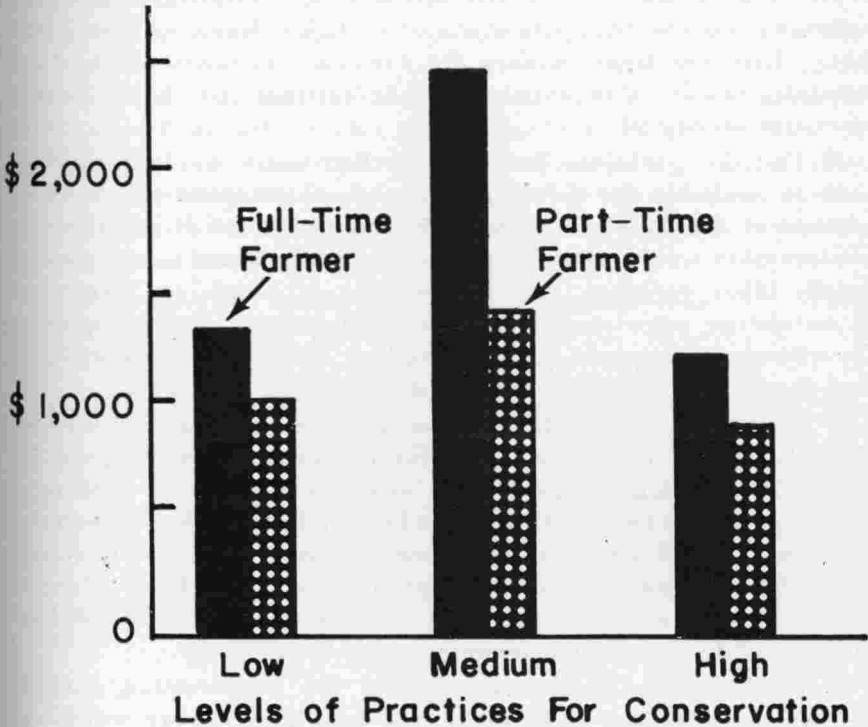


Figure 4. Level of practices for conservation and limit on current net farm earnings, low-production farms, Upper East Tennessee Valley, 1962.

cal assistance of the U.S. Department of Agriculture—they have not been included in this budget analysis. If others who would benefit from the farmer's carrying out a level of practices for conservation higher than is

in his interest to adopt under present conditions wish him to do so, then arrangements might be made for these benefiting groups to buy this service. Such a study is, however, beyond the scope of this report.

## SUMMARY, CONCLUSIONS, AND IMPLICATIONS

**O**n a representative, low-production farm in the Upper East Tennessee Valley, estimated income would be increased considerably by use of improved farming systems involving more intensive soil management practices for conservation and higher levels of technology than are now practiced, according to a budget analysis. However, within the range of practices for conservation considered, the highest level did not result in the greatest income.

- For the full-time farmer who has a high ratio of labor to other resources, the level of practices for conservation that the local SCS representative would ordinarily recommend would give a higher estimated income than either lower or higher levels as planned by him. This was true whether the income was measured by total receipts, family labor earnings, labor earnings per hour, or rate of return on capital.

- For the part-time farmer who had more limited labor resources available for farming, and the same capital and land resources as the full-time farmer, the medium level of practices for conservation would give the greatest estimated total sales, greatest family labor earnings, and highest rate of return on investment if no charge were made for labor. The lower level of practices for conservation would give the highest return per hour of labor and the highest return to capital after paying for labor.

- The results of this study suggest a general relationship between the intensity of use of practices for conservation and current income. It is: using practices more intensively raises the limit on a farmer's current income if he has a low level of use, but as intensity increases beyond a certain level, benefits from their use decreases. A corollary follows: there is an optimum economic level of use of practices from which either higher or lower levels of use will reduce possible current net income to the farmer.

- Of the three levels of practices for conservation studied, neither the full-time farmer nor the part-time farmer would rationally select the highest level on the basis of current income alone. He would adopt the highest level only if he were willing to

accept lower current income for an increased future income, if he were partly paid for the conservation practices, or if he were to receive some non-economic benefit such as an esthetic preference for the system.

● The part-time farmer might rationally choose either the low- or medium-level of practices for a conservation system, depending on his own value system and economic status. He might prefer a low total return but high return per unit of resources, which would be the case with a low level. Or he might prefer a medium-level plan involving higher total returns but lower returns per unit of resources, a larger investment, and more work.

● On the selected farm, the use of higher levels of practices for conservation would increase the total investment required and thus reduce the number of acres that could be operated with a limited amount of capital. The full implication of higher income per acre on a smaller acreage with the higher level system, compared with lower income per acre on more acres with the low level system, was not studied in detail. However, where capital is a limiting factor on size of business, this relationship tends to favor a lower level of practices for conservation.

● Before a farmer would adopt the high level of practices for conservation over the medium level studied, he would need some incentive other than that included in these budgets.<sup>8</sup> This incentive might come from others who could benefit from his adoption of the high level. The possibility that benefited groups might make incentive payments to farmers to encourage them to adopt the higher levels of practices for conservation is recognized, but is beyond the scope of this study.

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<sup>8</sup> Conservationists might be able to develop other systems that would give equal protection to productivity, but produce higher incomes than the present high systems.

(3.5M/9-63)



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