INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES OF THE OAS

A METHOD OF SOIL AND WATER CONSERVATION ANALYSIS

San José, Costa Rica
1965

Inter-American Institute of Agricultural Sciences of the OAS

A METHOD OF SOIL AND WATER CONSERVATION ANALYSIS

By Dr. Jose Marull

"This is a Ph.D. Thesis
presented to Cornell University
September 1952"

San Jose, Costa Rica
1965

ACKNOWLEDGMENTS

Numerous individuals have made this work possible and to all of them the author wishes to express his thanks.

Special acknowledgment is made to Professor Paul J. Zwerman for his unfailing guidance, training, and encouragement received. To Dr. Richard Bradfield, Head of the Agronomy Department, for his advise and financial help. Other members of the same Department also contributed, particularly Professor H. G. Hartwig, whose helpful sugestions are deeply appreciated.

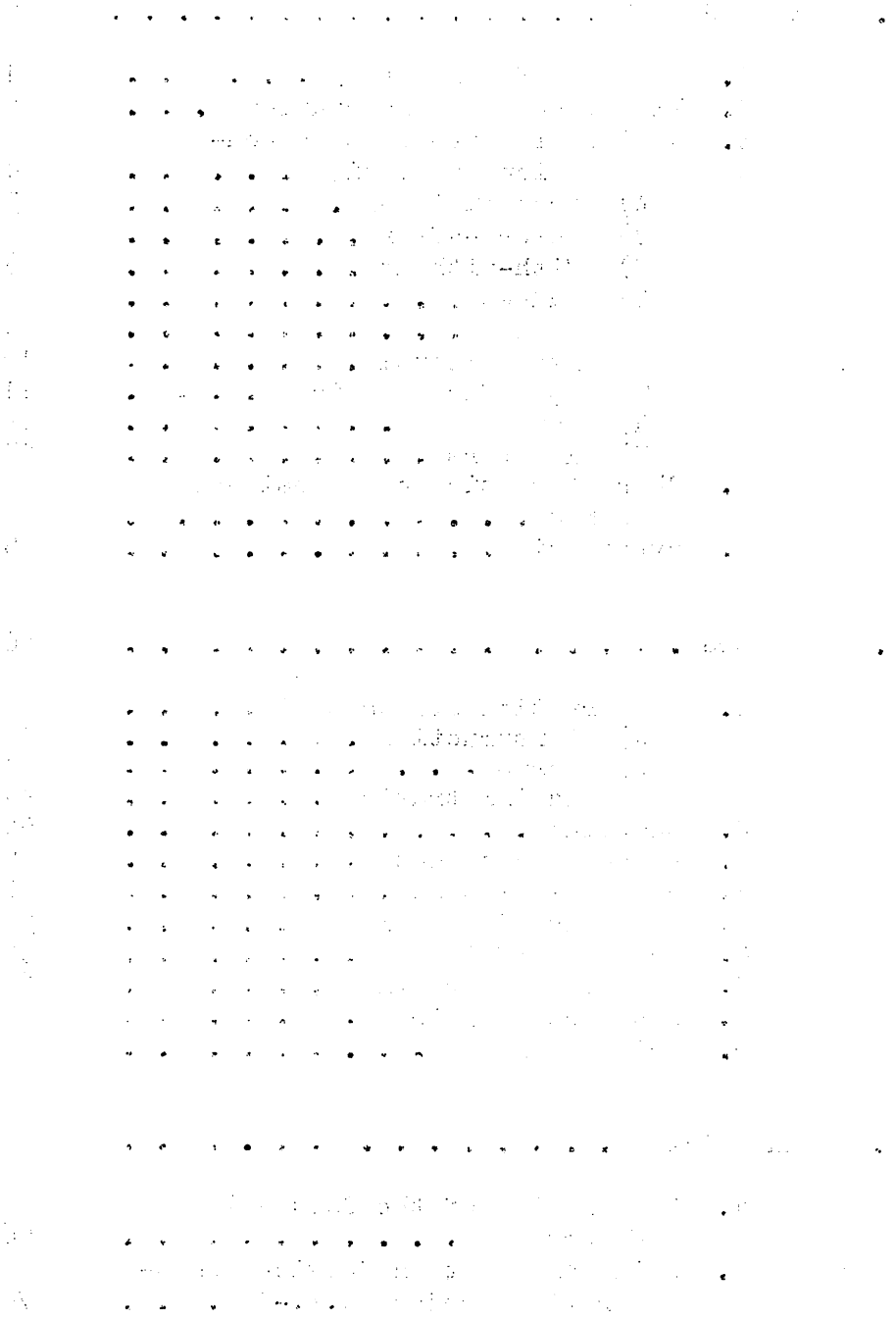
Among the many of the Cornell staff that gave their time and advise, the author is specially indebted to Professors Howard Conklin, H. F. DeGraff, O. A. Larson, and F. E. Winch.

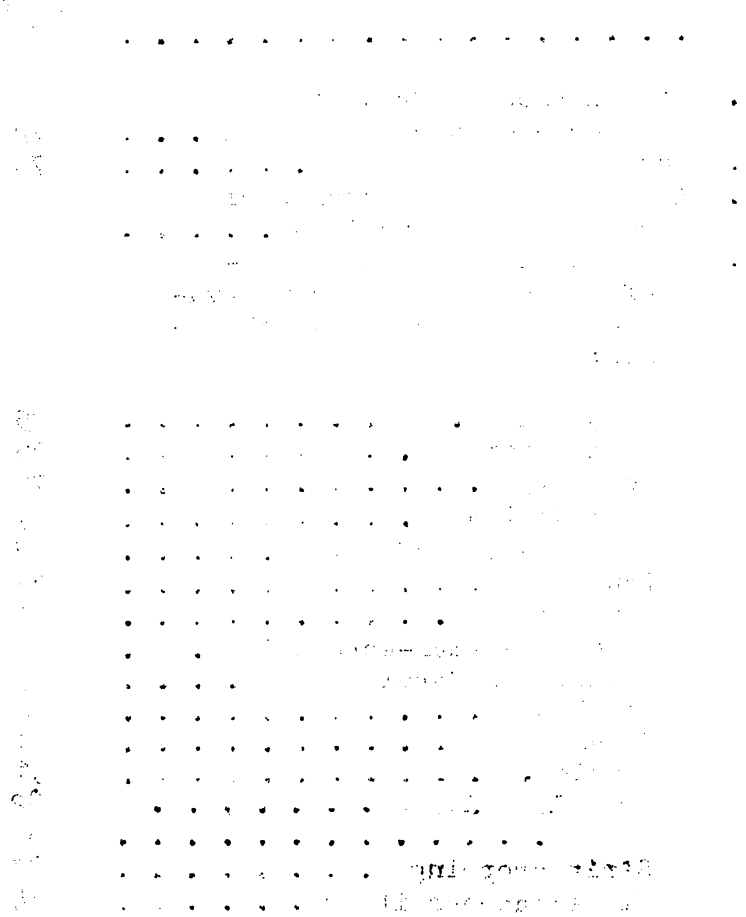
Messrs. Rodman Fellows and George Free, of the United States Department of Agriculture, Soil Conservation Service, have the author under greatest obligation. They supplied liberally maps, files and, foremost, their invaluable experience.

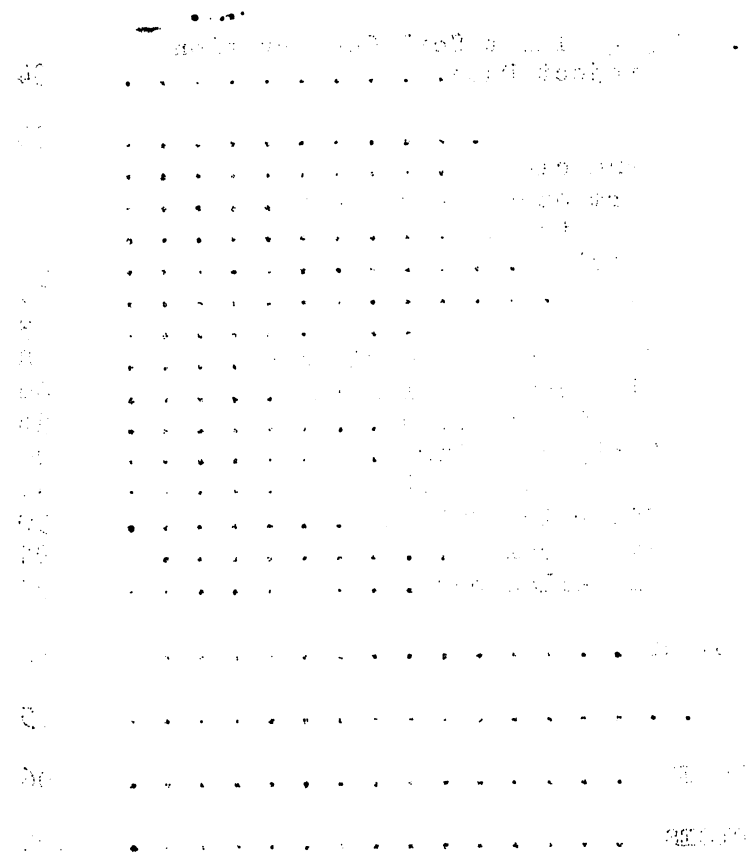
The Directors of the Tompkins County Soils Conservation District approved of this research and fostered it.

A great deal of credit is due to the farmers in the Cayuga Inlet Valley for their straightforward cooperation.

CONTENTS







I.

INTRODUCTION

1. Purpose of This Study

The main purpose of this work is to develop a method that will make possible a soil and water conservation analysis both by areas and by practices. No such research tool is available at present in spite of the national and world wide importance of conservation (6, 8).

2. Importance of Conservation

Ever since the United States public became soil conscious in the early 1930's, there has been a steady flow of literature on soil and water conservation. (9, 41, 114, 115).

Publications on soil and water conservation are more than twice as numerous as those for the average of all agricultural subjects judging from Bibliography of Agriculture (109), Table 1.

A stream of appropirations has also evidenced high activity in conservation. According to Reports of the Director of Finance, one-fourth of all expenditures of the United States Department of Agriculture are made for soil conservation.

TABLE 1

NUMBER OF ENTRIES IN BIBLIOGRAPHY OF AGRICULTURE, SEVEN YEARS (1945-1951)

Subject heading	Total	Average per heading
Soil erosion	4,585	655
All 268 subject headings	534,259	285

Under the Agricultural Conservation Program alone, federal payments made to assist farmers carrying out conservation practices have reached the 2.6 billion dolar mark for 1936-1950 (108).

In the last 15 years, all 48 states have passed enabling legislation setting up soil conservation districts. At present, 2,330 Districts include 83 percent of the farms in the United States, Table 2.

Underlying all conservation activities is the basic assumption that the huge damage prevented amply justifies effort and expenses involved. Even though, this assumption is probably right, it has not been completely tested because the lack of numerical expression of conservation status has thus far precluded research.

Need for such information becomes more acute in view of the following facts:

a. In 1933, a 20-year goal to treat all United States land for conservation was set.

b. Experimental data available has to be analyzed and interpreted.

c. Appropriations have to be voted wisely by legislators.

d. Administrators must justify their activities.

e. Creditors want a sound basis for their loans.

f. Farmers, as managers, have to make decisions.

g. Taxpayers demand to know whether expenses have been paid out or not.

TABLE 2

SELECTED DATA ON SOIL CONSERVATION
CUMULATIVE TO DECEMBER 31, 1950 (108)

	United States	New York
Districts organized:		
Number	2,330	38
Total area, acres	1,278,397,538	18,868,480
Number of farms	4,828,993	106,637
Active plans, number	831,146	15,043
, acres	234,211,055	2,078,956
Acres treated	131,332,692	852,301
Surveys	360,864,583	7,294,910

3. Review of Approaches to Conservation Evaluation

Soil and water conservation has been approached from various angles by philosophers, economists, politicians sociologists, agronomists, foresters, civil engineers, hydrologists, and others.

Most of them made philosophical analyses of fundamentals and of the relationships to the theories prevailing in their respective fields. This treatment of the subject does not lead in itself to an immediate numerical characterization of conservation and, as such, is beyond the scope of the present study. Nevertheless, it has contributed substantially to our understanding of conservation in national life and of its role for the generations to come.

Out of the numerous studies available, perhaps the most comprehensive ones are those of Bunce (13, 14, 15, 16, 17,) and Salter (91). Some authors have explored relationships to aspects such as society (31, 34, 35, 48, 123), economic systems (23, 86, 88), public policies (38, 46, 49, 52, 53, 64, 81, 85), business(22, 55, 61, 68, 118), credit (11, 19, 39), costs and returns (7, 21, 24, 44, 47, 73, 126), economic theory (36, 37, 51, 54, 57, 65, 69, 75), and research programs (63, 66, 90, 103, 124).

Their legacy is by no means limited to supply and ideological background for conservation's place in social, economical, and political thinking. They have pointed out the problems blocking the road to evaluation of conservation. Those difficulties are summarized in the list below:

1. Semantic problems. Words such as "conservation" and "resources" have many meanings, escaping precise definition.
2. Confounding of conservation effects with farm management and ordinary farm practice.
3. Confounding with individual differences in managerial ability.
4. Confounding with variability in capital outlay.
5. Confounding with space, i.e., place to place, variability.
6. Confounding with variability in time.
7. Uncertainty of projecting into the future.
8. Need to assume unwarranted cause-effect relationships.

A few approaches have numerical values as their goal. They attempt an analysis of conservation in terms of erosion, production, profit or attitudes. Their highlights are pointed out below.

A. Erosion index

a. Criterion: Degree of erosion.

b. Procedure: Erosion ratings are recorded along with economic data, such as farming system, farm acreage, tenancy status, and mortgage.

Relationships of erosion index to economic data are brought about through tabulation.

c. Advantages:

1. Uses numerical values.

2. Makes no cause-effect assumptions.

d. Disadvantage: Oversimplifies conservation into negative erosion.

3. References: Schickele, et al. (98, 99, 100).

f. Remarks: Iowa Bul. 333 (98), published in 1935, represents the earliest attempt to relate conservation and economic figures.

Besides showing connection of degree of erosion and type of farming, these papers have also contributed to focus attention on importance of relief from financial pressure to improve conservation,

B. Before-after

a. Criterion: Profit

b. Procedure: Business analysis before and after adopting conservation practices are compared.

c. Advantages (124):

1. Same physical unit followed throughout.

2. Some insight into changes through time and on effects upon management may be gained if cost accounts are available.

d. Disadvantages (26):

1. Assumes correlation of conservation and income.

2. Effects of conservation cannot be isolated from that of uncontrolled variables, such as weather, prices, costs, marketing conditions, changes in management, type of farming, size, etc.

3. Long time is required to accumulate data.

e. References: Collier (26), Cornell (30), Dwyer (33), Peterson (87), Johnson (63), Taylor (103), Weitzell (122, 124).

f. Remarks: This approach was started in 1936 by Ecomomic Research Division of the Soil Conservation Service in cooperation with the Bureau of Agricultural Economics, and also with 17 state agricultural experiment stations.

Even though some progress was made, their originators, discouraged by weaknesses of this method as well as pressed for more rapid results, largely abandoned it for the "Budget" approach (See D below).

C. With-without:

a. Criterion: Profit

b. Procedure: Incomes of farms having a conservation plan are compared to those of farms with no plan.

c. Advantages: Data may be gathered in short time.

d. Disadvantages;

1. Difficulty in finding pairs of farms of comparable physical, economical, and managerial conditions.

2. There are additional sources of distortion of income by uncontrolled variables other than conservation, besides those already mentioned under B. d. 1 and 2.

e. References: Anderson (5), Bunce (12), Collier (26) Dwyer (33), Sauer (94, 95, 96, 97,), Walter (117), Weitzell (120, 121, 122).

f. Remarks: Method originated by the same group that started the "before-after" approach, with which it has been combined at times (122). It has also been used together with farmer's polls (12), and with a system of weights for soil protection (26) resembling somewhat the productivity balance calculation (10, 92).

The work of Sauer has shown that farms

having conservation plans also are higher in: yields, income, and capital investment.

D. Budget

a. Criterion: Profit

b. Procedure: Compares present to future income, once a conservation plan is operating on the farm.

c. Advantages:

1. Short time is required to figure budget.
2. Is a good planning tool. In fact, the only one available to project conservation into the future.
3. Follows the same physical unit throughout.
4. Is adapted to sampling.

d. Disadvantages:

1. Sufficient information to calculate budget is not always available.
2. Idealization, exaggeration, and bias towards effect of conservation has been observed in practice.
3. Assumes conservation-income correlation.

e. References: Johnson (63), and Weitzell (124).

f. Remarks: Created by the originators of methods B. and C. Is very useful in experienced hands, particularly as orientation for farm planners in both extension work and conservation districts.

E. Merit

a. Criterion: Profit

b. Procedure: Analogous to method C, except for a point score intended to reflect the extent to which needed. Conservation has been applied on the land.

c. Advantages: Eliminates need of pairing farms.

d. Disadvantages:

1. Assumes that conservation and income are correlated.
2. Unsuited for large areas.
3. Inadequate to study individual practices.
4. Cumbersome sampling requirements.

e. References: Collier (26), Taylor and Baker (104), and Weitzell (124).

f. Remarks : Originated by Collier in 1945. In the Palouse wheat-pea region of Washington and Idaho, no correlation between amount of conservation and farm income was found in a 6-year period (104).

F. Experimental

a. Criterion: Profit.

b. Procedure: Comparisons are to be made of incomes resulting from experimental farms where conservation factors have been allowed to vary systematically.

Only those practices influencing soil, nutrient and/or water losses are to be considered as affecting conservation. Flow data are to be changed, first into crop yield and livestock production equivalents, which, in turn, are to be converted into incomes.

Results will be subsequently generalized for larger areas by means of correlation with soil groupings.

c. Advantages: Factor interactions could be measured.

d. Disadvantages:

1. Lacks practicability. Is too complex to handle by present experimental methods.
2. Conversions would have to be on a largely arbitrary basis.
3. Conservation assumed equivalent to erosion plus water loss, plus fertility depletion.

e. References: Taylor (103), Weitzell (124).

f. Remarks: Advanced by Weitzell in 1947, the idea has not been carried into practice as yet.

G. Specific practices

a. Criterion: Soil and water losses, or crop yield, or both.

b. Procedure: Effect of a single practice is measured against a check.

c. Advantages:

1. Accurate simple data gathered for specific conditions.
2. Individual practices tested.
3. Objective.

d. Disadvantages:

1. Slow piecemeal accumulation of data.
2. No composite picture of conservation is obtained.
3. Area studies are difficult.

e. References: Anderson (5), Bennett (8), Gaines. et.al., (41), Lamb, et.al., (67), Moore (76), Mosher and Case (80), Stallings (101, 102), Tom (105).

f. Remarks: The bulk of research results listed in bibliographies as well as digested in book form has come from this approach. It has served as the basis for practically all of conservation practices put on the land in the last twenty years.

H. Farm case

a. Criterion: Profit

b. Procedure: Similar to methods B and C, with more detail, and special emphasis on the farm in relation to prevailing farming system in the area.

c. Advantage: Same physical unit followed throughout.

d. Disadvantage: Not adapted to large areas.

e. References: Anderson (5), Bunce (12, 18), Coddington and Derr (25), Gibson (42, 43), Morison and Falconer (78), and Pubols, et al., (89)

I. Adopters

a. Criterion: Farmer's social attitude.

b. Procedure: Sociological data for farmers adopting recommended practices is compared to figures for non-adopters.

Information is gathered by personal interview.

c. Advantage: Supplies a type of information not available by other methods.

d. Disadvantage: Only a part of a complex picture is obtained.

e. References: Cummings (32), Illionis Agr. Exp. Sta. (60).

f. Remarks: This approach has not yet been tried for conservation studies. However, certain soil conserving practices -- like liming, fertilizing and mowing pastures -- were not significantly related to physical resources, e.g., soils, or economic environment, e.g., land class, but they did show correlation to social and cultural traits of individuals engaged in farming.

4. Characteristics of a Desirable Method

None of the approaches reviewed above seems entirely satisfactory. But, in spite of their disadvantages, they have contributed important bits of information. Examined collectively, they seem to suggest that conservation, in order to be properly evaluated, has to include elements pertaining to areas as diverse as the physical setup, the farm business, and the psychology of the individual.

It will be highly desirable to combine the advantages of different approaches without retaining their shortcomings.

An ideal method will satisfy fully the following requirements (2):

1. Measure soil and water conservation status numerically and directly from its varied expressions, physical, economical, and social.
2. Have representative coverage, i.e., sample all elements and in proportion to their relative magnitudes.
3. Allow mathematical manipulation of data as well as statistical testing of method itself for validity (i.e., measuring what it is supposed to measure), and reliability (giving consistent reproduceable results).
4. Be as objective as possible.

5. Free from unwarranted assumptions such as homogeinity of farm unite, cause-effect relationships, etc.
6. Operate without requiring previous isolation of conservation from management, definition of resources, or exact definition of conservation.
7. Be flexible enough to handle variability as to: acreage, space (place to place), time, research developments, amount of information available, practices.
8. Provide analysis of individual practices, as well as by areas, along with their correlations.
9. Be acceptable to all concerned and practical to handle, i.e., not too time-consuming, costly, cumbersome or irritating.

5. Hypothesis

The hypothesis is here formulated that it is possible to develop a method closely approximating these ideal requirements set forth in the previous section.

II

METHODS

1. Conservation status Test

A. Construction

A test for soil and water conservation status was devised specifically for this study. It is based on statistical principles analogous to those used in measuring achievement in the United States Civil Service Commission (2) and at educational institutions (50, 106, 107).

Materials to develop the test came mostly from two sources:

a. Cooperation of experienced specialists from both the U.S.D.A Soil Conservation Service and Cornell University. Most noteworthy contributions were made by Mr. Rodman Fellows, Tompkins County Soil Conservation District, and Cornell Professors Howard Conklin, Herbert B. Hartwig, Fred E. Winch, and Paul J. Zwerman.

b. Research results available, particularly those for nearby areas such as the Cohocton River Demonstration Project (76) and the Arnot Experiment Station (67).

Ranking of present-day situation both by areas and by practices was the primary purpose in designing the

test. It may also yield useful predictions in estimating needed conservation. However, no special attempt was made to develop this test as a planning tool, for which purpose labor income budgeting in function of land use capabilities has proved satisfactory.

The test itself was a coordinated aggregate of 165 items covering a wide range of farm practices, as well as business data and farmer's individual experience and thinking. Progress towards defining items was done first by dividing the test into broad outlines of information need: a) to identify areas; b) to measure conservation, c) to interpret findings, and also by d) farms; e)fields; and f) operators. As a result, certain items referred to the farm as a unit, while others were recorded separately for each field. Some of them -- 37 -- were known to have conservation significance (Tables 3 and 4), a few were doubtful as conservation indicators, the rest were added mainly for interpretation purposes, i.e., to enable an unravelling of relationships.

An effort was made to attain the greatest accuracy by thorough coverage of subject matter, limiting the length at the largest number of items that would be practical to handle in a one-day visit to each farm. That should make the most effective use of time and money.

TABLE 3

LOCATION OF THE CONSERVATION SIGNIFICANT ITEMS IN THE CARD PUNCHING OUTLINES

Item	Card	Column
Attitude toward conservation	1	32
Attitude toward tree planting	1	64
Contour farming	2	69
Contour furrows	1	58
Cover crop	2	66
Cover, vegetation	2	30
Crop	2	63
Drainage, open	2	38
Drainage, stone or tile	2	39
Diversion ditch	2	75
Fence removal	1	38
Fence, permanent	1	43
Forest -- see Woodlot	-	--
Grazing intensity	2	31
Grazing method	1	66
Green manure. Legume turned under	2	65
Green manure, summer	2	67
Gully control	2	73
Hedgerow removal	1	38
Irrigation	1	60
Land use changes	2	25
Lime status	2	46
Manuring	2	40
Mulching	2	68
Nitrogen status	2	51
Pasture type	2	32
Phosporus status	2	56
Ponds	1	59
Potassium status	2	61
Rotation	2	62
Streambank control	1	53
Strips	2	70
Strips, correction	2	71
Terrace --see Diversion	-	--
Waterways, grassed	2	72
Windbreaks	2	74
Woodlot. Improvement cutting	2	29
Woodlot. Planting	2	28
Woodlot. Stand	2	27

TABLE 4

CORRELATION OF 1952 AGRICULTURAL CONSERVATION PROGRAM FOR NEW YORK (110) WITH CARD PUNCHING OUTLINES

Practices receiving PMA payments	Card	Column
1 Liming materials	2	46
2. Phosphate	2	56
3. Potash	2	61
4. Rye, annual ryegrass or wheat cover crop	2	66
5. Small grain, millet, or Sudan grass cover crop	2	66
6. Turning under seetclover, red clover, alsike clover of alfalfa	2	65
7. Summer green manure crops	2	67
8. Mulching commercial orchards or vineyards	2	68
9. Mulching strawberries and perennial vegetables	2	68
10. Clearing land suitable for improved permanent pasture	1	38
11. Removing stone walls and hedgerows	1	53
12. Installing tile drainage systems	2	39
13. Constructing permanent open drainage ditches	2	38
14. Constructing diversions	2	75
15. Establishing a contour stripcropping system	2	70
16. Controlling stream banks	1	53
17. Planting forest trees	2	28
18. Improving woodlands	2	29
19. Excluding livestock from woodlots	2	31

All items were prepared first as to subject matter, then revised as to fitness for testing purposes. They were all of the limited response objective type, which minimizes distortions due to spacial heterogeneity, poor definition of practices, and bias.

By further breakdown, a list of mutually exclusive alternatives was set for each item. Both desirable and

undesirable situations were included among the answers. Flexibility and adaptability of multiple-choice approach allowed handling of all cases. Most conservation significant items (Table 3) were taken care of through the uniform set of coded choices listed below:

0. Practice neither recommended nor present.
1. Not recommended but carried out.
2. Recommended and carried out as recommended.
3. Recommended, carried out changed into an acceptable form.
4. to 7. Recommended, carried out unsatisfactorily modified.
8. Recommended,absent. Carried out but later destroyed.
9. Recommended, never done.

Unfavorable or unsatisfactory choices from the conservation standpoint -- 4 to 9 in most cases -- were termed "foils".

Arrangement of items was by subject matter to facilitate field work. Also, in order to permit mechanical precessing of data, they were organized into four groups, one of each kind of IBM card to be punched.

After assembling the test in a tentative way, a tryout was run during the fall of 1951 on farms representing a wide variety of conditions. Each time gained experience was incorporated.

B. Test forms

Data for items grouped in card 1, were recorded in the blank form to be found on next page. Those for cards 3 and 4 were recorded in the enclosed forms used by Cornell Agricultural Economics Department for land classification surveys. Information was then coded according to the card outlined and registered in special IBM coding sheets, from which, in turn, punching was made.

Card 2 data by individual fields was coded in the field and recorded directly in a coding sheet, with considerable time saving.

Cayuga Inlet Soil Conservation Project

DATA FOR CARD OUTLINE No. 1

Col. 2-3 Farm number: Project _____ Code _____

Airphoto number _____ Date _____

Col. 30 Operator at Project time _____

Present operator _____

Same family: Yes ___ No _____

Owner _____

Col. 4-6 Same farm: Yes _____ No _____

& 24-29 If not, acres sold _____ bought _____

Col. 31 Records available:

_____ Cash account, years _____

_____ Inventory, years _____

_____ Dairy production, years _____

_____ Poultry production, years _____

Col. 32 Do you think conservation pays? Yes ___ No ___

I don't know _____ If yes, why? _____

_____

Col. 33 Would you have gone further in soil conservation if technical help had continued after District was established? Yes _____ No _____ No opinion __

Col. 34 If you had a son, would you like him to farm this farm,_____, a nearby farm _____, a farm elsewhere _____, no farm _____. I don't know___.

Col. 35 What changes have you made in this farm since the Project started? None ___ Shifting to: dairy ___, sheep ___, beef ___, poultry ___, grain ___, vegetables ___, several shifts ___.

Col. 64 Would plant more trees. Yes ___ No ___ No opinion _____.

Col. 36 Manure is stored, ___, hauled daily to field ___, Reinforced with superphosphate. Yes ___ No ____.

Col. 37 Manure is applied to meadow ___, grain ___, row crop ____.

Col. 66 Grazing of pastures is: continous _____, rotational ___; mowed: Yes ____ No ____.

Col. 67 Water in pasture is : adequate ___, inadequate __.

Col. 68 Midsummer pasture shortage: Yes ___, No _____. There is: emergency crop ____, aftermath _____ grass silage _____.

Col. 69 Assistance received in woodlots, other than SCS: none ____, in planting _____, in management _____.

Col.	Conservation practices:	Code:
Col.38-42	Hedgerow removal	ft.
Col.43-47	Fence removal	ft.
Col.48-52	New fence	ft.
Col.53-57	Stream bank control	ft.
Col. 58	Contour furrows	

Cayuga Inlet Soil Conservation Project,
DATA FOR CARD OUTLINE No. 1

Col. 59 Pond _____ acres

Col. 60 Irrigation _____ acres

Remarks:

_____

_____

_____

_____

_____

CARD OUTLINE BY FARMS

CAYUGA INLET SOIL CONSERVATION PROJECT, Card No. 1

Column	Item	Tabulation Code
1	Study	1
2-3	Farm number	(As given in Appendix A)
4-5-6-7	Acres operated	To the nearest unit
8-9-10-11	Total foils	
12-13-14-15	Farm foils	
16-17-18-19-	Field foils	
20	Land economics Class number	
21-22-23	Productivity balance	Nearest hundredth, plus ten
24-25-26	Acres bought since Project started	Nearest unit
27-28-29	Acres sold	Nearest unit
30	Operator changes	2. None 3. New operator but same family 4. New operator, no kin
31	Records available	1. Cash account only 2. Inventory only 3. Dairy production only 4. Poultry production only 5. Cash acc't & Inventory 6. Cash, Invent., Dairy 7. ", ", Poultry 8. ", ", Dairy 9. None
32	Does conservation pay?	2. Yes 3. No X. No opinion

Card 1

Column	Item	Tabulation Code
33	Would you have gone further in SC with more help	(Same Code as for Col. 32)
34	Would like son to farm	2. This farm 3. A nearby farm 4. A farm elsewhere 5. No farm X. Don't know
35	Farming type changes made or being made	1. None 2. Shift to dairy 3. Shift to sheep 4. Shift to beef 5. Shift to poultry 6. Shift to grain 7. Shift to vegetable 8. Shift to other 9. Several shifts
36	Manure handling	1. Reinforced, hauled daily 2. " , stored covered 3. " , " unprotected 4. Not reinforced, hauled daily 5. Not reinforced, stored covered 6. Not reinforced stored unprotected
37	Crop manured	1. Meadow 2. Grain 3. Row crop
38	Hedgerow removal	0. None 1. Not recommended, carried out 2. Recommended, carried out as recommended 3. Recommended, carried out, changed but acceptable 4. Recommended,carried out detrimentally modified 9. Recommended, not carried out

Card 1

Column	Item	Tabulation Code
39-40-41-42	Length of hedgerow in Project	Nearest foot
43	Fence removal	(Same Code as for Col. 38)
44-45-46-47	Length of fence	Nearest foot
48	Permanent fence	(Same Code as for Col.38)
49-50-51-52	Length of permanent fence in Project	Nearest foot
53	Streambank control	(Same Code as for Col.38)
54-55-56-57	Length of streambank	Nearest foot
58	Contour furrows	Same Code as for Col.38)
59	Pond	(Same Code as for Col.38)
60	Irrigation	(Same Code as for Col.38)
61-62-63	Acres irrigated	Nearest unit
64	Attitude towards more tree planting	2. In favor 9. Against X. No opinion
65	Assistance in woodlots, other than Soil Conserv. Service	0. None received 1. Assisted in planting 2. Assisted in management 3. Assisted in both
66	Grazing method in pastures	1. Rotational, mowing, scatter of droppings. 2. Rotational, mowing 3. Rotational 4. Continuous, mowing, scatter 5. Continuous, mowing. 6. Continuous
67	Water in pasture	2. Adequate for livestock 4. Not adequate 9. No water

Card 1

Column	Item	Tabulation Code
68	Midsummer pasture	1. Shortage met by emergency crop 2. No shortage 3. Shortage met by aftermath 4. Shortage met by grass silage 5. 6. 9. Shortage, nothing done about it
69	Type of road	1. Hard 2. Gravel 3. Dirt
70	Years lived at this residence	1. Born here 2. 0-2 years 3. 3-5 " 4. 6-10 " 5. 11-20 " 6. Over 20 "
71	Last previous residence	1. Urban 10,000 or more 2. Urban under 10,000 3. Open country
72 to 79	Blank	
80	Card number	1

CARD OUTLINE BY FIELDS

CAYUGA INLET SOIL CONSERVATION PROJECT, Card No. 2

Column	Item	Tabulation Code
1	Study number	1
2-3	Farm number	(As given in Appendix A)
4-5	Field number	
6	Sector number	
7-8-9-10	Acres	To the nearest tenth
11-12	Total foils per acre	
13	Farm foils per acre	
14-15	Field foils	
16-17	Soil type number	(As given in Appendix E) (99. No type dominant)
18	Slope class	1. A 2. B 3. BB 4. C 5. D
19-20	Soil erosion	00. None. Recent deposition 01. 1 02. 2 03. 3 04. 4 05. 5 06. 6 07. 7 77. 7 08. 8 88. 8 09. 9 99. 9
21	Land capability class number	

Card 2

Column	Item	Tabulation Code
22	Land economics class number	
23	Land use recommended in SCS Project	0. None 1. Forest 2. Pasture, permanent and native 3. Cropland, including rotation pasture 4. Orchard 5. Vineyard 6. Wildlife 7. Farmstead 8. Miscellaneous 9. Idle
24	Present land use	(Same Code as for Column 23).
25	Land use change	2. No change 3. Non-detrimental change 4. Detrimental change

F O R E S T
Card 2

Column	Item	Tabulation Code
26	Type	1. Natural weed-trees 2. Old field hardwoods 3. Northern " 4. Pine " 5. Oak " 6. Black locust " 7. One-species plantation 8. Two-species plantation 9. Three-species plantation
27	Stand	1. Uneven age, brush growth 2. Uneven age, young growth 3. Uneven age, merchantable growth 4. Uneven age, old " 5. Uneven " mixed" 6. Uneven " brush " 7. " " young " 8. " " merchantable growth 9. Uneven age, old growth
28	Planting	0. None recommended, none found 1. Not recommended, carried out 2. Recommended, carried out as recommended 3. Recommended, carried out changed but acceptable 4. Recommended, carried out, detrimentally modified 9. Recommended, not carried out
29.	Improvement cutting	(Same Code as for Column 28)

F O R E S T
C a r d 2

Column	Item	Tabulation Code
30	Ground bare	1. None or less than 1/4 2. About 1/4 bare 4. About 1/2 bare 6. About 3/4 bare 8. More than 3/4 bare
31	Grazing intensity	0. In forest: little or none 2. In pasture: moderate 4. In forest: moderate 5. " heavy, open park 6. " very heavy, final 8. In pasture: overgrazed 9. " little or none

P A S T U R E
Card 2

Column	Item	Tabulation Code
32	Type	Grasses: / Legumes: 0. Less than 1/4 / More than 3/4 1. About 1/4 / About 3/4 2. About 1/2 / About 1/2 3. About 3/4 / About 1/4 4. More than 3/4 / Less than 1/4 8. Weeds predominant 9. Brush encroachments
33-34	Legume species	0. Not identified 1. Alfalfa 2. Ladino clover 3. Alsike clover 4. Medium red clover 5. Wild white clover 6. Birdsfoot trefoil 7. 8. 9. Others Code also Col. 34 - same Code as for Col. 33 - when more than one legume species is abundant.
35-36	Grass species	0. Unidentified 1. Bromegrass 2. Timothy 3. Orchard grass 4. Kentucky bluegrass 5. Redtop 6. Reed canary grass 7. Ryegrass 8. 9. Others Code also Col. 36 - same Code as for Col. 35 - if more than one grass species is abundant.
37	Natural drainage	First digit of profile number, Appendix F.
38	Open drainage	(Same Code as for Col. 28)
39	Artificial drainage tile or stone	(Same Code as for Col. 28)

F E R T I L I Z E R S
Card 2

Column	Item	Tabulation Code
40-41	Manure applied per acre	Nearest ton
42-43	Lime content of soil profile	Second digit of soil profile number, Appendix F
44-45	Lime applied	Nearest tenth of ton/acre/year
46	Lime status	Same Code as for Col. 28)
47-48	Nitrogen need	Nearest pound per acre
49-50	Nitrogen applied in fertilizers	Nearest pound per acre
51	Nitrogen status	Same Code as for Col. 28)
52-53	Phosphoric acid need	Nearest pound per acre
54-55	Phosphoric acid applied	Nearest pound per acre
56	Phosphoric acid status	(Same Code as for Col. 28)
57-58	Potash need	Nearest pound per acre
59-60	Potash applied	Nearest pound per acre
61	Potash status	(Same Code as for Col. 28)

C R O P L A N D
Card 2

Colume	Item	Tabulation Code
62	Rotation type	0. G-H-H-H-H 1. G-H-H-H 2. G-H-H 3. R-G-H-H-H 4. R-G-H-H 5. R-G-H 6. R-R-G-H 7. R-R
63	Crop class	0. No crop. Idle or plowed 1. Meadow. Pasture or hay 2. Grain crop 7. Row crop
64	Crop plant	If meadow (Col. 63, choice 1): 1. Meadow, first year 2. Meadow, second year 3. Meadow, third year 4. Meadow, fourth year etc. If grain (Col. 63, choice 2): 1. Barley 2. Oats and barley 3. Oats 4. Wheat 5. Rye 6. 7. 8. 9. Other If row crop (Col. 63, 7): 1. Corn 2. Potatoes 3. Buckwheat 4. Cabbage 5. Beans 6. Peas 7. Tomatoes 8. Other vegetables 9. Others If crop is unidentified, Code zero

C R O P L A ND
Card 2

Column	Item	Tabulation Code
65	Legume turned under	(Same Code as for Col. 28)
66	Cover crop	(Same Code as for Col. 28)
67	Summer green manure crop	Same Code as for Col. 28)
68	Mulched crop	(Same Code as for Col. 28)
69	Contour farming	(Same Code as for Col. 28)
70	Strips	0. None recommended, none found 1. Not recommended but present 2. Recommended, present, as recommended 3. Recommended, present, changed either to forest or to pasture Recommended, present, modified with no detriment into strips. 4....wider 5....straighter 6....wider and straighter 7. Recommended, present, out of contour or other wise detrimentally modified 8. Recommended, absent, carried out but plowed up later 9. Recommended, absent, never started
71	Correction strips	(Same Code as for Col. 28)
72	Grassed waterways	(Same Code as for Col. 28)
73	Gully control	(Same Code as for Col. 28)
75	Windbreaks	(Same Code as for Col. 28)

C R O P L A N D
Card 2

Column	Item	Tabulation Code
75	Diversion terrace	0. None recommended, none found 1. Not recommended but present 2. Recommended, present as recommended 3. Recommended, present, modified without detriment 4. Recommended, present, no buffer strip 5. Recommended, present, silted 6. Recommended, present, out of grade 7. Recommended, present, unsatisfactory 8. Recommended, absent, carried out but plowed up later 9. Recommended, never done
76-77-78-79	Length of diversion recommended	Nearest foot
80	Card number	2

CARD OUTLINE BY FARMS

CAYUGA INLET SOIL CONSERVATION PROJECT, Card No. 3

Column	Item	Tabulation Code
1	Study number	1
2-3	Farm number	(As given in Appendix A)
4-5-6-7	Acres operated	To the nearest unit
8-9-10-11	Total foils	
12-13	Elevation of property	Nearest hundred feet
14	Tenure	1. Full owner 2. Part owner 3. Full tenant 4. Life estate
15	Farming status	1. Farm (Full time commercial) 2. Part time & subsistance farm 3. Rural residence 4. Seasonal residence 5. House vacant 6. House gone
16-17-18-19	Acres owned	Nearest unit
20-21-22-23	Acres rented in	Nearest unit
24-25-26-27	Acres rented out	Nearest unit
28-29-30	Total acres of crops	Nearest unit
31-32-33	Acres of idle cropland	" "
34-35-36	Acres of woods not pastured	Nearest unit
37-38-39	Acres of woods pastured	Nearest unit
40-41-42	Acres of permanent pasture	Nearest unit
43-44-45	Acres of season pasture	Nearest unit
46-47	Acres of farmstead and waste	Nearest unit
48-49	Acres of corn for grain	Nearest unit

Card 3

Column	Item	Tabulation Code
50	Acres of corn for silage	Nearest unit
52-53	Acres of corn fodder	Nearest unit
54-55-56	Acres of oats	Nearest unit
57-58-59	Acres of oats and barley	Nearest unit
60-61-62	Acres of other mixed grains	Nearest unit
63-64	Acres of buckwheat	Nearest unit
65-66	Acres of wheat	Nearest unit
67-68-69	Acres of alfalfa	Nearest unit
70-71-72	Acres of clover and mixed hay	Nearest unit
73-74-75	Acres of other hay	Nearest unit
76-77	Acres of hay cut on others	Nearest unit
78-79	Acres of hay cut by others	Nearest unit
80	Card number	3

CARD OUTLINE BY FARMS

CAYUGA INLET SOIL CONSERVATION PROJECT, Card No. 4

Column	Item	Tabulation Code
1	Study number	1
2-3	Farm number	(As given in Appendix A)
4-5-6-7	Acres operated	Nearest Unit
8-9-10-11	Total foils	
13-14	Acres of grass silage cut	Nearest unit
15-16	Acres of sudan grass and millet	Nearest unit
17-18	Acres of potatoes	Nearest unit
19-20	Acres of other crops	Nearest unit
21-22-23	Number of cows	
24-25	Number of heifers	
26-27	Number of calves	
28-29	Number of bulls	
29-30	Number of sheep	
31	Number of brood sows	
32-33	Number of other pigs or hogs	
34-35-36-37	Number of hens, estimate average for year	
38-39-40	Pullets raised sexed	
41-42-43	Pullets raised straight run	
44-45-46	Number of broilers	
47-48-49	Other poultry	Nearest hundred

Card 4

Column	Item	Tabulation Code
50-51-52-53	Gallons of maple syrup	
54-55-56	Cords of wood cut for all pruposes	
57-58-59	Timber and lumber cut	Nearest thousand feet
60-61	Number of people in household	
62	Number of tractors	
63	Size of tractors	1. 1 plow 2. 2 plow 3. 3 plow 4. over 3 plow
64	Number of trucks	
65	Size of trucks	1. Under 1 ton 2. 1 to 2 tons 3. Over 2 tons
66	Basement barn	1. Yes 2. No
67	Number of silos	
68-69-70	Number of stantions in barn or barns	
71	Electricity in house	1. Yes 2. No
72	Telephone	1. Yes 2. No
73	Running water	1. Yes 2. No
74	Furnace	1. Yes 2. No
75-76-77	Owner's estimate of value of farm with stock and tools	Nearest thousand dollars
78-79	Owner's estimate of value of real estate	Nearest thousand dollars
80	Card number	4

C. Administration of Test

This test was applied to farms cooperating in the Cayuga Inlet Soil Consevation Project, New York. Data was gathered in a uniform way and personally by inspection of the fields and through interviewing the farmers. Details about information recorded may be found below.

1. Card 1

Study number, Column 1

A number -- one -- was assigned to this study in order to make possible the utilization of the same IBM cards in an analysis where information from other areas might also be included.

Data was collected in the fall of 1951 and spring of 1952 and corresponds to the crop year ending in the fall of 1951.

Farm number, Columns 2 and 3

In the original Project, farms were numbered by the clock system (4), first letters designating a community, followed by a clock direction where 12 o'clock points to the north, a zone number in miles from the community, and a letter for the house. Thus N-4-1-R means: near Newfield, in direction four o'clock, one mile away, house R.

Farms were coded according to the list included as Appendix A. For convenience, an index by cooperators, and one by airphotos are added as Appendixes B and C.

For a research including a large number of farms, more columns should be left aside under this heading.

Acres operated, Columns 4 to 7

Acres rented in and operated as one unit with main farm are included, but acres owned and rented out are not considered.

More columns should be used in areas where farms are very large.

Total foils, Columns 8 to 11

These represent the product of a conservation deficit rating multiplied by the number of acres. They result from adding farm (Columns 12 to 15) and field (Columns 16 to 19) foils.

Farm foils, Columns 12 to 15

Are the product of farm acres (Columns 4 to 7) times the number of unfavorable conservation items for the farm taken as a whole.

Choices numbered 4 to 9 were considered unfavorable for conservation in the following ten columns: 32, 38, 43, 48, 53, 58, 59, 60, 64, and 66.

Field foils, Columns 16 to 19

Represent unfavorable conservation situations in significant items, when fields were considered individually.

They are the sum of products of fieled acres (Card 2, Columns 7-10) times field foils (Card 2, Columns 14-15).

Land Class, Column 20

Economic class number was recorded as read from map for Tompkins County. (71)

Productivity balance, Columns 21 to 23

Even though it was not intended to calculate productivity balances as part of this study, it is realized that this might be advisable later on or convenient in similar studies. Space left will allow easy subsequent punching of productivity balance data if so desired.

Calculations may be made using blank included as Appendix D, which is an adaptation for New York State of the procedure deviced at Ohio Experiment Station (92), c.f. (10). In order to handle negative values, cards may be either double-punched in position "y" or single-punched adding ten units to every value.

Changes in acreage, Columns 24 to 29

Acres bought and acres sold since the Project was established have usually not interfered with information

recorded in Cards 1 and 2, but they did prevent analysis of business data (Cards 3 and 4) by confounding areas inside and outside the original Project.

Records available, Column 31

Intends to locate forms suitable for further study, including years for which data is available.

Farmer's opinions, Columns 32, 33, 34, 64

Questions relative to his attitude towards conservation were worded as follows: Do you think conservation practices pay? Do you have a specific fact in mind?

Column 34 aims at finding which is the attitude of the farmer to his community.

2. Card 2

Study number and farm number., Columns 1 to 3

Correspond to identical columns in Card 1 already considered.

Field numbers, Columns 4 and 5

Fields numbers are those shown on revised land use plans of the original project.

Sector number, Column 6

When an area marked as a single field on the original project plans appeared to be managed in more than one way, it was subdivided into as many sectors as were necessary to properly describe the field.

Acres, Columns 7 to 10

Acreage was recorded to the nearest tenth of an acre because of the small areas found, especially in stripcroped land, where each strip was treated as an independent field in the original project.

Total foils per acre, Columns 11 and 12

They result from adding columns 13 and 14-15.

Farm foils per acre, Column 13

They are the sum of foils in the following ten columns of Card 1: 32, 38, 43, 48, 53, 58, 59, 60, 64, and 66.

Field foils per acre, Columns 14 and 15

They are the sum of foils in the following 27 columns of Card 2: 25, 27, 28, 29, 30, 31, 32, 38, 39, 40, 46, 51, 56, 61, 62, 63, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75,

Soil type number, Columns 16 and 17

Type numbers refer to those in use at the establishment of the Cayuga Inlet Project and are given in Appendix E. The Tompkins County District has since adopted a new numbering; its basis and correlation to the old notation are included as Appendix F.

Slope class, Column 18

Percent of slope for the various classes was taken as originally mapped; namely:

On well drained and moderately well drained till and outwash soils		On poorly and imperfectly drained till and all lacustrine	
A	0 to 5%	A	0 to 2%
B	5 to 15%	B	2 to 8%
BB	15 to 25%	BB	8 to 15%
C	25 to 35%	C	15 to 30%
D	35% and over	D	30% and over

They correspond to the groupings included in the soil legend below (58).

SOIL LEGEND

Upland -- non-calcareous till, well drained

1 Lordstown stony loan and silt loam
7 Wooster and Bath
27 Wooster stony silt loam (a poorer soil, than other members of the Wooster series)

Upland -- non-calcareous till, imperfectly drained

8 Canfield
28 Mardin

Although these soils are imperfectly drained, the mottling or hard pan occurs below 24 inches and they take the same slope groups as do the well drained till soils.

Upland -- non-calcarcous till, poorly drained.

2 Volusia stony silt loam
63 Volusia stony silt loam, deep phase
23 Fremont
43 Fremont, deep phase
34 Allis stony silt loam (if desirable to separate from Volusia)

(In the deep phases of the above soils the mottling or hard pan occurs between 10 and 24 inches from the suface)

4 Chippewa
11 Hornell

Upland - slightly calcareous till, well drained

17 Alkaline subsoil Wooster

Upland - slightly calcareous till, imperfectly drained

18 Langford - although this soil is imperfectly drained, the mottling or hard pan occurs below 24 inches and it takes the same slope group as the well drained till soil.

Upland - slightly calacareous till, poorly drained.

13 Erie
53 Erie, deep phase, mottling between 10 and 24 inches.

Terrace and outwash

12 Chenango fine sand loam
21 Howard fine sand loam
22 Chenango gravelly loam and gravelly silt loam
26 Otisville
36 Groton gravelly loam
24 Braceville
32 Palmyra gravelly silt loam
37 Groton fine sandy loam
31 Howard gravelly loam and gravelly silt loam

Lacustrine

25 Dunkirk silt loam
29 Canadea silt loam
35 Arkport of Dunkirk fine sandy loam
39 Granby

Bottom lands

5 Tioga
6 Eel and Middlebury
9 Muck
14 Holly and Wayland (too poorly drained to be cultivated)
15 Chagrin
16 Small bottom, unclassified as to soil type, but well enough drained to be used for pasture, at least.
19 Well drained muck

Recent deposition

3 Gravel deposits
33 Silt depostis
46 Mixed patches

Gravelly and stony areas

Soil Erosion, Columns 19 and 20

As used ordinarily in erosion surveys (59, 84):

+ Recent deposition
1 No apparent erosion
2 Slight sheet erosion. Less than 25% topsoil removed
3 Moderate to serious sheet erosion 25-75% of topsoil removed
4 Severe sheet erosion. Over 75% of topsoil removed
5 Very severe sheet erosion. Topsoil and subsoil removed, with erosion of parent material
6. Land slips, mapped on areas exposed by slips
7 Occasional shallow gullies, 3 gullies or less per acre.
8 Frequent shallow gullies, more than 3 gullies per acre.
9 Destroyed by gullying.
Encircling of gully symbols 7, 8 or 9 shows gullies too deep to be crossed by farm implements. Stabilized erosion is indicated by underlining erosion symbol.

Land use capability class number, Column 21

Numbered as done by the United States Soil Conservation Service (8, 84, 113). Not available in this case.

Land economics class number, Column 22

Recorded as read from map of Tompkins County (71).

Land use, Columns 23 to 25

Recommended use was read from maps in file at

the Tompkins County Soil Conservation District. These maps were drawn at the scale of one inch to five hundred feet.

For present use mapping, land was classified following the definitions of United States Department of Agriculture, Handbook 18, page 276 (111).

Woodlots, Columns 26 to 31

These items were prepared with the help of Professor Fred E. Winch.

Species were identified using the keys given in Cornell 4-H Club Bulletin 85 (27), classified according to Cornell Extension Bulletins 716 and 722 (28, 29). Stages of growth terms described a large proportion of trees having, at breast height, a diameter of: under 4 inches, was called brush; 4 to 12 inches, was called young; and over 12 inches, was called merchantable.

Pastures, Columns 30 to 36

Species were identified following the keys prepared by Professor H. B. Hartwig for his course on Production of Field Crops, at Cornell University.

Drainage, Column 37

Natural drainage was recorded by means of the first digit of the soil profile number now in use for Tompkins County and listed as Appendix F (93).

Lime content of soil profile, Column 42

Second digit of present soil number, Appendix F, was used to record lime in the profile.

Lime and fertilizers, Columns 42 to 61

An estimate was made for each individual field, based on rotation, crop, soil and recommendations of Cornell extension agronomists (3).

Rotation type, Column 62

In the choices, G stands for a grain crop; H, for hay; R, for a row or intertilled crop.

Columns 65 to 79

These practices are judged according to specifications of the New York Agricultural Conservation Program for 1952 (110).

Card 3 and Card 4

They are essentially the coding outlines in use for land economics surveys, and are self-explanatory.

Productive work units were taken from the most recent revision done by Professor Stanly Waren, which is given below:

WORK UNITS FOR LIVESTOCK AND CROPS

Livestock	Work units per head
Cows	13
Heifers	2
Bulls	5
Hens	0.16

Livestock	Work units per head
Pullets raised	0.05
Broilers raised	0.01
Brood sows	3
Hogs raised	1
Ewes and rams	0.5

Crops	Work units per acre
Hay - 1st cutting	0.7
2nd and 3rd cuttings	0.7
Corn silage	2.5
Corn for grain	1.5
Oats	1
Barney	1
Oats and Barley	1
Wheat	1
Buckwheat	1
Dry beans	3
Potatoes	9
Cabbage	9
Peas for canning	2
Tomatoes for canning	12
Apples, commercial	12
Home orchard	3
Fruit not of bearing age	2
Miscellaneous	
Work off farm, days	1

2. Sampling

The original Cayuga Inlet Project included 103 cooperating farms, which constituted a statistical "universe" for the purposes of this work. Data on some of the farms became lost in a fire but all 70 remaining were used.

These farms having available data were considered as a representative sample of all farms included in the Project for the following reasons:

a. A large share of the statistical universe is represented, both in farm numbers and in acreage. Therefore, they are very likely to duplicate the characteristics of the complete group.
b. Fire destruction of data was at random.
c. Part of each one of the watershed airphotos is included in the sample.

Except for those cases dealing with a universe, all others will require a representative sample secured by either one of these alternatives: random sampling of individual farms, cluster of farms, purposive or stratified sample (45, 62, 125).

3. Processing of Data

Data gathered in the form detailed in previous sections was coded as indicated in the card outlines and registered in IBM coding sheets. These have 80 columns and 40 lines, but there is no limit to the combinations possible (127).

From the sheets, data were transmuted into holes punched on IBM standard cards (20, 128). Cards

are 3 1/4 by 7 3/8 inches and of a thickness of 150 cards to one inch.

Punching was done mechanically at a rate that varied from 20 to 100 cards per hour, 80 on the average. Accuracy of punching was checked by means of another machine, the verifier,

Each of the 80 vertical columns in the card is divided into 12 punching positions, including the numerals 0 through 9.

Sorting of the cards was mechanically done as punched holes caused electrical contacts in the various pieces of equipment -- sorter, collator, and tabulator -- the operations proceeding at some 400 cards per minute.

4. Goodness of the Test

It was deemed desirable to ascertain the degree of reliability, validity and discrimination that this conservation status test could afford.

Reliability

The extent to which results of the test were verifiable, i.e., its reliability was measured as follows:

1. One conservation significant item was eliminated at random, in order to have an even number.
2. The remaining 36 were split into two groups, taking alternate items.

3. Reliability was calculated by means of the Spearman-Brown formula (2):

$$r_t = \frac{2r_{12}}{1 + r_{12}}$$

where r_t is reliability coefficient of the complete test

r_{12} is correlation between the foils in the two halves of the test.

Validity

The extent to which the test measures what it is supposed to measure, called its validity, is merely another way of looking at the correlation between conservation and significant items, referred to later as item-analysis.

Discrimination

Diagnostic value was judged on an item basis, by means of the expression:

$$D = R \cdot F$$

where

D is discriminating power

R is percent of acres without foil

F is percent of acres showing foil

Modifications

Even though reliability and validity are not fixed properties of any test in as much as they vary with the material tested, they can be set at an approximately desired level by using the formulas below (2):

$$n_r = \frac{r_{nn}\ (1 - r_{xx})}{r_{xx}\ (1 - r_{nn})}$$

$$n_v = \frac{1 - r_{xx}}{\frac{r^2_{xy}}{r_{(nx)y}} - r_{xx}}$$

where

n_r = length of test required for a given reliability, i.e., number of times by which the test has to be lengthened

n_v = length of test required for a given validity

r_{nn} = reliability desired

$r_{(nx)y}$ = validity desired

r_{xx} = reliability of original test

r_{xy} = correlation between criterion (Y) and original test (X).

5. Analysis of Practices

In order to analyze individual conservation practices, indexes of adoption and of persistence were coined.

Index of adoption was taken as the ratio of units where the practice was carried out to those where recommended. For most items, it was the sum of units in choices 1 to 8, divided by those from 2 to 9.

Index of persistence was the ratio of units

retaining the practice in satisfactory conditions to number of units in which the practice was recommended. It usually included choices 2 and 3 in the numerator, and the sum of 2 thru 9 as denominator.

For most practices, an acre was taken as one unit, but for a few one foot was used.

6. Analysis of Items

Value of the various items as indicators of conservation status of an area was determined by validity coefficients, i.e., estimates of the item criterion correlation.

Tetrachoric "r" was selected as the most suitable expression for this type of work (40, 79). It was obtained as follows:

1. Cards corresponding to the highest ratings were sorted out.
2. A group of the same acreage having the lowest ratings was also picked.
3. Foils were counted for the items in both groups and arranged in tabular form.
4. Frequencies were converted into percentages of total acreage included in both groups.
5. Tetrachoric " r " was computed from Mosier and McQuitty (79) charts.

6. Significance was determined by comparison with Snedecor's table, entered at degrees of freedom equal to total acres minus two.

7. Conservation Ratings

It was mentioned before that unsatisfactory situations from the conservation standpoint were named "foils". If foil numbers are added up on unit acre basis, a rating is thus obtained which directly ranks conservation status. Its calculation may be conveniently represented by the following formula:

$$R = \frac{\Sigma\ (FxA)}{A}$$

where:

R, is conservation rating per acre

F, is Number of foils of individual piece

A, is Acreage of individual piece

These ratings are simple and suitable for statistical analyses restricted to one set of data, as is the case here with one Project. But, for comparisons with another group of data, these ratings would require adjustment. Perhaps in most cases it will be enough to correct for number of significant items and, in so doing, arrive at a sort of coefficient, that could be represented as follows:

$$B = \frac{R}{I}$$

where

B, is a Conservation coefficient

R, is Conservation rating per acre

I, is Number of conservation significant items tested

Obviously, the values of B will fall within the limits 0 and 1.

Sometimes, it will be desirable to eliminate the units involved. Then, a transmutation into common units of standard deviation would be advisable, i.e., $\frac{x}{\sigma}$ or $\frac{x - M}{\sigma}$, or into a D-score. if negative and decimal values are to be avoided (2).

At present, there is no experimental evidence on which relative weights could be assigned to the items and even less to the choices, but a refinement in that direction is not at all impssible. For the time being weighing by acreages seems to be the only justifiable thing to do. On the other hand, in educational research, both theoretical calculations and empirical data have shown no significant effect when items were weighed for validity.

By mechanical sorting within the group of cards number four, it was possible to select land of specified characteristics, calculate a statistical norm of central tendency, and test the significance of the differences found.

8. Other Correlations

Besides those pertinent relationships considered in previous sections, it is also possible to take advantage of information gathered by this method and analyze it beyond the needs of this research which is merely only of helping to interpret conservation items.

The simplest approach would be to apply a technique identical to the one already described for conservation items. This could be carried one step further by dealing with individual choices within items. The number of correlations to be calculated may be obtained from the following formulas :

$$M = \frac{n^1}{p^1 (n-p)^1}$$

and

$$n^1 = e^{-n} n^n \sqrt{2 \pi n} \quad , \text{ approximately}$$

where

M, is number of correlations

n, is number of items to be correlated

p is number of items considered at a time

For example, disregarding choices and taking 2 items at a time will require the calculation of some 27,000 correlations.

9. Critical Rates

This section defines what values have been taken as critical.

Choices in conservation significant items have been selected so that numbers of 4 or larger represent foils, i.e., unfavorable situations. This holds true for Card 1, Columns 32, 38, 43, 48, 53, 58, 59, 60, 64, and 66; Card 2 columns 25, 28, 29, 30, 31, 38, 39, 46, 51, 56, 61, 62, 63, 65, 66, 67, 68, 69, 70, 72, 73, 74, and 75. Columns 27 and 70, Card 2, show foils only in choices 7 through 9. Column 32, Card 2, shows foils in 0, and 4 through 9. Column 40, Card 2, shows foils only in zero.

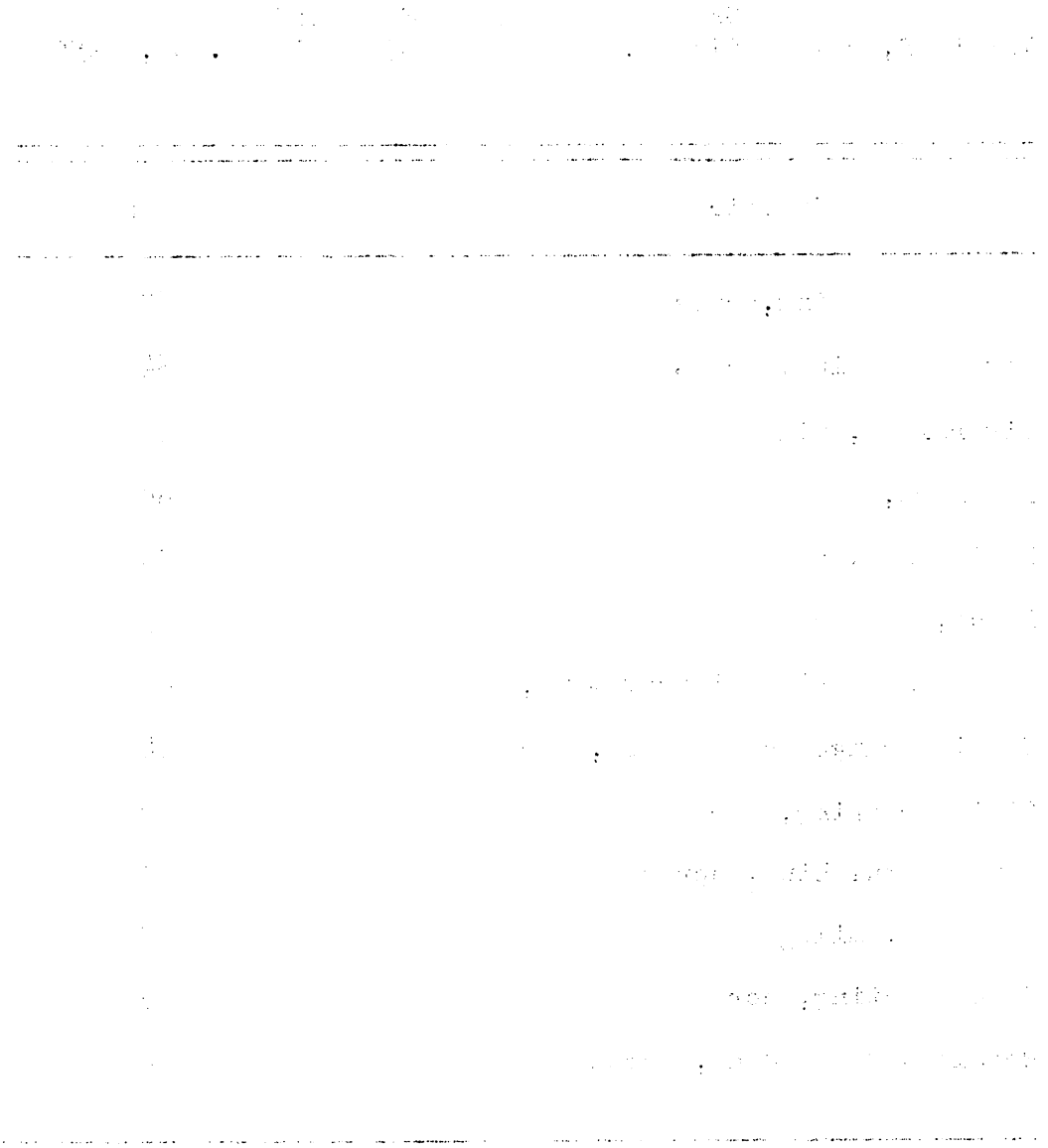
Means for the various groups were taken as reference values within the Project.

No absolute figures are available to compare outside of the Project but it was felt that an indication of differential adoption of practices could be gained from the contents of Table 5, calculated on data for United States, cumulative for the period 1936-1950 (108)

TABLE 5

PERCENT OF PLANNED PRACTICES APPLIED ON THE LAND, UNITED STATES, CUMULATIVE 1936 TO DEC. 31, 1950

Practice	Percent
Contour farming,acres	65
Cover cropping, acres	64
Diversions, miles	53
Drainage, acres	60
Irrigation, acres	53
Ponds, number	75
Range and pasture improvement, acres	60
Seeding range and pasture, acres	44
Strip cropping, acres	57
Stubble mulching, acres	81
Terraces, miles	47
Tree planting, acres	49
Woodland management, acres	62



III

MATERIALS

The Cayuga Inlet Soil Consevation Demonstration Project was used as a source of experience while this method was being developed. It provided also a testing ground for the finished tool.

Selection of this area was based on several good reasons listed below.

a) More than decade had elapsed since the Project was established and during all that period there had been no further attempts to foster conservation. In other words, after an initial push in the late 1930's the farmers were left to themselves with no assistance other than that available to all farmers in the Tompkins County District (82, 83, 110).

b) Present District Conservationist, Mr. Rodman Fellows, had been a key man in the original Project and was willing to contribute invaluable information and his experience to this research.

c) Records were available in the District Office, including farm plans and a soil conservation survey done on airphotos at one inch to 500 feet, during 1935-36.

d) The area was of moderate size.

e) Field work could be easily carried from nearby Ithaca.

1. Description of the Cayuga Inlet Watershed (112)

Location: In New York State, on the southwest corner of Tompkins County, centered about the Newfield-West Danby axis, at approximately 42°20' N and 76°35' W.

Nearly two-thirds of the watershed fall within the town of Newfield, the remainder, in Danby, except for very small portions in Ithaca and in Tioga County.

Shape: Roughly triangular, one side paralleling New York route 13.

Area 23,639 acres

Drainage: As shown in figure 1, the systems empties into the southern tip of Cayuga Lake. It drains all the area above Enfiled Glen, thru two main streams, one on the east and one on the west side.

Elevation: Ranges from 460 to over 1900 feet above sea level (Mean level of Cayuga Lake, 381 feet) Figure 2 shows 100 ft. contour intervals.

Fig. 1

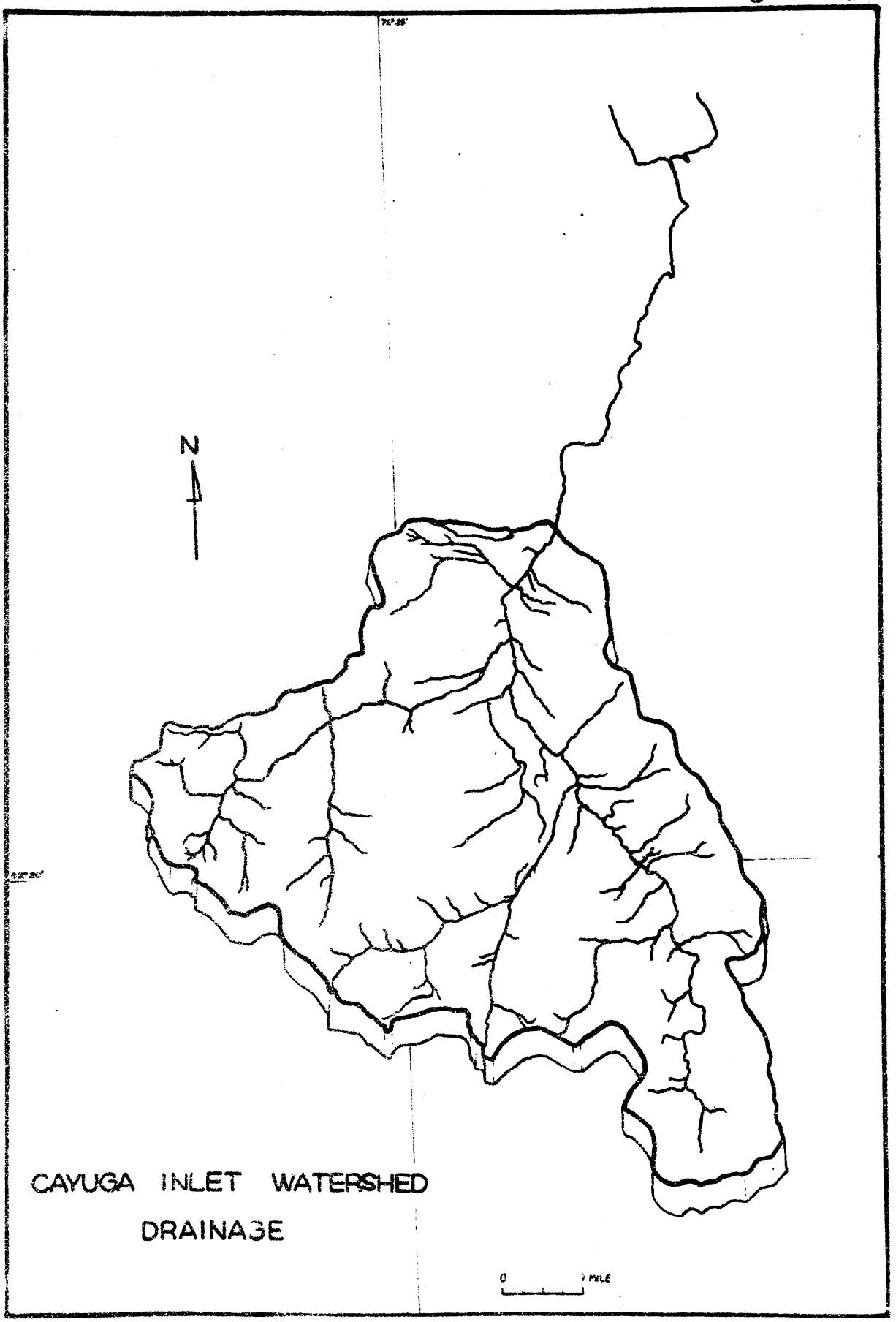


Fig. 2

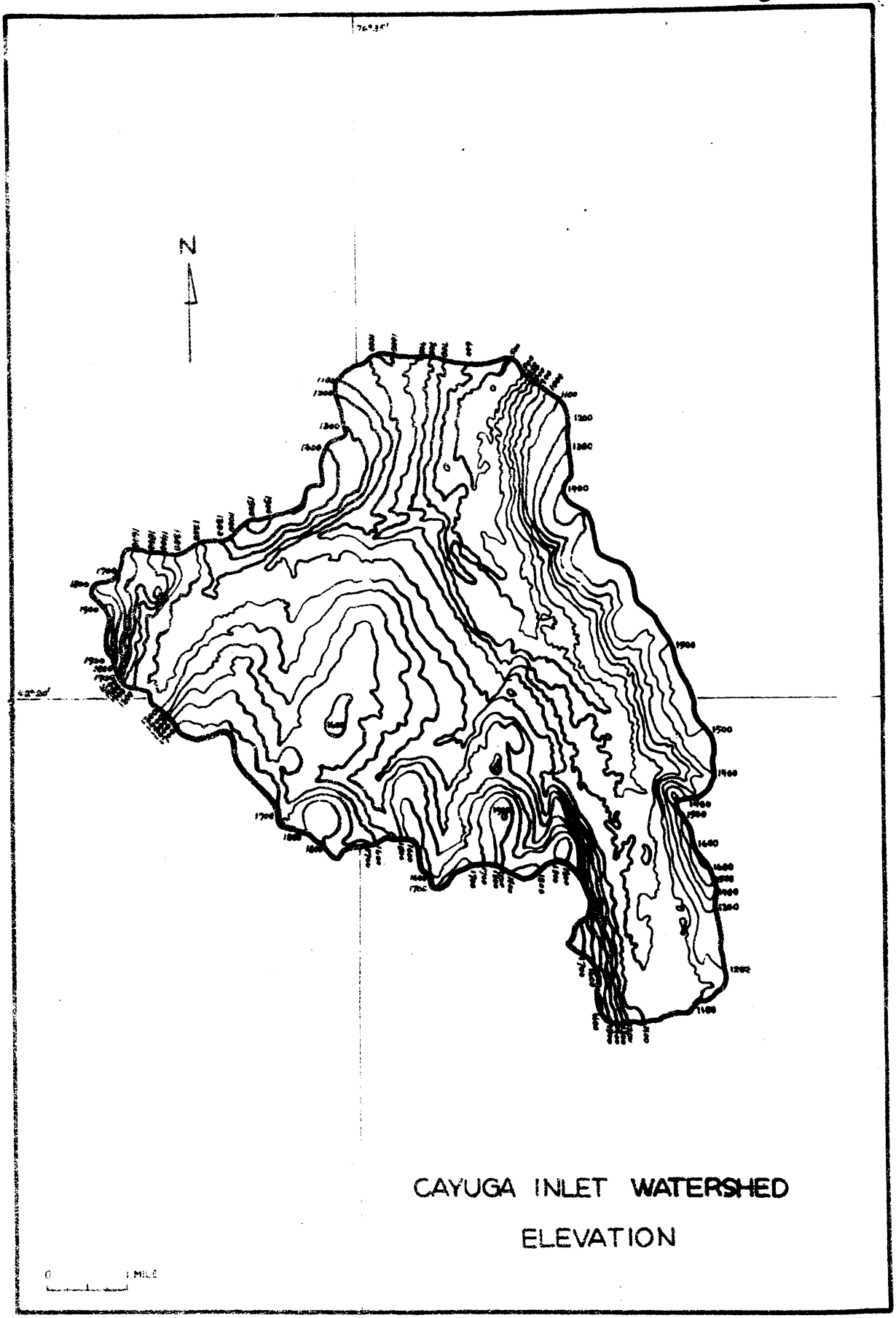
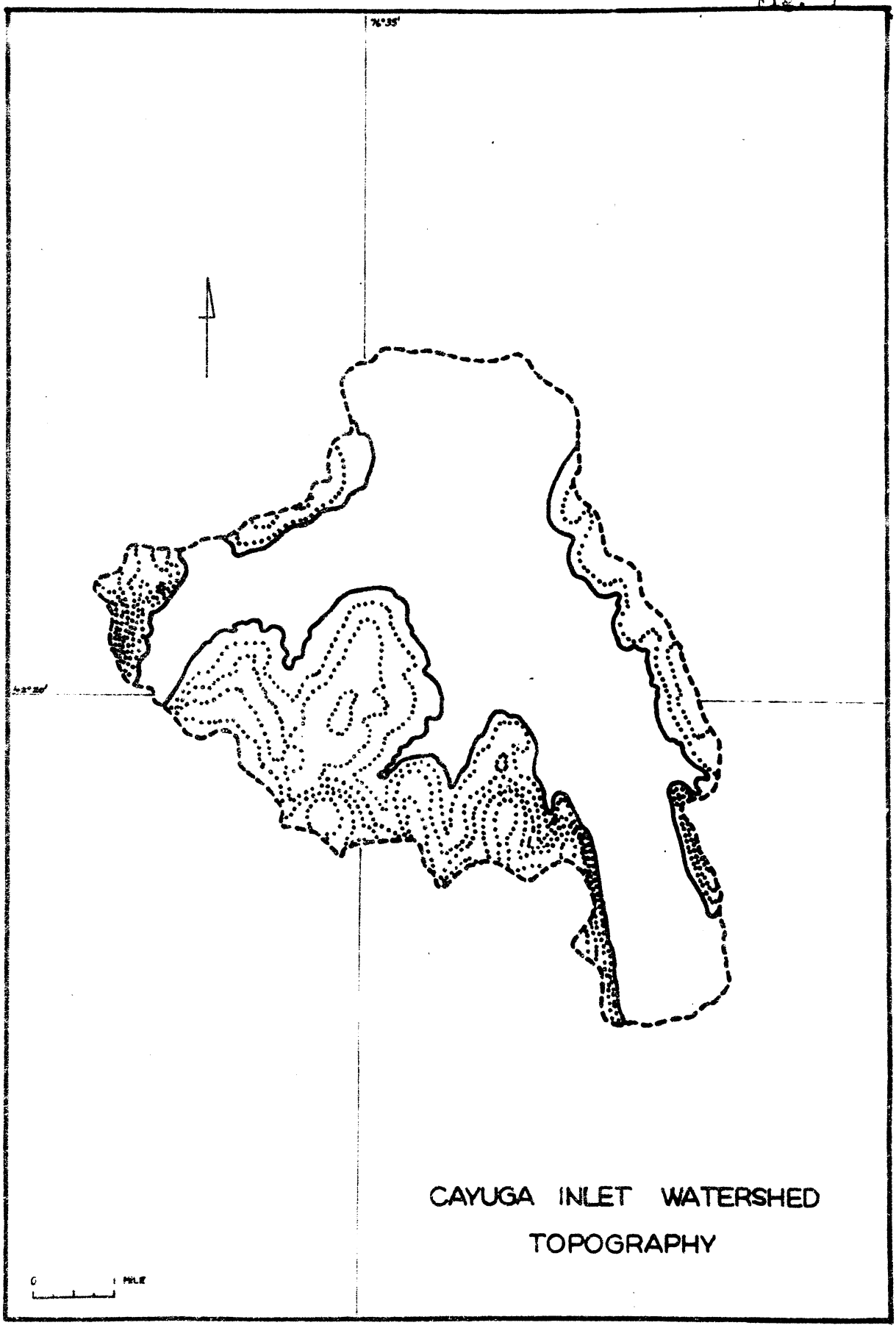


Fig. 3



CAYUGA INLET WATERSHED

TOPOGRAPHY

Topography and Physiography: The watershed in part of the Allegheny Plateau, which rises to some 1900 feet above sea level. Only small areas of the plateau remain intact, the bulk showing a markedly rolling topography.

Two main valleys bisect the plateau, as shown in Fig. 3, where the solid line represents the 1300-ft. contour. In addition, there are a number of lateral narrow ravines, descending from the steep upper slopes, through gentler lower sides, and into rolling valley bottom with morainic deposits.

Climate: Climate is that of the New York Central Lakes region (77), resembling closer the one of Ithaca.

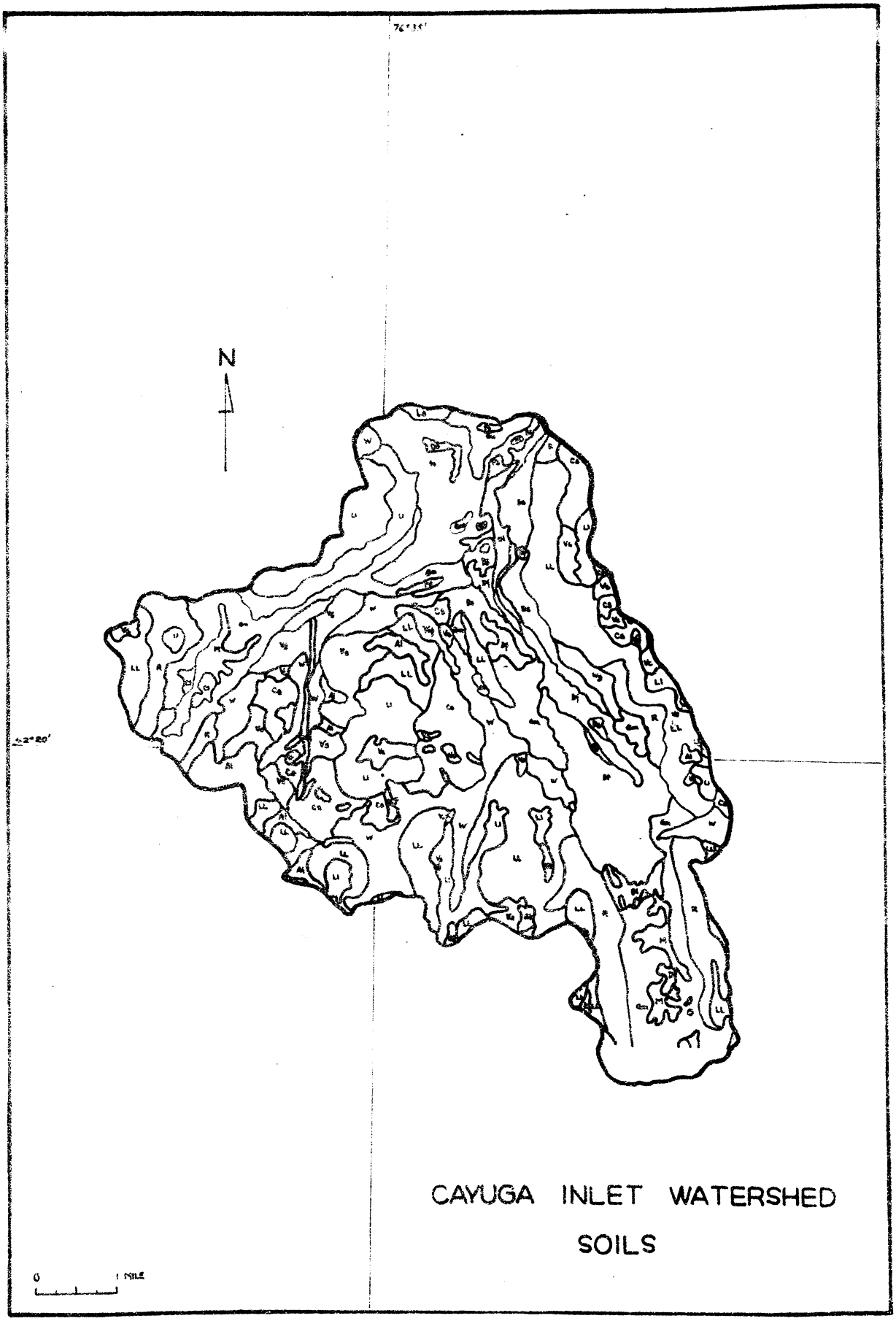
Observations of 66-86 years show the following mean annual figures:

Temperature	47°F
Precipitation	30-40 in.
Relative humidity	77%

Data for the growing season is found below:

Length	157 days
Temperature	60-65°F
Precipitation	15-18 in.
Sunshine	57% of possible

Fig. 4



Soils: Out of the 30 units mapped in the area, only eighteen of them occupied more than 1% of the total acreage. Those having more than 5% are listed below:

Soil type	Percent area
Lordstown stony silt loam	26.1
Langford silt loam	11.8
Palmyra gravelly loam	10.6
Dunkirk silty clay and silt loams	9.7
Wooster gravelly silt loam	7.6
Erie gravelly silt loam	7.1
Fremont gravelly silt loam	5.6

Lordstown is dominant on the hilltops, while Wooster is common at 1600-1200 feet, with Dunkirk and Palmyra further down (58). About 70% of the area has soils derived from glacial till, 14% are lacustrine, 11% outwash, and 5% alluvial.

Nearly one-fourth of the land is poorly drained and is imperfect on another one-third, c.f. Appendix E and figure 4.

Productivity is generally low, except for the valley bottoms.

Slopes: B slope dominates, including some 40% of the area. BB, comes second with 24%, the remainder being about equally distributed with 12% for each A, C, and D slopes.

Erosion: When the conservation survey was done in the mid 1930's, erosion was not found serious on the steep forested upper valley walls, but on the irregular slopes farther down, moderate to severe sheet erosion occurred. Severe sheet erosion was found at the top of the plateau as well as near the bottom of the valley. Occasional gullies appeared on the upland (59, 67).

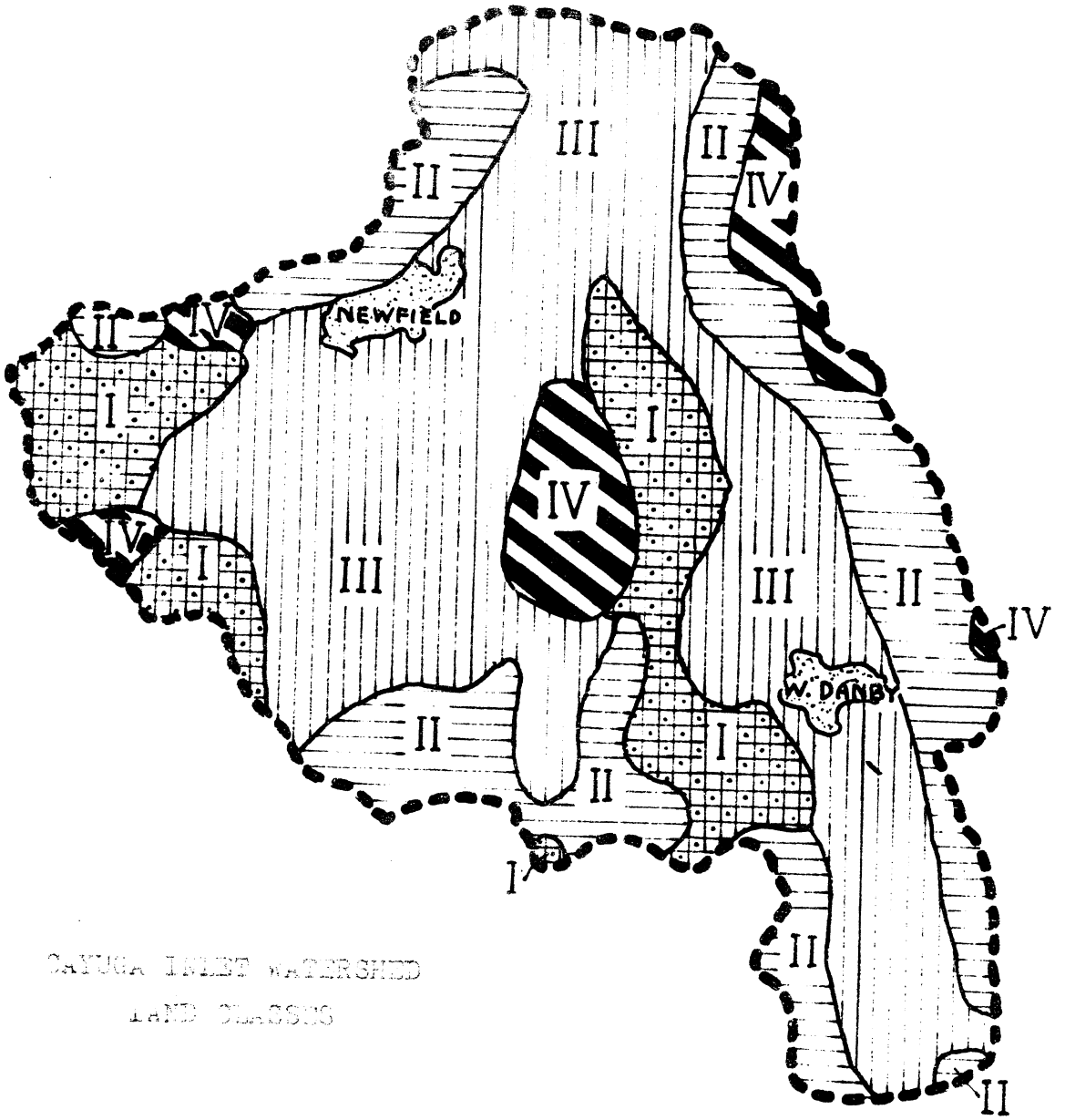
A breakdown of the area follows:

Erosion Class	Percent
1. No apparent erosion	13.6
2. Slight sheet erosion	22.1
3 Moderate sheet erosion	51.8
4. Severe sheet erosion	9.8
Land cut by gullies	1.9

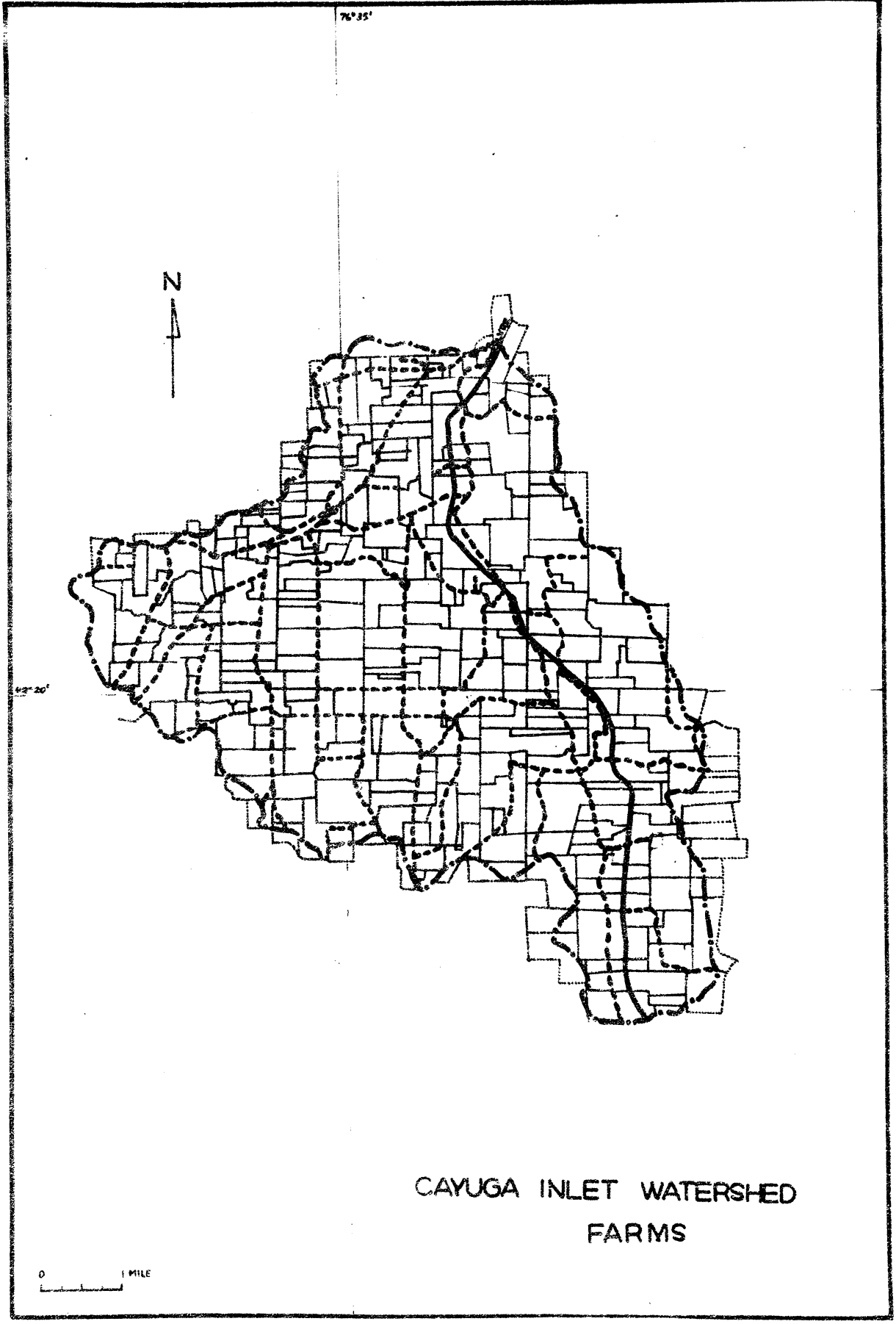
Water is the only erosive agent and causes the greatest damage in the summer.

Land use: At the time of the survey, the water shed was about equally divided among woodlots, cropland, and pastures, with 17% idel and 2% urban lands interspersed. Half of the cultivated area was harvested for hay. The most important cash crops were beans and buckwheat, occupying 4% of the land. Spring grains and rye covered 5%.

Fig. 5



CAYUGA INLET WATERSHED
LAND CLASSES



A four-year rotation of corn, oats and 2 years of hay was prevalent.

Farming system: Dairy farming was the main enterprise, with poultry gaining importance through the years (56, 70, 71, 72, 74, 116, 119).

Land classes: As shown in figure 5, slightly more than one-half of the watershed lays in economic land class III, 28% in II, 15% in I, and less than 6% in IV (71).

Farms Included in the watershed were 263 farms, ranging in size from 5 to 450 acres, the median being 94. (See figure 6).

A little over 10% of the farms were operated by tenants, mostly on a 50-50 basis.

2. Soil Conservation Service Demonstration Project, N.Y.-2

Based on a survey of the watershed plus data from several sources, such as the Cohocton River Demonstration Project and the Arnot Experiment Station, the Cayuga Inlet Demonstration Project N.Y.-2, was set along the following main objectives (112).

1. Include in cooperation contracts one-half of the watershed - 12,000 acres - by June 1, 1937.
2. Put 5,000 acres -- 20% of Project area -- under contour tillage. Out of these, strip crop 2,000.

3. Remove from cultivation 2000 acres of slopes over 35% slope and plant them to trees.
4. Retire from cultivation and put in permanent sod, 1000 acres of land on poorly drained soils with slopes over 15% plus all above 25% slopes on other soils.

Since the establishment of the Tompkins County District in 1940, the policy has been of no interference with the area as explained earlier.

IV

RESULTS

TABLE 6

CORRELATION OF PROJECT AND WATERSHED CHARACTERISTICS, CAYUGA INLET VALLEY

	Percent of area*	
	Project	Watershed
Soils:		
Lordstown	21.2	26.1
Langford	8.4	11.8
Palmyra	0.4	10.6
Dunkirk	5.5	9.7
Wooster	10.4	7.6
Erie	19.2	7.1
Fremont	10.4	5.6
Slope Class:		
A	5.8	11.8
B	41.8	39.7
BB	27.2	23.9
C	14.5	12.6
D	10.6	12.0
Sheet Erosion:		
None	9.5	13.6
Slight	19.3	22.1
Moderate	63.0	51.8
Severe	8.9	9.8
Land Class:		
I	4.2	14.7
II	28.6	27.7
III	51.2	50.9
IV	16.0	5.7

*Based on 6,478.3 acres for the Project, and 22,316 for the watershed

r = 0.86, significant at 1% point.

TABLE 7

GOODNESS OF THIS SOIL CONSERVATION STATUS TEST

Average diagnostic value	1924
Correlation coefficient between two halves of test	0.82
Spearman-Brown reliability coefficient	0.9
Validity coefficients of selected individual items:	
Conservation pays	0.01
Conservation doesn't pay	0.99#
Recommended hedgerow removal carried out	0.30
Recommended fence removal carried out	0.15
Recommended new fence constructed	0.30
Stream bank control	0.82
Against more tree planting	-0.88
Grazing methods	0.99#
No change in land use	-0.18
Detrimental change in land use	-0.62
Woodlots of even age stand and young growth	-0.96
Recommended improvement cutting of woodlot carried out	0.55
Vegetation cover of 75-100%	-0.80
Little or no grazing in forest	0.99#
Moderate grazing in pastures	-0.47
Botanical composition of grassland	-0.90
Artificial drainage	0.34
Lime status of soil	0.01
Crop	-0.01
Strip cropping	0.30
Grassed waterways	-0.99#

Low discriminating power

TABLE 8

ADOPTION AND PERSISTANCE OF RECOMMENDED PRACTICES
CAYUGA INLET SOIL CONSERVATION PROJECT

	Adoption	Persistence
Land use	0.88	----
Tree planting	1.48	0.40
Improvement cutting	1.00	0.77
Grazing	0.65	0.29
Open drainage	1.00	0.00
Tile drainage	1.10	0.67
Strip cropping	1.00	0.61
Correction strips	1.00	0.70
Grassed waterways	1.00	0.77
Gully control	1.00	1.00
Diversion ditches	1.00	0.91
Stream bank control	1.00	0.97
Hedgerow removal	1.00	0.98
Fence removal	1.00	0.90
New Fence	1.00	0.97

TABLE 9

TETRACHORIC CORRELATION COEFFICIENTS OF SLOPE CLASS TO CONSERVATION RATINGS

	r
A	0.73**
B	0.26
BB	-0.26
C	-0.13
D	-0.60

TABLE 10

TETRACHORIC CORRELATION COEFFICIENTS OF SOIL EROSION TO CONSERVATION RATING

	r
No apparent erosion	-0.01
Slight sheet erosion	0.03
Moderate to serious sheet erosion	0.00
Severe sheet erosion	0.03
All kinds of sheet erosion	0.01
Occasional shallow gullies	-0.60
Frequent shallow gullies	0.76**

** Significant at 1% point

TABLE 11

TETRACHORIC CORRELATION COEFFICIENTS OF SOIL TYPES TO CONSERVATION RATING
CAYUGA INLET SOIL CONSERVATION PROJECT

	r
Lordstown	-0.32
Gravel deposits	0.65
Chippewa	0.90**
Wooster	0.09
Muck	0.99#
Erie	0.61
Holly, Wayland and Maumee	0.97**
Small bottoms	-0.99#
Alklaine subsoil Wooster	-0.01
Langford	-0.47**
Howard	0.99#
Fremont	0.26
Bracoville	0.99#
Dunkirk	-0.99**
Mardin	-0.99#
Canaedea	0.01
Howard gravelly loam	0.26
Arkport	-0.99#
Groton gravelly loam	0.14
Groton	0.99#
Deep Lordstown	-0.40
Fremont, deep phase	0.00
Erie, deep phase	-0.14
Mixed, no type predominant	-0.38

** Significant at 1%

One of the rating graphs showed zero acreage

TABLE 12

TETRACHORIC CORRELAT ON COEFFICIENTS OF SOIL DRAINAGE AND CONSERVATION RATING

	r
Natural drainage:	
Well drained	-0.18
Imperfectly drained	-0.30
Poorly drained, impervious layer deep below	0.97**
Poorly drained, impervious layer near surface	0.47
Very poorly drained	0.90**
Tile drainage:	
Satisfactory	0.34
Unsatisfactory	-0.55

TABLE 13

TETRACHORIC CORRELATION COEFFICIENTS OF LIME CONTENT IN SOIL PROFILE AND CONSERVATION RATING

	r
Very low	0.00
Low	0.06
Medium	0.01
High	-0.33

** Significant at 1% point

TABLE 14

TETRACHORIC CORRELATION COEFFICIENTS OF LAND USE AND CONSERVATION RATING

	Recommended	Present
	r	r
Forest	-0.09	-0.30
Pasture	0.14	-0.07
Cropland	-0.09	-0.40
Orchard	-0.30	0.59
Wildlife	0.45	0.45
Farmstead	0.30	0.24
Miscellaneous	0.59	-0.03
Idle	0.96	-0.45
None	-0.99#	-0.99#

TABLE 15

TETRACHORIC CORRELATION COEFFICIENTS OF CHANGES IN LAND USE AND CONSERVATION RATING

	r
No change	-0.18
Harmless change	-0.50
Harmful change	-0.62

one of the rating graphs showed zero acreage

TABLE 16

TETRACHORIC CORRELATION COEFFICIENTS OF LAND CLASS TO CONSERVATION RATING

	r
Land Class II	0.14
Land Class III	-0.44
Land Class IV	0.78**

TABLE 17

TETRACHORIC CORRELATION COEFFICIENTS OF PRODUCTIVE-MAN-WORK UNITS TO CONSERVATION RATING

	r
PMWU in crops	-0.18
PMWU in livestock	-0.59
PMWU in crops and livestock	-0.47
PMWU per man	-0.60

TABLE 18

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN CHANGES IN FARMING TYPE AND CONSERVATION RATING

No change	-0.85**
Shift towards poultry	0.85**
Other shifts	0.45

** Significant at 1% point

TABLE 19

TETRACHORIC CORRELATION COEFFICIENTS OF WOODLOT ITEMS AND CONSERVATION RATING

	r
Type:	
Natural wood-tree	-0.99#
Northern hardwoods	-0.96**
One-species plantation	0.99#
Three-species plantation	0.99#
Stand:	
Uneven age, young growth	-0.45
Uneven age, merchantable growth	-0.99#
Uneven age, mixed growth	-0.03
Even age, young growth	-0.96**
Planting:	
As recommended	0.99#
Satisfactorily modified	-0.99#
Unsatisfactory	-0.99#
Not recommended but carried out	0.99#
Improvement cutting:	
Satisfactory	0.55
Unsatisfactory	-0.99#

** Significant at 1% point
# One of the rating graphs showed zero acreage

TABLE 20

TETRACHORIC CORRELATION COEFFICIENTS OF GROUND BARE AND CONSERVATION RATING

None or less than one-fourth	-0.80
About one-fourth	0.30
About three-fourth	-0.99

TABLE 21

TETRACHORIC CORRELATION COEFFICIENTS OF GRAZING AND CONSERVATION RATING

Forest:	
Little or no grazing	0.38
Moderate grazing	-0.99##
Pasture:	
Little or no grazing	-0.96**
Moderate grazing	-0.47**

** Significant at 1% point

One of the rating graphs showed zero acreage

TABLE 22

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN GRASSLAND ITEMS AND CONSERVATION RATING

		r
Grass-legume ratio:		
Less than	1:3	-0.55
About	1:3	-0.83**
About	1:1	-0.86**
About	3:1	-0.90**
More than	3:1	-0.62
Weeds predominant		-0.99#
Brush encroachments		0.97**
Presence of:	Alfalfa	-0.45
	Red Clover	-0.45**
	Timothy	-0.55
	Kentucky Bluegrass	-0.39
Adequate water in pasture		-0.76**
No shortage in midsummer pasture		-0.59**

** Significant at 1% point
# One of the rating graphs showed zero acreage

TABLE 23

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN CROP CLASS AND CONSERVATION RATING

Meadow	0.30
Grain	0.00
Row crop	-0.93**

TABLE 24

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN STRIP CROPPING AND CONSERVATION RATING

Strips recommended:	
:Present as recommended	0.30
Modified without harm:	
Removed from cultivation	0.03
Made wider	-0.82**
Made straighter	0.69**
Made wider and straighter	-0.71**
Modified with damage	-0.72**
Plowed up	-0.76**
Never laid on the land	-0.14
Strips not recommended but present	0.55
Correction strips, as recommended	0.65

** Significant at 1% point

TABLE 25

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN MISCELLANEOUS ITEMS AND CONSERVATION RATING

	r
Attitude in favor of conservation	0.01
Attitude in favor of more technical help	0.30
Attitude against tree planting	-0.88**
Unsatisfactory grassed waterways	0.71
Hedgerow removed	0.30
Fence removed	0.15
Fence built	0.30
Stream bank control satisfactory	0.82**
Want son to farm same farm	-0.15
Crop manured	0.15
Way in which manure is handled	0.14

TABLE 26

LAND USE
CAYUGA INLET SOIL CONSERVATION PROJECT

	Recommended, 1935-40		Present, 1951-52	
	Acres	Percent	Acres	Percent
Pasture	2,498	38.4	2,279	39.6
Cropland	2,164	33.4	1,642	28.6
Forest	1,647	25.2	1,154	20.0
Farmstead	107	1.7	91	1.6
Wildlife	30	0.5	13	0.2
Orchard	26	0.4	8	0.1
Miscellaneous	23	0.4	9	0.2
Idle	2	*	556	9.7
None	2	*	5	*
	6,499	100.0	5,756	100.0

**Significant at 1% point
* less than 0.1%

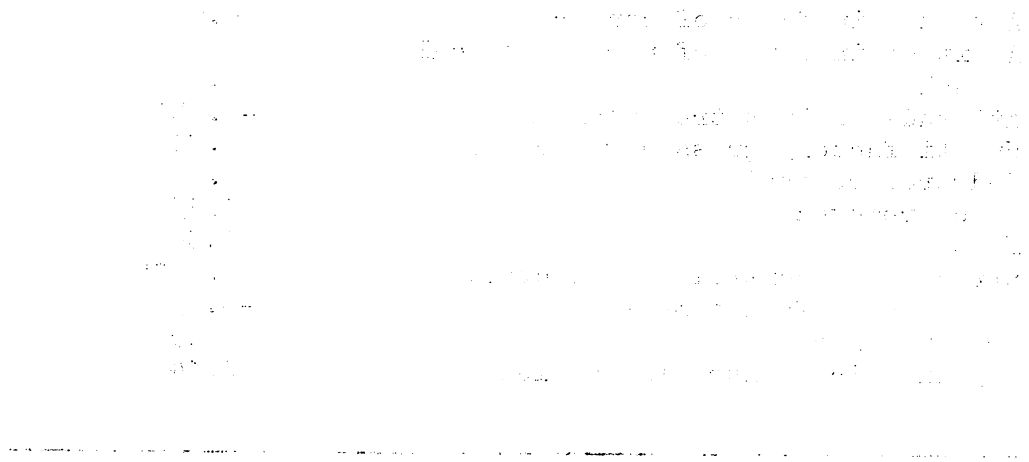


TABLE 27

LAND CLASS
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
Class I	277.2	4.2
Class II	1,849.8	28.6
Class III	3,331.9	51.2
Class IV	1,039.7	16.0
	6,498.6	100.0

TABLE 28

FARM OPERATOR CHANGES, 1940 to 1952
CAYUGA INLET SOIL CONSERVATION PROJECT

Same operator	24
New operator, same family	20
New operator, no kin	20
No operator	2
	66

TABLE 29

SOIL TYPES, OLD AND NEW CLASSIFICATIONS
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres		Percent	
	Old	New	Old	New
Arkport (now Dunkirk)	62.0	1.0	1.0	0.0*
Braceville	9.3	9.3	0.1	0.1
Canaedea	186.1	186.1	2.9	2.9
Cazenovia	4.9	4.9	*	*
Chagrin and Genesee	15.6	15.6	0.2	0.2
Chippewa	76.6	76.6	1.2	1.2
Dinkirk	356.0	418.0	5.5	6.4
Eel and Middlebury	25.8	25.8	0.4	0.4
Erie	762	762.9	11.7	11.7
Erie, deep phase (now Langford)	485.0	0.0	7.5	0.0
Fremont	431.4	431.4	6.6	6.6
Gravel deposits	25.3	25.3	0.4	0.4
Granby	10.5	10.5	0.2	0.2
Groton gravelly loam (now Palmyra)	478.2	0.0	3.5	0.0
Groton	109.9	109.9	1.7	1.7
Fremont, deep phase (now Mardin)	241.0	0.0	3.5	0.0
Holly, Mayland and Maumee	91.7	91.7	1.4	1.4
Howard	63.3	63.3	1.0	1.0
Langford	548.1	1,033.1	8.4	15.9
Lorstown	1,012,4	1,373.5	15.5	21.1
Lordstown, deep phase	361.1	0.0	5.6	0.0
Mardin	14.1	255.1	0.2	3.9
Muck	30.2	30.2	0.5	0.5
Palmyra	29.7	507.9	0.5	0.5
Small bottoms	24.8	24.8	0.4	0.4
Valois	0.0	202.9	0.0	3.1
Volusia	89.4	89.4	1.4	1.4
Wooster	472.8	472.8	7.3	7.3
Alkaline subsoil Wooster (Now Valois)	202.9	0.0	3.1	0.0
	6,479.4	6,479.4	100.0	100.0

* Less than 0.1%

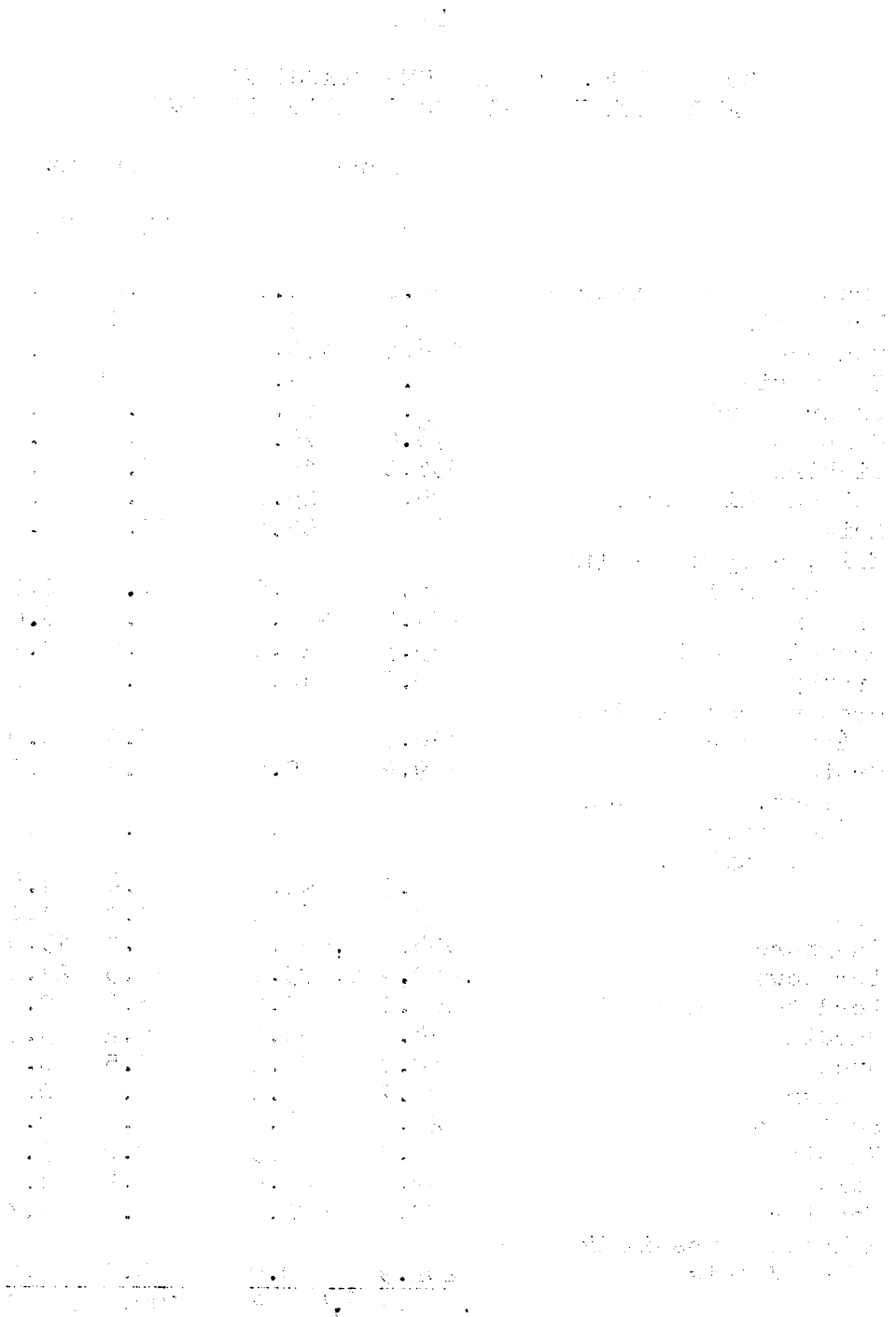


TABLE 30

SOIL EROSION
CAYUGA INLET SOIL CONSERVATION PROJECT, 1934-1940

	Acres	Percent
Recent deposition	0.3	*
No apparent erosion	615.1	9.4
Slight sheet erosion	1,250.5	19.2
Moderate to serious sheet erosion	4,072.0	62.4
Severe sheet erosion	576.6	8.8
Very severe sheet erosion	3.0	*
Land slides	0.2	*
Occasional shallow gullies, crossable	1.0	*
Occasional gullies, not crossable	157.2	2.4
Frequent gullies, not crossable	25.0	0.4

TABLE

SLOPE
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
A	377.8	11.8
B	2,710.4	39.7
BB	1,763.5	23.9
C	938.8	12.6
D	687.8	12.0
	6,478.3	100.0

* Less than 0.1% based on 6,518.7 acres

TABLE 31

SOIL DRAINAGE
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
Well drained	3,262.8	50.4
Imperfectly drained	1639.9	25.3
Poorly drained	1,575.6	24.3
	6,478.3	100.0

TABLE 32

SOIL PROFILE CONDITIONS
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
Friable thruout	3,257.9	50.3
Hardpan present	1,417.0	21.8
Impervious layer near the surface	1,400.2	21.6

TABLE 33

LIME CONTENT OF SOIL PROFILE
CAYUGA INLET SOIL CONSERVATION PROJECT

Lime in soil material	Subsoil Reaction	Acres	Percent
Very low	Acid	2,947.9	47.6
Low	Acid	2,109.6	34.0
Moderate	Slightly acid	92.5	1.5
High	Neutral or slightly acid	1,044.8	16.9
		6,194.8	100.0

TABLE 34

ORIGIN OF SOILS
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
Bottom lands	188.1	2.8
Lacustrine	614.6	9.5
Terrace and outwash	690.4	10.6
Upland till, acid	2,702.3	41.4
Upland till, slightly calcareous	1,998.9	30.9
Complex	285.1	4.4
	6,479.4	100.0

TABLE 35

STRIP CROPPING
CAYUGA INLET SOIL CONSERVATION PROJECT

	Acres	Percent
Strips recommended:		
Present as recommended	578.8	46.6
Modified without damage:		
Removed from cultivation	131.2	10.6
Strips made wider	160.9	12.9
Strips made straighter	59.9	4.8
Wider and straighter	80.7	6.5
Modified with damage	27.8	2.2
Plowed up	147.2	11.9
Never laid on the land	23.0	1.9
Strips not recommended but Present	22.4	1.8
	1,237.7	100.0

TABLE 36

DIVERSION DITCHES BUILT
CAYUGA INLET SOIL CONSERVATION PROJECT, 1951-52

	Feet	Percent
Working satisfactorily	31,350	91.0
Silted	2,280	6.6
Inadequate buffer strip	830.	2.4
	34,460	100.0

Correction Strips -- Out of only 4 correction strips surveyed, one had been plowed up, one removed from cultivation, and two remained as recommended. Their average size was 1.6 acres.

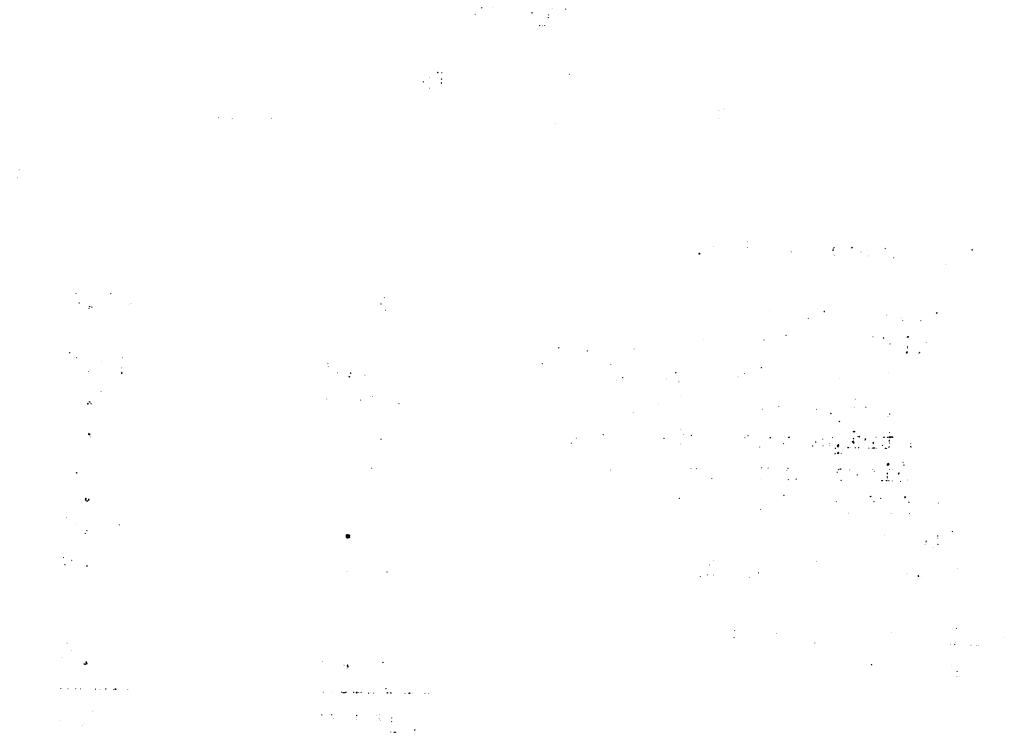


TABLE 37

TILE DRAINS INSTALLED
CAYUGA INLET CONSERVATION PROJECT

Farms, number	22
Fields affected, number	49
Fields affected, acreage	189.6
Length of tile, feet	20,043
Acres of fields where:	
Recommended and working	123.1
Not-recommended and working	15.5
Recommended and not operating satisfactorily	51.4

TABLE 38

MISCELLANEOUS DATA

CAYUGA INLET SOIL CONSERVATION PROJECT

Number of farms	70
Number of fields	1,617
Project recommendations on:	
Hedgerow removal	90,005 feet
Fence removal	266,730 feet
Fence building	132,925 feet
Stream bank control	6,400 feet
Fields with satisfactory waterways	32
Field with satisfactory gully control	13
Acres in fields with unsatisfactory open drainage	44.1
Acres in non-cropland cultivated	224

V

CONCLUSIONS

It is felt that data presented under part IV supports the following conclusions.

A) On the Method

1. This approach constitutes a sufficiently reliable tool to analyze soil and water conservation, though there is room for considerable improvement towards the theoretial maximum diagnostic value.
2. Validity of individual items as indicators of conservation varies widely. It is not considered advisable to reduce the number of items until more is learned about their behaviour when applied to other areas.

B) On the Cayuga Inlet Project

3. Farms included in the Project are a representative sample of the whole watershed.
4. There has been high adoption of conservation practices, reflecting the large extent to which prolonged effect treatments were carried out by Soil Conservation Service personnel.

5. Persistence of practices is generally good, except for those where the farmers encountered particularly difficult problems.

6. Conservation status appeared to be significantly related to the following items:

   A) Presence of level land

   b) Presence of frequent gullies

   c) Presence of a few soil types, namely, Chippewa, Langford, Dunkirk

   d) Very poor drainage and also poor one when impervious layer was deep in the profile

   e) Presence of land of the best economic class (Class IV) in the area

   f) Presence of woodlots of northern hardwoods, of even age and young growth

   g) Shift to poultry or no change in farming type

   h) Grazing intensity of pastures and completeness of vegetation cover, as well as botanical make-up

   i) Adequate supply of midsummer forage and of water in pastures

   j) Existence of row crops

k) All modifications of strips except for turning them into meadow

l) Control of streambanks

m) Farmer's attitude towards tree planting

7. Even though idle land has been reduced from 17% of the area in 1935 to 9.7% at present, it is still far from being eliminated.

8. There has been an increase in pasture with reduction of cropland.

9. Two-thirds of the farms have new owners.

10. Drainage problem areas include one-half of the acreage. Diversion ditches have proved very effective and about two-thirds

11. Over 70% of the soils are of glacial origin and 80% of them low in lime.

12. Almost one-half of the strips laid on the land have been altered to fit changing farming needs but, fortunately, most modifications do not appear to have been harmful.

13, The Cayuga Inlet Project, taken as a whole, has been a clear success and a credit to

those that planned and carried it out.

SUMMARY

In spite of the national importance of soil conservation, research on it has been handicapped by the lack of adequate instruments, either to measure conservation status over a given area or to appraise individual practices.

A method to analyze soil and water conservation is proposed here and the kind of information obtainable is illustrated with data from its application to the Cayuga Inlet Soil Conservation Project, New York. This approach is essentially based on the concepts of achievement testing and the findings of soil conservation research.

BIBLIOGRAPHY

1. Ableiter, J. K.
   1937. Productivity ratings in the soil survey report. Soil Sci. Soc. Amer. Proc. 2:415-422.

2. Adkins, Dorothy C.
   1947. Construction and analysis of achievement tests. U. S. Government Printing Office, Washington, D. C.

3. Aldrich, Samuel R.
   1952. Fertilizers for Field Crops, 1952. (N. Y.) Cornell Ext. Bul. 780 Revised.

4. American Rural Index Corporation
   1920. "Clock System" Rural Index. Danby and Newfield Towns Issued by Tompkins County Farm Bureau, Ithaca, N. Y.

5. Anderson, H. O.
   1947.48. Soil Conservation Pays.
   I. Effect on farm production and income.
   II. Effects of specific soil conserving practices on yields and costs.
   III. Larger incomes from complete farm conservation plans.
   30 p. La Crosse, Wis. U.S. Soil Conservation Service

6. Aull, G. H., Gabbard, L. P., and Timmons, John F.
   1950. United Nations Scientific Conference on the Conservation and Utilization of Resources. Jour. Farm Econ. 32:95-111

7. Baker, V. W.
   1950. The economic implications of conservation. Western Farm Econ. Assoc. Proc. 23:141-143.

8. Bennet, H. H.
   1939. Soil Conservation. Pp. 993 McGraw-Hill Book Co., New York.

9. Benton, Mildred
   1941. Economic and social aspects of soil conservation. Pp. 24. U. S. Dept. Agr., Soil Conservation Service, Library Hist. 2.

10. Berger, K. C., Holc, F. D., Beardsley, J. M.
1951. The Wisconsin soil productivity score card.
Amer. Soc. Agron. and Soil Sci. Soc. Amer.
1951. Meetings. Abstracta: 75.

11. Black, J. D.
1946. Tailored credit for land improvements.
J. Farm Econ. 28:596-604

12. Bunce, A. C.
1939. The farmer looks at soil conservation in
southern Iowa.
Iowa Agr. Expt. Sta. Bul. 381.

13. Bunce, A. C.
1941. Time preference and conservation.
Jour. Farm Econ. 22:533-543

14. Bunce, A. C.
1941. Society and conservation
Land Policy Review 4(6):13-22.

15. Bunce, Arthur Cyril
1942. Economics of soil conservation. Pp. 227
Iowa State College Press, Ames, Iowa.

16. Bunce, A. C.
1942. Public policy and action for conservation
Jour. Farm Econ. 24:97-108
Reviews in p. 361.

17. Bunce, A. C.
1942. War and Soil Conservation.
Jour. Land and Public Utility Economics
18 (2):121-133.

18. Bunce, A. C.
1942. A method of estimating the economic effects
of planned conservation on an individual farm
28 p. U. S. Dept. Agric. Misc. Pub. 463

19. Campbell, W. W.
1947. Our part in soil conservation.
Miss. Banker 32(2):18, 38, 40, 42.

20. Casey, R. S., and Perry, J. W. editors
1951. Punched Cards. Their applications to science
And industry. Pp. 506.
Reinhold Publishing Corp., New York.

21. Ciriacy-Wantrup, S. Von
1938. Economic aspects of land conservation
Jour. Farm Econ. 20:462-473

22. Ciriacy-Wantrup, S. Von
1941. Economics of joint costs in agriculture.
J. Farm Econ. 23:771-818

23. Ciriacy-Wantrup, S. Von
1942. Private enterprise and conservation
J. Farm Econ. 24:75-96

24. Ciriacy-Wantrup, S. Von
1947. Capital returns from soil-conservation practices.
J. Farm Econ. 29:1181-1196.
Discussion 1196-1202.

25. Coddington, J. W., and Derr, D. E.
1939. An economic study of land utilization in the tobacco area of southern Maryland.
Md. Agr. Exp. Sta. Bul. 424.

26. Collier, George W.
1945. Procedures for studying the returns from conservation farming.
J. Farm Econ. 27:686-688

27. Cope, J. A., and Winch, Fred E.
1948. Know Your Trees.
N.Y. Cornell 4-H Club Bul. 85

28. Cope, J. A.
1948. Trees and products of farm woodland
N.Y. Cornell Ext. Bul. 722.

29. Cope, J. A.
1950. Care and culture of farm woodlots
N.Y. Cornell Ext. Bul. 716.

30. Cornell, Jr., F.D.
1936. A social and economic survey of the Spencer soil conservation area.
West Va. Agr. Expt. Sta. Bul. 269.

31. Crikman, C. W.
1949. Interregional economic and social aspects of of an objective evaluation of soil conservation.
J. Farm Econ. Proc. 31:660-663.

32. Cummings. Gordon J.
1950. The differential adoption of recommended farm practices among dairymen in a New York community. Typewritten. pp. 144.
Cornell Univ. Master's Thesis, Ithaca, N. Y.

33. Dwyer, C. H.
1950. A method of computing conservation benefits of a range program.
J. Soil and Water Conserv. 5:115-124,126

34. Duncan, O. D.
1940. A sociological view of soil conservation
Soil Conservation 5 (11):

35. Ely, Richard T., Hess, Raolph H., Leith, Charles K., and Carver, Thomas N.
1913. The foundations of national prosperity p. 378.
Macmillan, New York.

36. Ely, Richard Theodore.
1916. Conservation and economic theory Amer. Institute of Mining Engineers. Bul. 109:211-226

37. Ely, R. T. and Wehrwein, G. S.
1940. Land economics. Pp. 363
Macmillan Co., New York.

38. Foster, E. A., and Vogel, H. A.
1940. Cooperative land use planning -- a new development in democracy,
U. S. Dept. Agr. Yearbook, Farmers in a changing World, 1940:1138-1156

39. Francis D. R.
1946. Bank credit by soil conservation
Federal Reserve Bank of St. Louis.

40. Frear, D. E. H.
1951. Correlation of research data and establishment of cause and effect relationships.
In Punched Cards, edited by Casey and Perry, pp. 305-310

41. Gaines, S. H., Vincent, F., Bloom, M., Carter, J. F.
1938. Bibliography on soil erosion and soil and water conservation.
U.S.D.A., Misc. Pub. 312

42. Gibson, Jr., W. L.
1937. An economic study of farming in Appomattox County, Virginia.
Va. Agr. Exp. Sta. Bul. 311

43. Gibson, Jr. W. L.
1940. Farm management aspects of soil conservation on flue-cured tobacco farms in Virginia.
Va. Agr. Exp. Sta. Bul.327

44. Gray, L. C.
1913. The economic possibilities of conservation.
Quarterly Jour. Economics 27:497-519

45. Grayson, P. E.
1952. The sampling significance of physical variability among New York farms. Pp. 298
Cornell Univ. Ph.D. Thesis, Ithaca, N.Y.

46. Grimes, W. E.
1938. Goals in conservation policy.
Jour. Farm Econ. 20:247-256

47. Hammar, C. H.
1931. Economic aspects of conservation.
Jour. Land And Public Utility Econ.
7:282-290.

48. Hammar, C. H.
1942. Society and conservation.
Jour. Farm, Econ. 24:109-123

49. Hastings, W. G.
1900. The development of law as illustrated by the decisions relating to the police power of the state. Amer. Philosophical So., Proc.
39 (163):359-554.

50. Hawkes, H. E., Lindquist, E. F., and Mann, C. R.
1936. The construction and use of achievement examinations pp. 496
Houghton Mifflin Co., Boston.

51. Heady, Earl O.
1949. Cooperating in objective soil conservation research. J. Farm Econ., Proc. 31:664-667/

52. Heady, E. O.
1951. Efficiency in public soil conservation program.
Jour. Political Econ.

53. Heady, Earl O.
1950. Some fundamentals of conservation economics and policy. Jour. Farm Econ. 32:1182-1195

54. Heady, Earl O., and Scoville, O. J.
1951. Principles of conservation economics and policy. Iowa Agr. Exp. Sta. Res. Bul.382.

55. Hedge, A. M.
1949. Soil conservation puts cash in the Treasury. Soil Conserv. 14:195-196

56. Henderson, Philip A.
1940. An economic study of farming in Tompkins County, New York, 1937. N Y. (Cornell) Agr. Exp. Sta. Bul. 728.

57. Hotelling, H.
1931. The economics of exhaustible resources. Jour. Political Econ. 39:137-175

58. Howe, F. B., Buckman, H. O., and Lewis, H. G.
1924. Soil survey of Tompkins County, New York. U. S. Dept. Agric, Bur. Soils.

59. Howe, F. B., and Adams, H. R.
1936. Soil erosion in New York. N. Y. (Cornell) Ext. Bul. 347.

60. Illinois Agricultural Experiment Station
1951. Research on Economics of Soil Conservation, in Cooperation with U.S.D.A., S.C.S. Mimeographed.

61. James, H. G.
1949. What John Smith needs to know about the benefits and costs of soil conservation. J. Farm Econ. Proc. 31:651-654

62. Johnson, N. W.
1939. Sorting and sampling farms for soil conservation research.

U. S. Dept. Agric.

63. Johnson, N. W.
1940. Analysis of the present program of research in the economics of soil conservation and suggestions for its improvement. U. S. Dept. Agric.

64. Johnson, M. W.
1941. Conservation -- An objective or an ideal?
Jour. Farm Econ. 23:819-832

65. Johnson, N. W.
1942. Needed developments in the evaluation of soil conservation benefits.
Jour. Farm Econ. 24:193-156.

66. Johnson, Neil W.
1943. Analysis of the present program of research in the economics of soil conservation,and suggestions for its improvement.
U. S. Dept. Agric., Bur. Agric. Econ.
Mar. 1943. pp. 14-15.

67. Lamb, Jr. John., Andrews, J. S., and Gustafson, A. F.
1944. Experiments in the control of soil erosion in southern New York.
N. Y. (Cornell) Agr. Expt. Sta. Bul. 811.

68, Landis, L.
1945. It pays to farm well
Banking 37 (12):55

69. Lange, G.
1941. A neglected point in soil conservation.
Jour. Farm. Econom. 23:467-474.

70. Lewis, A. B.
1933, (Methods used in an economic study of land utilization in Tompkins County, N. Y.)
Pp. 25. Mimeographed. Ithaca.

71. Lewis. A. B.
1934. An economic study of land utilization in Tompkins County, New York.
N. Y. (Cornell) Agr. Expl Sta. Bul. 590

72. McGurk, John Leo
1951. Farm Management Adjustments in Tompkins County, 1907 to 1947. Cornell Univ. Ph.D. Thesis
Pp. 167., Ithaca, N. Y.

73. McNall, P. E.
1940. Economic phases in soil erosion control
Jour. Farm Econ. 22:613-620

74. Misner, E. G.
1942. Thirty years of farming in Tompkins County, New York.
N. Y. (Cornell) Agr. Exp. Sta. Bul. 782.

75. Moody, R. E.
1941. Mr. Bunce on time preference and conservation. Jour. Farm Econ. 23:646-649.

76. Moore, George C.
n.d. - A study of the influence of strip cropping on the average length of fields. Bath, N. Y.

77. Mordoff. R. A.
1949. The climate of New York State N. Y. (Cornell) Ext. Bul. 764.

7 . Morison, F. L., and Falconer, J. I.
1939. The relationship between soil maintenance and profitable farming. Ohio Agr. Exp. Sta. Bul. 604

79. Mosier, C. I., and McQuitty, J. V.
1940. Methods of item validation and abaca for item-test correlation and critical ratio of upper-lower difference, Psychometrika 5(1):57-65.

80. Mosher, M. L., and Case, H. C. M.
1938. Farm practices and their effects on farm earnings. Illinois Agr. Expt. Sta. Bul.444.

81. Nelson, A. Z.
1942. Conservation expenditures on federal lands. Jour. Farm Econ. 24:611-620

82. New York (Cornell) College of Agriculture
1950. Conservation services available to New York farmers.... N. Y. (Cornell) Ext. Bul. 788.

83. New York State Soil Conservation Committee
1951(?) New York State Soil Conservation Districts. 10 Years of Progress (1940-1950) Report.

84. Norton, E. A.
1939 Soil conservation survey handbook. U. S. Dept. Agr. Misc. Pub. 352.

85. Osgood, O. T.
1941. Some observations on the relation of farm land tenure to soil erosion and depletion. Jour. Land and Public Utility Economics vol. 17 (4):413-414.

86. Peterson, G. M.
1937. Diminishing returns and planned economy
Pp. 254, Ronald Press, New York.

87. Peterson, M. J.
1940. An economic study of agriculture in the Little Beaverdam Creek area, Anderson County, South Carolina.
South Carolina Agr. Expt. Sta. Bul. 332.

88. Pigout, A. C.
1932. The economics of welfare 4th ed., pp. 976.
Macmillan Co., London.

89. Pubols, B. H., Orr, A. H., and Heisig, C. P.
1939. Farming systems and practices and their relationship to soil conservation and farm income in the wheat region of Washington.
Wash. Agr. Exp. Sta. Bul. 374

90. Regan, M. M., and Weitzell, E. C.
1947. Economic evaluation of soil and water conservation measures and programs.
J. Farm Econ. 29:1275-1294.

91. Salter, Leonard A.
1948. A critical review of research in Land Economics
Pp. 258. Univ. of Minnesota Press, Minneapolis.

92. Salter, R. M., Lewis, R. D., and Slipher, J. A.
1936. Our heritage -- the soil.
Ohio Agr. Exp. Sta. Bul. 175

93. Saltonstall, Jr., Leverett, Comp.
1952. Hay and pasture seedings for '52.
(N. Y.) Cornell Ext. Bul. 781 Revised.

94. Sauer, Elmer Louis
1947. Economics of soil and water conservation: Effects of practices followed on farms in selected Illinois areas.
Univ. of Illinois Ph.D. Thesis, Abstract.
Urbana, Ill.

95. Sauer, E. L.
1947. Long time benefits of conservation.
Ill. Farm Economics No. 145:533-536.

96. Sauer, E. L.
1949. Methods of evaluating soil conservation measures
J. Farm Economics Proc. 31:655-659

97. Sauer, E. L., McGurk, J. R., and Norton, L. J.
1950. Costs and benefits from soil conservation in northeastern Illinois.
Ill. Agr. Exp. Sta. Bul. 540:561-596

98. Schickele, Rainer, Himmel, J. P., and Hurd, R. M.
1935. Economic phases of erosion control in southern Iowa and northern Missouri. Iowa Agr. Expt. Sta. Bul. 333.

99. Schickele, Rainer
1937. Economics of agricultural land use adjustments. I. Methodology in soil conservation and agricultural adjustment research.
Iowa Agr. Exp. Sta. Res. Bul. 209

100. Schickele, Rainer, and Himmel, J. P.
1938. Socio-economic phases of soil conservation in the Tarkis Creek area.
Iowa Agr. Expt. Sta. Res. Bul. 221

101. Stallings, J. H.
1950. Abstracts of recent published material on soil and water conservation IV.
U.S.D.A. PA - 143,

102. Stallings, J. H.
1951. Abstracts of recent published material on soil and water conservation. V.
U.S.D.A. PA - 173, 66p.

103. Taylor, M. C.
1947. An evaluation of "Evaluating Soil Conservation". Rejoinder by Weitzell, E. C. pp. 974-976
J. Farm. Econ. 29:966-973

104. Taylor, M. C., and Baker, V. W.
1947. Soil conservation and farm income in the Palouse wheat-pea area.
Wash. Agr. Expt. Sta. Pop. B. 186.

105. Tom, C. A.
1940. Time requirements and costs of farm operation on strip-cropped and non-strip-cropped fields.
N. Y. State College of Agric. A. E. 329.

106. Tyler, Ralph W.
1949. The road to better appraisal
Nat'l. Education Assoc. Journal 38:336-337

107. Umstattd, J. G.
1947. Instructional procedures at the college level.
Pp. 195. University of Texas, Austin, Tex.

108. United States Department of Agriculture
1951. Agricultural Statistics
Pp. 742.
U. S. Government Printing Office, Washington, D.C.

109. United States Department of Agriculture Library
1942-- Bibliography of Agriculture
U. S. Government Printing Office,
Washington, D. C.

110. U. S. Department of Agriculture, Production and Marketing Administration.
1951. New York Agricultural Conservation Program.
Handbook for 1952.
U. S. Dept. Agric.

111. United States Department of Agriculture, Soil Survey Staff
1951. Soil survey manual. Pp. 503
U. S. Dept. Agr. Handbook 18.

112. U. S. Soil Conservation Service Files
1935. Project work program of the Cayuga Inlet
Soil Conservation Project, N. Y., 2. Pp. 27.
1939. Soil Conservation Survey Report, Cayuga Inlet
Watershed, Ithaca, N. Y., by J. W. Roehl
and H. C. Knoblauch, P. J. Cladwin, and
E. J. Kahabka. Pp. 67.
Typewritten.

113. United States Soil Conservation Service
1946. Land Capability legend: land use symbols,

114. U. S. Soil Conservation Service
1950. Summaries of annual reports of research project supervisors for calendar year 1949, by G. R. Stewart
122 p., Washington, D. C.

115. U. S. Soil Conservation Service
1951. Books, booklets and bulletins on soil and water conservation. P. 15.
Washington, D. C.

116. Vaughan, Lawrence M.
1928. Abandoned farm areas in southern New York. pp. 345. Typewritten
Cornell Univ. Ph. D. Thesis, Itaca.

117. Walter, D. H.
1938. An economic study of farming in the Crooked Creek area, Indiana and Armstrong Counties, Pennsylvania.
Penna. Agr. Expt. Sta. Bul. 369.

118. Wantrup, S. V.
1951. Dollars and sense in conservation.
Calif. Agr. Expt. Sta. C. 402.

119. Warren, G. F., and Livermore, K. C.
1911. An agricultural survey. Townships of Ithaca, Dryden, Danby, Lansing, Tompkins County, New York.
N. Y. (Cornell) Agr. Exp. Sta. Bul. 295.

120. Weitzell, E. C.
1939. Economic implications of soil conservation in Marshall County,
West Va. Agr. Expt. Sta. Bul. 293

121. Weitzel, E. C.
1941. Farm management for soil conservation in the Harrison area.
West Va. Agr. Expt. Sta. Bul. 301

122. Weitzel, E. C.
1942. Economics of soil conservation in West Virginia.
West Va. Agr. Expt. Sta. Bul. 305.

123. Weitzell, E. C.
1943. Economics of soil conservation I.
Individual and social considerations.
Jour. Land and Pub. Util. Econ. 19:339-353.

124. Weitzell, E. C.
1947. Evaluating soil conservation.
J. Farm Econ. 29:475-494.

125. West, Quentin M.
1951. The results of applying a simple random sampling process to farm management data.
N. Y. Cornell University, Dept. of Agricultural Economics 743.

126. Wilcox, W. W.
1938. Economic Aspects of soil conservation.
Jour. Political Econ. 46:702-713

127. Wise, C. S.
1951. Mathematical analysis of coding systems, in
Punched Cards, edited by Casey and Perry.
pp. 276-302.

128. Zeisig, H. C., and Martin, P. T.
1951. Commercially available punched-card systems,
equipment, and supplies.
In Punched Cards, edited by Casey and Perry,
pp. 39-75.

APPENDICES

Cayuga Inlet Soil Conservation Project Farms

A. Index by communities

B. Index by cooperators

C. Index by airphotos

D. Soil productivity balance blank

E. Cayuga Inlet Project: Soil type numbers

F. Cayuga Inlet Project: Correlation of soil type numbers with those now in use for Tompkins County

APPENDIX A

CAYUGA INLET SOIL CONSERVATION PROJECT FARMS

INDEX BY COMMUNITIES

Community	Farm No.	Name	Code Number
Danby	D- 6-1-Y	Emery, Charles	01
	D- 6-1-X	Emery, Charles	02
Ithaca	I- 6-5-D	Layen, Fred	03
	I- 7-3-X	Babcock, H. E,	04
	I- 7-4-U	Gaienski,Joseph	05
	I- 7-4-X	Felock, Anthohy	06
Newfield	N- 1-1-A	Stepan, Frank	07
	N- 1-2-F	Millard, Henry	08
	N- 2-0-Z	Taber, Carl	09
	N- 2-1-D	Payne, Fred	10
	N- 2-1-X	Albright, Mrs. R.C.	11
	N- 2-1-X	Poelvoorde, Albert	11
	N- 2-2-M	Babcock H. E.	12, 13
	N- 3-1-I	Payne, Fred	14
	N- 4-0-T	Estabrook, E. T.	15
	N- 4-1-K	Payne, Bert	16
	N- 4-1-K	Payne, Bert	17
	N- 4-1-R	Seely, Lenford	18
	N- 4-1-Z	Kippols, Lydia	19
	N- 4-2-D	Kent, Paul	20
	N- 4-2-R	Cutter, Paul	21
	N- 4-2-V	Pipper, Simoon	22
	N- 4-3-B	Bowers, Mrs. Alice M.	23

Cayuga Inlet S. C. Project Farms

Community	Farm No.	Name	Code Number
New field	N- 4-3-J	Pakkala, Wilfred	24
	N- 4-3-L	Rajala, Jacob	25
	N- 4-3-L	Tichenor, Richard	26
	N- 4-3-D	Kuuttila, Waind	27
	N- 4-4-C	Patana, William	28
	N- 5-0-M	Hine, Amelia	29
	N- 5-1-B	Payne, Glenn	30
	N- 5-1-Z	Makki, Eugene	31
	N- 5-1-R	Payne, Will	32
	N- 5-2-H	Joki, Matt	33
	N- 5-2-Hb	Joki, Matt	34
	N- 5-3-M	Lintala, Emil	35
	N- 5-3-T	Laine, Oscar	36
	N- 5-3-Z	Ruuspakka, George	37
	N- 6-1-Z	Heliseva, John	38
	N- 6-2-P	Parsons, Roy	39
	N- 6-3-H	Lummuka, John	40
	N- 6-7-Q	Hine, Wilbur	41
	N- 7-1-S	Korbell, Joseph	42
	N- 7-2-B	Krejca, Otto	43
	N- 7-3-A	Mazourek, Rudolf	44
	N- 7-3-P	Korbell, William	45
	N- 8-1-A	Blovsky, Frank	46
	N- 8-1-B	Greene, H. E.	47
	N- 8-2-B	Blovsky, Henry	48
	N- 8-2-L	Leonard, Purl	49
	N-11-2-C	Button, George	50

Cayuga Inlet S. C. Project Farms

Community	Farm No.	Name	Code Number
Newfield	N- 12-1-B	Seely, Leslie	51
	N- 12-1-F	Makela, Howard	52
	N- 12-1-F	Rice, Mrs, Minna B.	53
	N- 5-0-X	Heslop, J. Henry	54
West Danby	WD- 5-0-X	Loomis, Everett	55
	WD- 5-1-A	Hunt, Samuel	56
	WD- 5-1-R	Long, Parshall	57
	WD- 5-2-H	Keckman, John	58
	WD- 7-1-J	Ruuspakka, George	59
	WD- 7-1-R	Blomquist, Aarne J.	60
	WD- 9-1-W	Knuuttila, Henry	61
	WD- 9-1-Z	Knuuttila, Henry	62
	WD-10-1-C	Ford, Howard	63
	WD-11-0-G	Harker, C. E.	64
	WD-11-1-A	Sincebaugh, Dewitt	65
	WD-11-1-B	Jackson, Eugene	66
	WD-11-1-W	Pertula, Albert	67
	WD-11-1-W	Silmu, Frank	68
	WD-11-2-X	Catchim, A. L.	69
	WD-12-1-A	Pesu, John	70

APPENDIX B

CAYUGA INLET SOIL CONSERVATION PROJECT FARMS

BY COOPERATOR

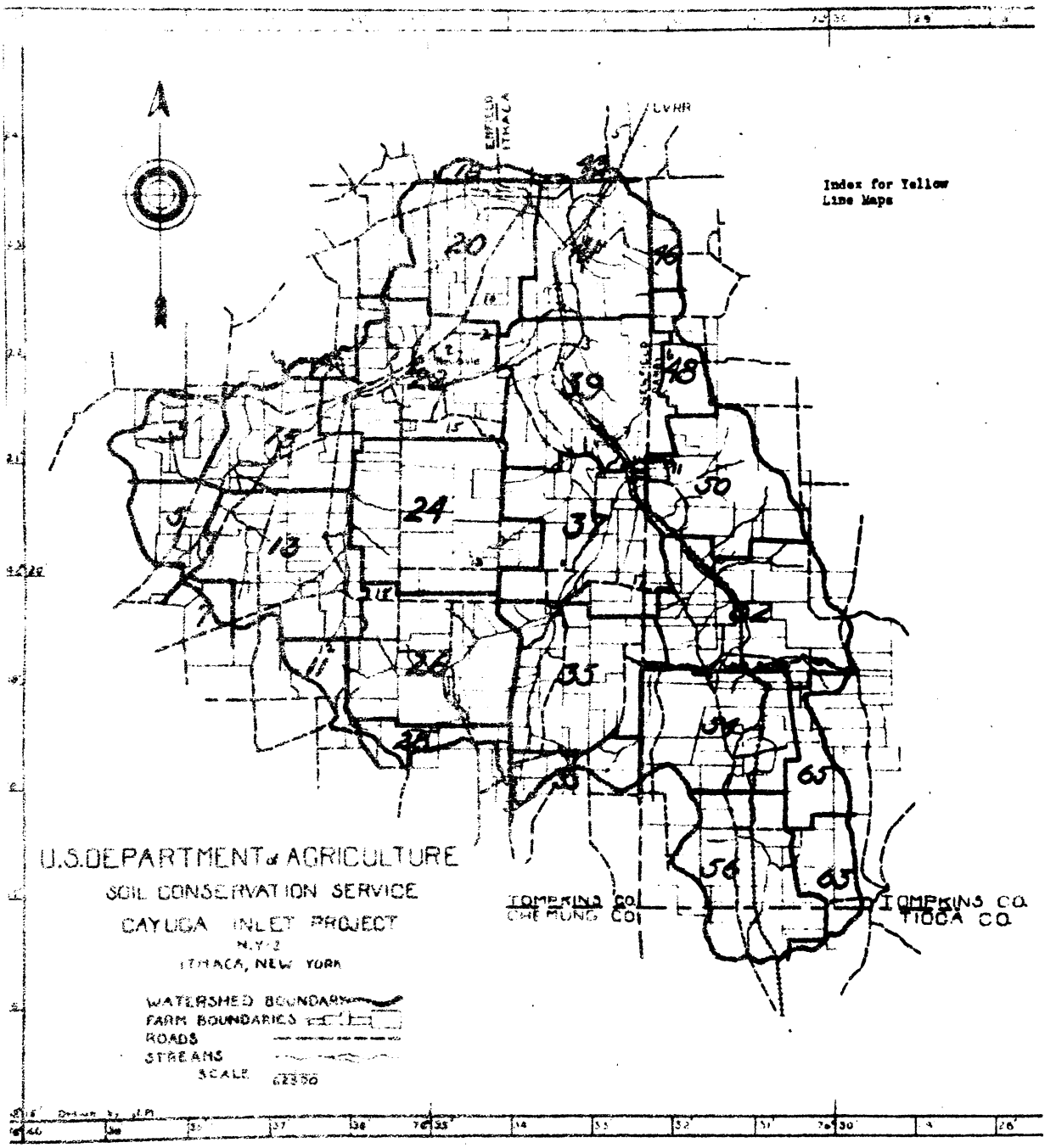
Name of cooperator	Farm No.	Photo	Acres	Code No.
Albright, Demont SEE:Babcock,H.E.				12
Albright Demont Farms "A"				13
Albright, Mrs. Roy SEE: Taber, C.				09
Albright, Mrs. R.C.SEE:Poelvoorde	N-2-1-X	39	119.0	11
Babcock, H.E.	I-7-3-X	41B 43A & B	317.0	04
Babcock, H.E. Farm B	N-2-2-M	41	82.2	12
Babcock, H.E. Farm A	N-2-2-M	41	159.2	13
Blaker, Mrs.H.L. SEE: Linsay, W.				
Bomquist, Aarne, J.	WD-7-1-R	33	140.6	60
Blovsky, Frank	N-8-1-A	15	94.8	46
Blovsky, Frank	N-8-2-B	3	108.0	48
" "				48
Bowers, Mrs. Alice M.	N-4-3-B	35	57.8	23
Button, George	N-11-2-C	50	97.2	50
Catchim, A.L.	WD-11-2-X		39.6	69
Cutter, Paul	N-4-2-R	26,35	163.5	21
Deyoung, George, SEE: Kent,P.				20
Emery, Charles	D-6-1-Y	52	133.8	01
Emery, Charles	D-6-1-Y	52	50.8	02
Estabrook, E.T.	N-4-0-T	22	161.0	15
Felock, Anthony	I-7-4-X	41	46.7	06
Ford, Howard	WD-10-1-C	37	143.0	63
Forsman, Allen & Burt SEE:Payne,F				
Gaeiski, Joseph	I7-4-U	41,20	17.1	05
Greene, N.E.	N-8-1-B	3	68.9	47

Name of cooperator	Farm No.	Photo	Acres	Code No.
Harker, C.E.	WD-11-O-G		126.7	64
Heliseva, John	N-6-1-Z	13,24	111.8	38
Heslope, J. Henry	N-5-O-X	22	5.2	54
Hine, Amelia	N-5-O-M	22	69.9	29
Hine, Wilbur	N-6-7-Q	13	169.5	41
Hokkenen, Albert SEE:Blomquist A.				60
Hunt, Samuel Jr.	WD-5-1-A	54	108.2	56
Jackson, Eugene	WD-11-1-B	52	104.1	66
Joki, Matt	N-5-2-H	24	78.3	33
Joki, Matt	N-5-2-Hb	26	42.4	34
Keckman, John R.	WD-5-2-H	56,63	99.3	58
Kent, Paul	N-4-2-D	24	74.0	20
Kinney, Leon A. SEE:Greene, N.E.				47
Kippola, Lydia Lathes	N-4-1-Z	24	76.8	19
Knuutila, A.SEE:Knuutila, Waind				27
Knuutila, Waind	N-4-3-D	26,35	131.0	27
Knuutila, Henry Farm "B"	WD-9-1-W	50,48	120.0	61
Knuutila, Henry Farm "A"	WD-9-1-Z	50	66.5	62
Korbell, Joseph	N-7-1-S	15	29.0	42
Krobell, Rudolph SEE:Korbell, W.				45
Korbell, William	N-7-3-P	5	71.0	45
Krejca, Otto	N-7-2-B	13	92.7	43
Laine, Oscar	N-5-3-T	26	184.0	36
Lamkin, Almon SEE: Cutter, P.				21
Lathes, Lydia SEE: Kippola, Lydia				
Layen, Fred	I-6-5-D	48	116.8	03
Leonard, Purl	N-8-2-L	3	83.8	49

Name of Cooperator	Farm No.	Photo	Acres	Code No.
Linsay, Willis SEE:Ruuspakka, G				59
Lintala, Emil	N-5-3-M	26,35	130.5	35
Lintala, Matt SEE: Lintala, Emil				35
Long, Parshall	WD-5-1-R	56	109.8	57
Loomis, Everett	WD-5-0-X	54	47.3	55
Lummuka, John	N-6-3-H	11	102.5	40
Makela, Howard	N-12-1-P	20	133.5	52
Makki, Emil SEE: Makki, Eugene				31
Makki, Eugene	N-5-1-Z	24	178.0	31
Mazoureck, Ladislav SEE:Makela, H.				52
Mazoureck Rudolph	N-7-3-A	5	70.6	44
Millard, Henry	N-1-2-F	20	66.2	08
Pakkala, John SEE:Tichener, R.				26
Pakkala, Matt SEE: Pakkala,W.				24
Pakkala, Wilfred	N-4-3-J	26,35	87.0	24
Parsons, Roy	N-6-2-P	13	72.2	39
Patana, Williams	N-4-4-C	35	146.6	28
Payne, Bert Farm "B"	N-4-1-K	37.	90.6	16
Payne, Bert Farm "A"	N-4-1-K	24	142.8	17
Payne, Fred	N-2-1-D	22	126.2	10
Payne, Fred	N-3-1-I	2467	77.0	14
Payne, Glenn	N-5-1-B	6595	57.5	30
Payne, Will	N-5-1-R	24	121.4	32
Pertula, Albert	WD-11-1-W	37	55.1	67
Pesu, John	WD-12-1-A	52	64.9	70
Pipper, Simeon	N-4-2-V	37	57.0	22
Poelvoorde, Albert	N-2-1-X	39	193.4	11

Name of cooperator	Farm No.	Photo	Acres	Code No.
Rajala, Jacob	N-4-3-L	35	55.2	25
Rice, Mrs. Minna B	N-12-1-F	20	30.8	53
Ruuspakka, Atte SEE: Ruuspaka, G.				37
Ruuspakka, George	N-5-3-Z	28,33,35	127.3	37
Ruuspakka, George	WD-7-1-J	33,35	110.7	59
Seely, Lenford	N-4-1-R	24	64.0	18
Seely, Leslie	N-12-1-B	20	85.9	51
Silmu, Frank	WD-11-1-W	37	73.6	68
Sineebaugh, Dewitt E.	WD-11-1-A	52,37	28.5	65
Stepan, Frank	N-1-1-A	20	102.8	07
Stepan, Joseph SEE: Stepan, F.				07
Taber, Carl	N-2-0-2	22	111.8	09
Tichenener, Richard	N-4-3-L	35,37	79.8	26

Fig. 7



WATERSHED BOUNDARY

APPENDIX C

CAYUGA INLET SOIL CONSERVATION PROJECT FARMS

INDEX BY AIRPHOTOS

Photo No.	Farm Code No.	Farm Project No.	Name
3	47	N-8-1-B	Greene, N.E.
3	48	N-8-2-B	Blovsky, Henry
3	49	N-8-2-L	Lecnard, Purl
5	44	N-7-3-A	Mazeureck, Rudolph
5	45	N-7-3-P	Krobell, William
11	40	N-6-3-H	Lummuka, John
13	38	N-6-1-Z	Heliseva, John
13	39	N-6-2-P	Parsons, Roy
13	41	N-6-7-Q	Hine, Wilbur
13	43	N-7-2-B	Krejca, Otto
15	42	N-7-1-S	Korbell, Joseph
15	46	N-8-1-A	Blovsky, Frank
20	05	I-7-4-U	Gaieski, Joseph
20	07	N-1-1-A	Stepan, Frank
20	08	N-1-2-F	Millard, Henry
20-	51	N-12-1-B	Seely, Leslied
20	52	N-12-1-F	Makela, Howard
20	53	N-12-1-F	Rice, Minna
22	09	N-2-0-Z	Taber, Carl
22	10	N-2-1-D	Payne, Fred
22	15	N-4-0-T	EstabrooK, E.T.
22	29	N-5-0-M	Hine, Amelia
22	54	N-5-0-X	Heslop, J. Henry
24	17	N-4-1-K	Payne, Bert

Photo No.	Farm Code No.	Farm Project No.	Name
24	18	N-4-1-R	Seely, Lenford
24	19	N-4-1-Z	Kippola, Lydia
24	20	N-4-2-D	Kent, Paul
24	30	N-5-1-B	Payne, Glenn
24	31	N-5-1-Z	Makki, Eugene
24	32	N-5-1-R	Payne, Will
24	33	N-5-2-H	Joki, Matt
24	38	N-6-1-Z	Heliseva, John
26	21	N-4-2-R	Cutter, Paul
26	24	N-4-3-J	Pakkala, Wilfred
26	27	N-4-3-D	Knuutila, Waind
26	34	N-5-2-Hb	Joki, Matt
26	35	N-5-3-M	Lintala, Emil
26	36	N-5-3-T	Lane, Oscar
28	37	N-5-3-Z	Ruuspakka, George
33	37	N-5-3-Z	Ruuspakka, George
33	59	WD-7-1-J	Ruuspakka, George
33	60	WD-7-1-R	Blomquist, Aarne
35	21	N-4-2-R	Cutter, Paul
35	23	N-4-3-B	Bowers, Alice
35	25	N-4-3-L	Rajala, Jacob
35	26	N-4-3-L	Tichener, Richard
35	27	N-4-3-D	Knuutila, Waind
35	28	N-4-4-C	Patana, William
35	37	N-5-3-Z	Ruuspakka, George
35	59	WD-7-1-J	Ruuspakka, George
37	16	N-4-1-K	Payne, Bert

Photo No.	Farm Code No.	Farm Project No.	Name
37	22	N-4-2-V	Pipper, Simeon
37	26	N-4-3-L	Tichener, Richard
37	63	WD-10-1-C	Ford, Howard
37	65	WD-11-1-A	Sincebaugh, Dewitt
37	67	WD-11-1-W	Pertula, Albert
37	68	WD-11-1-W	Silmu, Frank
39	11	N-2-1-X	Albright, Mrs. Roy C. Poelvoorde, Albert
39	64	WD-11-0-G	Harker, C.E.
39	69	WD-11-2-X	Catenim, A.L.
41	06	I-7-4-X	Felock, Anthony
41	13	N-2-2-M	Babcock, H.E.
48	03	I-6-5-D	Layen, Fred
48	61	WD-9-1-W	Knuutila, Henry
50	50	N-11-2-C	Button, George
50	51	WD-9-1-W	Knuutila, Henry
50	62	WD-9-1-Z	Knuutila, Henry
50	64	WD-11-0-G	Harker, C.E
52	01	D-6-1-Y	Emery, Charles
52	65	WD-11-1-A	Sincebaugh, Dewitt
52	66	WD-11-1-B	Jackson, Eugene
52	70	WD-12-1-A	Pesu, John
54	55	WD-5-0-X	Loomis, Everett
54	56	WD-5-1-A	Hunt, Samuel
56	57	WD-5-1-R	Long, Parshall
56	58	WD-5-2-H.	Keckman, John
63	58	WD-5-2-H	Keckman, John

APPENDIX E

CAYUGA INLET PROJECT - SOIL TYPE NUMBERS

Alphabetical list

Alkaline subsoil Wooster, 17, (now Valois)

Arkport, 35, (now Dunkirk)

Aurora, 58

Barrien, 65

Braceville, 24

Camillus, 49

Canaden, 29

Cazenovia, 42

Chagrin, 15

Chenange, 12, 22

Chippewa, 4

Crosby, 73

Darien, 72

Dunkirk, 25, 35 (formerly Arkport)

Eel, 6

Erie, 13, 53 (now Langford)

Farmington, 71, 81

Fremont, 23, 43 (now Mardin)

Genesee, 15

Gravel deposits, 3

Graby, 39

Groton, 37, 36 (now Palmyra)

Herkimer, 47

Hilton, 57

Holly, 14

Honeoye, 78

Alphabetical list

Wayland, 14

Wooster, 7, 17 (now Valoia)

Numerical List

1 Lordstown

2 Volusia

3 Gravel deposits

4 Chippewa

5 Tioga

6 Eel and Midlebury

7 Wooster

9 Poorly-drained muck

12 Chenango fine sandy loam

13 Erie

14 Holly, Wayland and Maumee

15 Chagrin and Genesee

16 Small bottoms

17 Alkaline subsoil Wooster

18 Langford

19 Well-drained muck

21 Howard fine sandy loam

22 Chenango gravelly loam

23 Freemont

24 Braceville

25 Dunkirk silty clay loam

26 Otisville

28 Mardin

29 Canead[illegible]

31 Howard gravelly loam

32 Palmyra

33 Silt deposits

35 Arkport fine sandy loam

36 Groton gravelly loam

38 Tyler

39 Granby & Poygan

41 Deep Lordstown

42 Cazenovia

43 Fremont deep phase

44 Mohawk

45 Schoharie

46 Mixed patches

47 Herkimer

48 Ottawa

49 Camillus

52 Lansong

53 Erie deep phase

55 Petrosky

57 Hilton

58 Aurora

59 Marcellus

61 Palatine

63 Volusia deep phase

65 Berrien

71 Farmington

72 Darien

73 Crosby

Numerical List

74 Lyons

75 Mentor

77 Ontario

78 Honeoye

81 Farmington deep phase

APPENDIX F

SOIL SURVEY CORRELATION GUIDE

Cayuga Inlet Project		Tompkins County District	
1	Lordstown	Si41	Lordstown eh. si. loam
2	Volusia	842	Volusia eh. si. loam
3	Gravel deposits	16	Undifferentiated alluvial
4	Chippewa	940	Chippewa silt loam
5	Tioga	A140	Tioga silt loam
6	Eel and Middlebury	A410 A440	Eel silt loam (Alkaline) Middlebury silt loam (Acid)
7	Wooster	142	Wooster gr. si. loam
9	Poorly-drained muck	MU	Muck, undrained
12	Chenango fine sandy loam	T143	Chenango gravelly loam
13	Erie	831	Erie gravelly silt loam
14	Holly, Wayland and Maumee *	A710 A740	Wayland silt loam (alkaline) Holly silt loam (acid)
15	Chagrin and Genesee	A110	Genesee silt loam
16	Small bottoms	16	Undifferentiated alluvial
17	Alkaline subsoil Wooster	133	Valois gr. loam
18	Langford	631	Langford gr. si. loam
19	Well-drained muck	MU	Muck, drained
21	Howard fine sandy loam	T1313	Howard gravelly loam
22	Chenango gravelly loam	T143	Chenango gravelly loam
23	Fremont	8411	Fremont ch. si. loam
24	Braceville	T440	Braceville silt loam
25	Dunkirk silty clay loam	L110 L110	Dunkirk silt loam Dunkirk silty clay loam
26	Otisville	T143	Chenango gravelly loam
28	Mardin	6411	Mardin ch. si. loam
29	Caneadea	L522	Caneadea silty clay loam

Cayuga Inlet Project	Tompkins County District
31 Howard gravelly loam	T 1313 Howard gravelly loam
32 Palmyra	T113 Palmyra gravelly loam
33 Silt deposits	16 Undifferentiated alluvial
35 Arkport fine sandy loam	L110 Dunkirk silt loam
36 Groton gravelly loam	T113 Palmyra gravelly loam
38 Tyler	T740 Red hook silt loam
39 Granby & Poygan	L0154 Granby fine sandy loam
41 Deep Lordstown	8141 Lordstown eh. si. loam
42 Cazenovia	2111 Cayuga gravelly silt loam
43 Fremont deep phase	6411 Mardin eh. si. loam
44 Mohawk	S141 Kashong shaly si. loam
45 Schoharie	L110 Dunkirk silt loam
46 Mixed patches	16 Undifferentiated alluvial
47 Herkimer	T113 Palmyra gravelly loam
48 Ottawa	L0416 Ottawa loamy fine sand
49 Camillus	S141 Kashong shaly silt loam
52 Lansing	121 Lansing gr. silt loam
53 Erie deep phase	631 Langford gr. si. loam (badly eroded)
55 Petrosky	L0114 Arkport fine sandy loam
57 Hilton	421 Conesus gr. silty loam
58 Aurora	S530 Aurora silt loam
59 Marcellus	421 Conesus gr. silt loam
61 Palatine	S131 Kashong shaly silt loam
63 Volusia deep phase	641 Canfield eh. silt loam
65 Berrien	L0416 Ottawa loamy fine sand
71 Farmington	S131 Kashong shaly silt loam
72 Darien	520 Darien silt loam

Cayuga Inlet Project	Tompkins County District
73 Crosby	511 Ovid gr. silt loam
74 Lyons	910 Lyons silt loam
75 Men r **	T1313 Howard gravelly loam
77 Ontario	133 Valois gravelly loam
78 Honeoye ***	1113 Honeoye gravelly loam
81 Farmington deep phase	S131 Kashong shaly silt loam

Notes:

* Maumee occupies nearly flat depressions; is developed from sandy soils, alkaline in reaction. Covered with water much of the time. Now mapped Westland or F.W. marah.

** Mentor is an alkaline stream terrace soil with considerable silt in its structure. Howard silt loam would be a better substitute.

*** It is very doubtful if Lansing or Honeoye is found in this area. Cayuga and Valois are more porbable.

SOIL TYPE LEGEND FOR THE TOMPKINS COUNTY DISTRICT

The origin of the soil is indicated by the following letters:

A- Alluvial flood plain soils

H- High bottom alluvial soils

F- Fan phase soils

T- Terrace soils

L- Lacustrine soils

S- Shallow upland soils, 20-40" to bed rock

V- Very shallow upland soils, 20" or less to bed rock

No letter - Deep upland soils.

The drainage-profile condition is indicated by the following numbers:

0- Well drained, loose, porous profile (may be dreughty)

1- Well drained, friable, mellow profile.

2- Well drained, with heavy layer in the profile

3- Well drained, with compact layer in the profile.

4- Imperfectly drained, with high water table, or impervious layer deep in the profile.

5- Imperfectly drained, with heavy layer in the profile

6- Imperfectly drained, with hardpan in the profile

7- Poorly drained, with high water table, or impervious layer deep in the profile.

8- Poorly drained, with high water table or impervious layer shallow in the profile.

9- Very poorly drained, with high water table or impervious layer in the profile.

The lime content is indicated by the following numbers:

1- Soil material high in lime, with neutral or slightly acid subsoils.

2- Soil material moderate in lime, with slightly acid subsoils

3- Soil material containing lime, with acid subsoils.

4- Soils acid throughout.