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IMPROVING THE INCOMES OF SMALL FARM FAMILIES IN COASTAL MAINE

Homer B. Metzger and Nicholas E. Flanders

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Homer B. Metzger and Nicholas E. Flanders¹

INTRODUCTION

Small farms represented a majority of the farms enumerated in recent censuses in Maine. Fifty three percent of the farms grossed less than \$10,000 a year from the sale of farm products in 1969 and 1974 according to the Census of Agriculture. Small farms contributed less than 5 percent of the total value of farm products in 1969, (9). Because of their low contribution to productivity, small farms are often seen as anomalies in the general trend towards larger farms using more capital and less labor.

Small farms cannot, out of hand, be condemned to disappearance through benign neglect. Several aspects of small operating farms are beneficial or potentially beneficial. Small farms provide opportunities to support those seeking a less intensive existence. Tourists and others benefit by the maintenance of the open spaces and the general aesthetics of farm country. Those people who work in towns and cities and commute from the nearby countryside gain from the additional income from the consumption of their self-grown food and the sale of some farm products. And, moreover, small farms can provide a significant degree of self sufficiency and, thereby, the means to support those seeking alternative lifestyles.

Potentially, the greater amount of labor required by small farmers would be of benefit under conditions of increasing unemployment in the nation. An increased number of small farms and small farm families would be of benefit where there has been a decline in the local economics of rural communities, particularly those communities that traditionally have provided services to farms and farm families, as in parts of Maine.

For these benefits to occur the families that live on small farms must still be able to obtain a reasonable standard of living if they are to continue the farm operation. Small farms, by definition, gross less than \$10,000 from the sale of farm products. The net income from these sales would be about \$3,000, which implies that the families living on small farms are living near or below the poverty level, if their sole

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source of income is from the farm. An avenue out of this quandary can be to combine, in a complementary manner, better utilization of current farm resources with off-farm employment such that the combination of the two will maximize the income of small farm families.

Two basic objectives were formulated for this study: 1) To determine the physical, human and financial resources, as well as the source of income from farm and non-farm outlets available to small farm families living in coastal Maine; and, 2) To develop optimal organizations of existing small farm and family labor resources in order to maximize the incomes of these farm families.

METHOD AND SCOPE OF STUDY

The study proceeded in four stages: 1. A sample of small farms, defined as farms with a gross farm income between \$1,000 and \$10,000, was drawn from three coastal Maine counties; 2. The farms were divided into groups representing four different resource situations; 3. Using the resource situations found in the representative groups in 2 above, together with secondary data, an income-maximizing, linear programming (LP) model was developed; 4. From the LP model optimum organizations of off-farm employment and farm enterprises were developed for each resource group under two management levels (average and above average) and two off-farm employment situations (part-time for the operator and part-time for both operator and spouse).

The data were analyzed using the Statistical Package for the Social Sciences available at the University of Maine at Orono's Computing and Processing Service, (13).

The LP model was run using the facilities of the Computer and Processing Service at the University of Maine at Orono. The program used was a package program based upon the Moffet Program revised for the IBM 370, (1).

Small Farm Sample

Personal interviews were conducted with 30 farm operators in the counties of Knox, Lincoln and Washington during May, June and July of 1975. Ten farm operators from each county were interviewed. These counties comprise part of the coastal area of Maine. They were also contiguous with two coastal counties, Waldo and Hancock, that had been surveyed as part of a similar study of small farms in coastal Maine, (10).

The names of prospective farm operators were obtained with the aid of county extension agents and town clerks, as well as through roadside observation. Contact with approximately 95 farm families was necessary to obtain 33 eligible small farm families.

Development of Resource Groups

Farm grouping was used to define differing resource situations among the small farms included in the survey. The farms were grouped according to two arbitrarily chosen resource restrictions: first the amount of cropland and secondly the amount of labor then available on the farm. There were four Resource Groups: Group I (high cropland, high farm labor) with more than 25 acres of cropland and 100 days or less of off-farm employment; Group II (high cropland, low farm labor) with more than 25 acres of cropland, but more than 100 days of off-farm employment; Group III (low cropland, high farm labor) with 25 acres or less of cropland and 100 days or less of off-farm employment; and Group IV (low cropland, low farm labor) with 25 acres or less of cropland but more than 100 days of off-farm employment. Five farms fell into Resource Group I, ten farms fell into Resource Group II, nine farms fell into Resource Group III, and six farms fell into Resource Group IV.

The amount of resources on the farms in each group was averaged. The average resources determined for each group became the basis for resource restrictions in the linear programming model.

For most of the resources this was a straight transfer: the maximum amount of cropland permitted by the LP model for each resource group was the average acreage of cropland found in that group. However, there were some important modifications to this straight transfer.

Since only a blueberry enterprise was included in the model as an activity, all the land classified in the original survey as blueberry and/or orchard was considered as blueberry land.

The amount of operating capital was the amount of cash and savings reported by each resource group plus \$1,014 as the estimated cost of purchasing meat, milk, eggs and vegetables in a "medium cost food basket" for a family of four in 1975. The amount that could be borrowed to supplement the operating capital, was the amount of short-term liabilities reported by the farmers in each resource group, i.e., the amount of accounts payable, notes payable and operating loans.

The limit on fixed capital expenditures without borrowing was set at the value of livestock found in the survey for each resource group. The low, or benchmark level of fixed capital that could be borrowed was set at the average amount of outstanding mortgages reported for each resource group. The high level of fixed capital credit was set equal to one-half the average gross value of the land, buildings and equipment reported for each resource group.

The only category of financial assets or liabilities that existed in the actual survey and not used in the development of the resource situations was the current cash value of stocks, bonds, annuities and life insurance. These were not included because they represented assets that usually were not put into the farm enterprise.

If the operator of a particular enterprise worked more than 200 days off the farm he was considered to be working full-time and given 2000 hours of labor time for the year to work off the farm. Part-time employment was considered to be between 100 and 200 days of off-farm employment and 1000 hours of off-farm employment were permitted in the resource restrictions on off-farm employment. The hours permitted under full-time and part-time employment were evenly divided between summer and winter. The assignment of this labor input into the categories - average wage earning ability or above average wage earning ability - was based on figures derived from the resource groups themselves, i.e., the average hourly wage reported by the group involved.

Total family labor hours were estimated by assuming the operator had 60 hours a week and the spouse 40 hours a week to spend either on the farm or in off-farm employment during 51 weeks of the year. The weekly amount of labor available on the part of the spouse was adjusted using a man equivalent of 0.9. It was assumed children 10 years of age or over could work 20 hours a week during the summer and 10 hours a week during the school year. Children's labor hours were adjusted using a man equivalent of 0.5. The total hours of family labor was divided equally between the two seasons.

The Linear Programming Model

The LP model was developed to optimize the farm family income. As mentioned in the previous section, the resource restrictions were based on the findings of the survey. The enterprises that were selected for inclusion in the model were commonly found on the farms surveyed. If two or more farms were engaged in a particular enterprise, the enterprise was included in the model. However, some enterprises not yielding positive returns based upon secondary data, or for which costs and returns data were not available, were excluded.

The LP model had 50 real activities and 32 constraints. There were three sectors to the activities in the model: 1) off-farm employment, with activities for the operator, spouse and one child to work off-farm, 2) farm enterprises including producing, selling and borrowing activities and 3) home consumption, with requirements for the families' consumption of milk, beef, eggs and vegetables. The home consumption sector

could meet these requirements by producing the food itself or by purchasing the goods from off-farm sources. The home consumption sector of the model used as food requirements the amount suggested in a medium cost budget by the USDA for the average four person family found in the survey.

Twenty-two externally generated constraints in the model were: the acres of cropland, permanent pasture, blueberry land, and forest land; the available amount of operating and fixed capital and the borrowing capacity to obtain more of each; the hours of labor permitted for the operator, his spouse and one child for off-farm employment on seasonal and differential earning capacity bases; the total amount of family labor for both farm and non-farm employment on a seasonal basis; and the total amount of building space.

Ten other constraints were used for the internal generation of resources. Included in these were limits on the production of hay and pasture and limits on the production of food for use on the farm by the farm family.

The production coefficients and the net returns that were used in the LP model were based upon a wide variety of secondary sources. The basic source for farm enterprise budgets was Dum, et al., (3). Some information on livestock, hay and pasture budgets was provided by Benson (2) and the Northeast Dairy Adjustment Study Committee, (14). The vegetable and squash budgets were developed using information from Metzger, et al. (11) and Erhardt, (4) as well as from the Soil Conservation Service, (17). Poultry budgets were developed from a poultry management manual (New England Cooperative Extension Service), (15). Additional information was provided by faculty of the Cooperative Extension Service (at the University of Maine at Orono and in county offices), personnel in the Farmers Home Administration, a State Regional Forester, and faculty of the Department of Agricultural and Resource Economics at the University of Maine at Orono. Information for the off-farm employment coefficients came from the Maine State Manpower Planning Council (8) and the U.S. Department of Labor, (22). The data from which the coefficients were developed were usually from early years, therefore, the original data were adjusted using a price index for the appropriate expenditure category to adjust the data to 1975, (18). For the budgets used to develop the coefficients in the model see Flanders, (6).

Optimal Organizations from the LP Model

In all, 12 resource situations, representing variations of the four basic resource groups, were analyzed and organizations derived using the

LP model. A benchmark plan was developed for each of the four resource groups, using an average level of management for all of the farm enterprises and a restricted amount of capital in terms of the amount of fixed capital that could be borrowed. The benchmark situations used the amount of off-farm labor, farm labor, land, building and financial resources of the existing small farms in the study.

For all of the resource groups a second optimal organization was found, assuming a higher level of management for all of the farm enterprises and a higher permissible level of long-term credit.²

The other four optimal organizations were associated with Groups I and III only. In each group the off farm labor situation was altered to permit the operator to work part-time off the farm, then both he and his spouse to work off-farm part-time.

RESOURCE SITUATIONS AND ENTERPRISE ALTERNATIVES

Resource Situations

Each of the resource groups had a benchmark situation and one or more other situations representing changes in resource restrictions. Resource Groups I and II had high land resources and Resource Groups III and IV had low land resources. Group I differed from Group II in that the operator had no off-farm employment while in Group II he had full employment off-farm. The same difference existed between Groups III and IV. Within each group, various resource situations were specified as a, b, c, and d, with "a" the benchmark resources, "b" changes in credit resources and "c" and "d" variations in hours available for off-farm employment.

Resource Group I—High Cropland, High Farm Labor

The benchmark resource situation for Resource Group I was Resource Situation Ia. Situation Ia was based on the following restrictions on land: 61 acres of cropland, 5 acres of permanent pasture, 1 acre of blueberry land and 57 acres of forest land, Table 1. The operating capital permitted was \$10,448, including \$2,844 of owned capital and \$7,604 which could be borrowed. The fixed capital was \$15,268 of owned capital which could be supplemented by \$15,268 in long-term credit. The spouse was able to get an above-average hourly wage and was allowed to work off-farm part-time during both seasons, i.e., 500

² A higher level of management was defined as improved decision-making, higher levels of input use and greater use of higher quality inputs.

Table 1

Resource Restrictions in Linear Programming Model for All Resource Situations in Resource Group I and II

Item	Situation				Situation	
	Bench- mark	Other			Bench- mark	Other
		Ia	Ib	Ic		
Cropland, ac	61	61	61	61	63	63
Permanent Pasture, ac	5	5	5	5	18	18
Blueberry Land, ac	1	1	1	1	2	2
Forest Land, ac	57	57	57	57	74	74
Operating Capital, \$	2,844	2,844	2,844	2,844	4,236	4,236
Short-Term Credit, \$	7,604	7,604	7,604	7,604	10,425	10,425
Fixed Capital, \$	2,720	2,720	2,720	2,720	3,776	3,776
Long-Term Credit, \$	15,268	34,000	34,000	34,000	9,820	44,433
Operator Off-Farm Employment, hr						
Above Average Wage						
Summer	0	0	0	0	1,000	1,000
Winter	0	0	0	0	1,000	1,000
Average Wage						
Summer	0	0	0	500	0	0
Winter	0	0	0	500	0	0
Spouse Off-Farm Employment, hr						
Above Average Wage						
Summer	500	500	0	500	0	0
Winter	500	500	0	500	0	0
Average Wage						
Summer	0	0	0	0	500	500
Winter	0	0	0	0	500	500
Total Family Labor, hr						
Summer	2,440	2,440	2,440	2,440	2,620	2,620
Winter	2,440	2,440	2,440	2,440	2,560	2,560
Building Space, sq ft	8,120	8,120	8,120	8,120	4,550	4,550

hours each half of a year. The operator did not work off-the-farm. There were no children in the labor force. The total amount of family labor permitted was 2,440 hours during each half year. Finally the building space available for farm use was 8,120 square feet.

Resource Situation Ib differed from Resource Situation Ia only in the amount of long-term credit—money that could be borrowed to increase the fixed capital available. This was increased to \$34,000, Table 1.

Resource Situation Ic differed from Resource Situation Ib in that neither the husband nor the spouse was permitted to take off-farm employment.

In Resource Situation Id both the operator and the spouse were permitted to work off the farm part-time. The operator was considered to earn only an average wage, in contrast to his spouse who was in the above average wage earning activity.

Resource Group II—High Cropland, Low Farm Labor

Resource Situation IIa was the benchmark situation for Resource Group II. It provided 63 acres of cropland, 18 acres of permanent pasture, 2 acres of blueberry land and 74 acres of woodland, Table 1. The basic operating capital was \$4,236 with an additional \$10,435 in short term credit permitted to supplement it. The basic fixed capital was \$3,776 with an additional \$9,820 in long-term credit permitted to supplement it. The operator was able to work full-time off the farm, 1,000 hours in each half-year or season, earning an above average wage. His wife was permitted to work part-time at an average wage earning level. This resource group did have a child above the age of 10 so that the farm labor supply was increased but not the off-farm labor supply. The total family labor during the summer was 2,620 hours, and during the winter was 2,560 hours. The building space for farm use was 4,550 square feet.

Resource Situation IIb differed from the benchmark resource restrictions of IIa in only one respect. For Resource IIb, the amount of fixed capital that could be borrowed was increased from \$9,820 to \$44,433.

Resource Group III—Low Cropland, High Farm Labor

Under the benchmark resource situation for Resource Group III (Resource Situation IIIa) the amount of cropland was 12 acres, the amount of permanent pasture was 5 acres, the amount of blueberry land was 10 acres, and the amount of woodland was 59 acres, Table 2. The amount of operating capital was \$9,502 and the amount of fixed capital was \$364. These two categories of capital could be increased by borrowing against \$2,145 of short-term credit to increase the operating capital, and \$6,562 of long-term credit to add to the fixed capital. Under this resource situation neither the operator nor the spouse was permitted to work off the farm. The amount of total family labor was 2,620 hours during the summer and 2,560 hours during the winter because this resource group had a child age 10 or over. The farm building space permitted was 3,456 square feet.

Resource situation IIIb was developed using the same resource restraints as those used in IIIa with the exception that Resource Situa-

tion IIIb increased the amount of fixed capital that could be borrowed from \$6,560 to \$25,094. Resource Situation IIIc maintained the same restrictions as IIIb, but permitted the operator to work off the farm part-time at an average wage, Table 2. This meant that the operator was able to work at a job providing an average wage for 500 hours of work in each half of the year.

Under Resource Situation IIId 1000 hours were available to the spouse for off-farm work at an average wage. Other resource restrictions were the same as Situation IIIc.

Table 2
Resource Restrictions in Linear Programming Model for All Resource Situations in Resource Groups III and IV

Item	Situation				Situation	
	Bench- mark	Other			Bench- mark	Other
		IIIa	IIIb	IIIc		
Cropland, ac	12	12	12	12	12	12
Permanent Pasture, ac	5	5	5	5	4	4
Blueberry Land, ac	10	10	10	10	6	6
Forest Land, ac	59	59	59	59	71	71
Operating Capital, \$	9,502	9,502	9,502	9,502	4,826	4,826
Short-Term Credit, \$	2,145	2,145	2,145	2,145	4,055	4,055
Fixed Capital, \$	364	364	364	364	1,458	1,458
Long-Term Credit, \$	6,560	25,094	25,094	25,094	9,975	36,042
Operator Off-Farm Employment, hr						
Above Average Wage						
Summer	0	0	0	0	1,000	1,000
Winter	0	0	0	0	1,000	1,000
Average Wage						
Summer	0	0	500	500	0	0
Winter	0	0	500	500	0	0
Spouse Off-Farm Employment, hr						
Above Average Wage						
Summer	0	0	0	0	0	0
Winter	0	0	0	0	0	0
Average Wage						
Summer	0	0	0	500	500	500
Winter	0	0	0	500	500	500
Total Family Labor, hr						
Summer	2,620	2,620	2,620	2,620	2,440	2,440
Winter	2,560	2,560	2,560	2,560	2,440	2,440
Building Space, sq ft	3,456	3,456	3,456	3,456	2,283	2,283

Resource Group IV—Low Cropland, Low Farm Labor

Resource Situation IVa was the benchmark resource situation for Resource Group IV. This situation permitted the use of a maximum of 12 acres of cropland, 4 acres of permanent pasture, 6 acres of blueberry land and 71 acres of woodland, Table 2. The basic operating capital was \$4,826, with an additional \$4,055 in short term credit. The fixed capital was \$1,458 with additional funds of \$9,975 in the form of long-term credit being available. The operator was permitted to work 1,000 hours each season, i.e., full-time at an above average wage level. The spouse was given 500 hours each half year, i.e., part-time, at an average wage level. The total number of hours of family labor for off-farm and farm work was set at a maximum of 2,440 hours for each half-year or season. The maximum amount of farm building space was 2,283 square feet.

Resource Situation IVb increased the amount of long-term credit, and therefore the amount of fixed capital that could be borrowed, to \$36,042. In all other respects Situation IVb had resources exactly as Resource Situation IVa, Table 2.

Enterprise Alternatives

The LP model had 50 enterprises or activities that were divided among three sectors: 1) off-farm employment, 2) farm enterprises, and 3) home consumption. (see Appendix table 1 for the model) The off-farm employment activities included two wage levels and most farm enterprise activities included two levels of management. In each instance these levels were specified as average and above average.

Off-Farm Employment—Ten activities were included in the off-farm employment sector covering off-farm employment for the operator, the spouse and one child. Both the operator and spouse had activities covering four employment situations: two wage levels (average and above average) and two seasons (May to October and November to April). There was a seasonal breakdown between summer and winter for the child, but there was no differentiation in the wage level.

Employment was on an hourly basis. The above average wage level for the operator of \$5.50 per hour was the mean wage received by the operator in Resource Groups II and IV. The average wage level was set at a fair wage for industrial work, \$4.00 per hour. (Maine State Manpower Planning Council) The above average wage for the spouse, \$4.00 per hour, was the mean wage received by Resource Group I spouses. The average wage for the spouses was \$2.30 per hour. The children's wage was set at the minimum wage for high school students: \$1.73.

Farm Enterprises—The farm enterprises that were selected for the model were based upon the enterprises found in the survey except for the wholesale squash enterprise. There was not a large wholesale market developed for squash. However, wholesale squash raising is an agronomically feasible enterprise for the State of Maine. For this reason it was included.

CROP ENTERPRISES. The vegetable enterprise had two production activities representing two levels of management, based on different levels of fertilizer and herbicide application and different amounts of labor input.

The mix of vegetable per acre of land was 64 percent sweet corn, 11 percent peas, 7 percent snap beans, 3 percent each tomatoes, potatoes, cucumbers and cabbage, 2 percent each carrots and winter squash, and 1 percent each summer squash and green peppers, (11). The vegetables produced could be used for home consumption or sold through a roadside stand operation.

The wholesale squash and contract squash enterprise activities were very similar to the vegetable enterprise activity except for two major differences. The first was that instead of using all family labor, the wholesale squash activities hired labor to harvest the crop. And, the wholesale squash budget included marketing and handling charges for transporting the crop to the processor.

The contract squash budget gave less of a return than the wholesale squash budget but this return was more secure and required less in the way of marketing and handling costs. It involved two levels of management, based upon the same labor-capital relationship that differentiated the two levels of management in the vegetable and wholesale squash enterprises.

The blueberry enterprise activities combined production, harvesting and transport to processor. The activities represented two levels of management with the higher level of management using more cultural practices and a greater amount of labor to harvest the greater yield, (12).

The pulpwood enterprise had two activities representing two levels of woodlot management. This enterprise was unique among the crop enterprises in that it used 2 to 4 hours of winter labor per acre depending upon the level of management. The coefficients for the pulpwood activities were based upon a ten year stand, i.e., the lot was harvested every ten years.

HAY AND PASTURE ENTERPRISES. The hay activities represented three possibilities: 1. The farm could produce its own hay and sell it; 2. The farm could produce its own hay and use it in a livestock enter-

prise; or 3. The farm could purchase hay for use in a livestock enterprise. Two management levels were distinguished for the production of hay, one yielding 1.7 tons per acre and the other yielding 2.5 tons per acre.

For providing pasture to feed livestock, two activities were provided: permanent pasture, and cropland pasture. The permanent pasture activity used one level of management. The cropland pasture activities were differentiated into two levels of management based upon the amount of fertilizer and seed that was employed.

LIVESTOCK AND LIVESTOCK PRODUCTS. The beef enterprise activities were cow-calf operations with two levels of management. The average level of management assumed a 90 percent calf crop and the above average operation assumed a 95 percent calf crop. This beef enterprise relied upon pasture and hay exclusively for feed. The beef produced could be sold or used for home consumption. The dairy enterprise activities were milk production operations at two levels of management. Annual production per cow of 8,000 lbs for the lower level of management and 10,500 lbs for the higher level of management were assumed. The milk produced could be sold retail, in the form of raw milk or dairy products, or to a processor (wholesale). The milk could also be used for home consumption. Since the amount of milk that would be used in home consumption would be less than what one cow would produce, the model ensured that when milk was produced for home consumption a minimum of one cow would be used and the excess milk sold.

The poultry production enterprise activities consisted of a barnyard operation based upon twenty hens with one level of management and a contract replacement pullet enterprise with two levels of management. The higher level of management was able to raise a bird on 1.5 square feet of floor space while the average level of management required 2 square feet. All costs associated with the enterprise except for building and equipment, electricity and repairs were assumed by the contractor. For an operator to start up this enterprise he had to build a new building instead of utilizing existing space as was the case in other enterprises.

The sheep raising activities produced lambs under two levels of management. The average level of management produced 1.3 lambs per ewe per year and the above average management level produced 1.5.

BORROWING ACTIVITIES. The borrowing activities permitted the borrowing of operating and fixed capital to increase the owned capital

available in each category. Interest charges were made on an annual basis using the Farmers Home Administration rate of 8.5 percent. The model did not permit amortization.

Home Consumption

Four food consumption requirements were included in the home consumption activity: milk, meat, eggs and vegetables. The home consumption requirements were based upon a medium cost market basket of goods for a family of the size encountered in this study, i.e., a family of four with one small child, (23). There was the option to either produce these food items on the farm or to purchase them in the store. The milk and egg requirements could be met by farm production with no additional resource requirements. To meet the requirements for meat and vegetables additional inputs were necessary. It was assumed that only beef was produced and it provided 75 percent of the meat requirement of the family. Since the beef production activity in the farm enterprise sector of the model was a cow-calf operation, the costs of raising a calf to 1,000 lbs were included in the home consumption of beef activity.

The home-use vegetable activity included the labor time and cost of canning the vegetables that were home grown and used in the house. The vegetable requirement was based upon the kinds and proportions of vegetables that were produced in the commercial vegetable enterprise.

OPTIMAL ORGANIZATIONS FOR RESOURCE SITUATIONS

The optimal organization for each resource situation is presented by Resource Group. Within each Group the benchmark situation represents average management while all other situations represent above average management.

Resource Group I—High Cropland, High Farm Labor

Optimal Organization Ia.—The optimal organization under the benchmark resource situation for Resource Group I uses basically three farm enterprises: vegetables, dairy cows and pulpwood. Nine acres of vegetables are grown, all of the 57 acres of woodland are selectively harvested for pulpwood, and 10 head of dairy cows provide milk for home use and the retail market, Table 3.

The farm operations require that operating capital of \$7,608 and fixed capital of \$4,028 be borrowed.

Table 3

Activities and Level of Activity in the Optimal Organizations of Small Farm Families in Resource Groups I and II

Item	Situation				Situation	
	Bench- mark	Other			Bench- mark	Other
		Ia	Ib	Ic		
Operator Off-Farm Employment, hr						
Above Average Wage						
Summer	0	0	0	0	1,000	1,000
Winter	0	0	0	0	1,000	1,000
Average wage						
Summer	0	0	0	500	0	0
Winter	0	0	0	500	0	0
Spouse Off-Farm Employment, hr.						
Above Average Wage						
Summer	500	500	0	500	0	0
Winter	500	500	0	500	0	0
Average Wage						
Summer	0	0	0	0	0	362
Winter	0	0	0	0	500	500
Farm Activities						
Sell Vegetables, 1b	36,033	59,414	84,510	31,529	0	0
Vegetable Production, ac	9	0	0	0	*	0
+Vegetable Production, ac	0	9	13	5	0	*
Wholesale Squash, ac	0	0	0	0	11	0
+Whole Squash, ac	0	12	8	15	0	28
Blueberries, ac	0	0	0	0	0	0
+Blueberries, ac	0	0	0	0	0	0
Pulp, ac	57	0	0	0	74	0
+Pulp, ac	0	0	0	0	0	0
Hay Production, ac	33	0	0	0	29	0
+Hay Production, ac	0	2	2	2	0	2
Buy Hay, tons	0	0	0	0	8	0
Cropland Pastured, ac	15	0	0	0	12	0
Permanent Pasture, ac	5	4	4	4	18	4
Sell Milk Retail, gal	8,752	993	993	993	11,095	993
Milk Production, head	10	0	0	0	12	0
+Milk Production, head	0	1	1	1	0	1
Sell Eggs, doz	0	0	0	0	0	0
Poultry Production, bird	0	0	0	0	0	0
Replacement Pullets, thsds	0	0	0	0	0	0
+Replacement Pullets, thsds	0	7	7	7	0	9
Operating Loan, dol	7,608	7,608	7,608	7,608	10,435	10,435
Fixed Capital Loans, dol	5,220	34,000	34,000	34,000	4,733	44,433

Table 3 (Cont'd.)

Item	Ia	Ib	Ic	Id	IIa	IIb
Home Consumption Activities						
Own Produced Vegetables, lb	206	206	206	206	206	206
Own Produced Milk, gal	228	228	228	228	228	288
Milk Purchased, gal	0	0	0	0	0	0
Beef Purchased, lb	653	653	653	653	653	653
Own Produced Eggs, doz	0	0	0	0	0	0
Eggs Purchased, doz	121	121	121	121	121	121

* Less than 0.5 acre

+Indicates above average level of management

This organization is achieved with the wife utilizing the full amount of off-farm employment that is permitted her, i.e., 500 hours each half-year, at an above average wage. The home consumption requirements are met by the farm production of milk and vegetables, but purchasing of eggs and beef.

There are few unused resources in Optimal Organization Ia. One acre of blueberry land, \$10,048 of long-term credit, 980 hours of total family winter labor and 6501 square feet of farm building space are not used, Appendix Table 2.

Optimal Organization Ib.—With the increase in the level of management and the amount of fixed capital that can be borrowed, the dairy cow enterprise becomes less important and the wholesale squash and replacement pullet enterprise come into this organization. Nine acres of vegetables are grown and wholesale squash is raised on 12 acres of cropland, Table 3. Seven thousand replacement pullets are raised under contract, and one cow is kept with some milk retailed. (Pulpwood is no longer harvested.) This organization requires that an operating loan of \$7,608 as well as a fixed capital loan of \$34,000 be used mainly for the pullet enterprise. The farm enterprises in Optimal Organization Ib are in conjunction with the spouse working 500 hours off-farm during both the winter and summer at an above average wage level.

Optimal Organization Ic.—A larger vegetable operation is taken on and the wholesale squash activity is decreased when off-farm employment by the operator and spouse is eliminated. This optimal organization calls for 13 acres of vegetables instead of nine acres. The wholesale squash activity decreases from 12 acres to 8 acres, Table 3. All other farm enterprise and home consumption activities remain the same as under Optimal Organization Ib.

Optimal Organization Id.—An increase in off-farm employment to part-time work by both the operator and spouse results in a decrease in the size of the vegetable activity, from that under Optimal Organizations Ib and Ic to 5 acres. The less labor intensive wholesale squash enterprise

increases over the levels encountered in Ib and Ic to 15 acres using an above average level of management, Table 3.

Resource Group II—High Cropland, Low Farm Labor

Optimal Organization IIa. — Under Optimal Organization IIa, the benchmark resource situation of Resource Group II, the farm enterprises consist of 11 acres of wholesale squash, 74 acres of woodland, selective harvested for pulpwood, and 12 head of dairy cows. The dairy cows require 29 acres of hay under average management, 18 acres of permanent pasture and 12 acres of pastured cropland. In addition, 8 tons of hay are purchased. This farm organization requires that \$10,435 in operating capital and \$4,733 in fixed capital be borrowed, Table 3.

The home consumption requirements are met by the family producing its own vegetables and milk and by purchasing the required amount of beef and eggs. Less than half an acre of vegetables is grown for home consumption.

The operator works off the farm the full amount of time which he is permitted: 1,000 hours, during both of the seasons. On the other hand, the operator's spouse works only during the winter for 500 hours. Substantial land, building and capital resources are unused, Appendix Table 2.

Optimal Organization IIb.—Under this optimal organization the acres of wholesale squash are increased to 28, the dairy operation is reduced to one cow and 9,000 replacement pullets are brought in as a result of the changes to an above average level of management and increased long term credit, Table 3. This farm organization borrows \$10,435 for operating capital and \$44,433 for fixed capital.

The higher level of management that is put into Optimal Organization IIb requires a greater amount of fixed capital than the benchmark Optimal Organization IIa. But, at the same time it permits the spouse to work more hours off-farm during the summer. The spouse works 362 hours in off-farm employment during the summer as compared to none during the summer under Optimal Organization IIa.

Resource Group III—Low Cropland, High Farm Labor

Optimal Organization IIIa. — Optimal Organization IIIa was the benchmark resource situation for Resource Group III. The farm operation grows 12 acres of vegetables and 10 acres of blueberries while 59 acres of woods are selective harvested for pulpwood, Table 4. Two head of dairy cows are kept which use 5 acres of permanent pasture and 6 tons of hay which is purchased. The milk is used both for home consumption and retail sales at the farm. Poultry production is in the optimal organization with 257 birds being raised and the eggs sold. In

addition 1,000 replacement pullets are raised under contract. The farm enterprises used a fixed capital loan of \$6,562. All of the enterprises are operated at an average level of management.

Table 4

Activities and Level of the Activities in the Optimal Organizations for Resource Groups III and IV

Item	Situation				Situation	
	Bench- mark	Other			Bench- mark	Other
		IIIa	IIIb	IIIc		
Operator Off-Farm Employment, hr.						
Above Average Wage						
Summer	0	0	0	0	1,000	1,000
Winter	0	0	0	0	1,000	1,000
Average Wage						
Summer	0	0	500	500	0	0
Winter	0	0	500	500	0	0
Spouse Off-Farm Employment, hr						
Above Average						
Summer	0	0	0	0	0	0
Winter	0	0	0	0	0	0
Average						
Summer	0	0	0	500	384	500
Winter	0	0	0	500	500	500
Farm Activities						
Sell Vegetables, lbs	52,008	78,908	69,241	42,237	0	19,211
Vegetable Production, ac	12	0	0	0	*	0
+Vegetable Production, ac	0	12	11	7	0	3
Wholesale Squash, ac	0	0	0	0	12	0
+Wholesale Squash, ac	0	0	2	6	0	9
Blueberries, ac	10	0	0	0	0	0
+Blueberries, ac	0	10	10	10	0	0
Pulp, ac	59	0	0	0	71	0
+Pulp, ac	0	59	59	59	0	71
Hay Production, ac	0	0	0	0	0	0
+Hay Production, ac	0	0	0	0	0	0
Buy Hay, tons	6	6	6	6	5	5
Cropland Pastured, ac	0	0	0	0	0	0
Permanent Pasture, ac	5	5	5	5	4	4
Sell Milk Retail, gal	1,277	1,266	1,266	1,266	908	917

Table 4. (Cont'd.)

Item	IIIa	IIIb	IIIc	IIId	IVa	IVb
Milk Production, head	2	0	0	0	1	0
+Milk Production, head	0	1	1	1	0	1
Sell Eggs, doz	3,740	1,289	0	0	0	0
Poultry Production, bird	257	94	8	8	0	8
Replacement Pullets, thsds	1	0	0	0	**	0
+Replacement Pullets, thsds	0	5	5	5	0	7
Operating Loan, dol	0	0	0	0	2,674	4,014
Fixed Capital Loan, dol	6,562	25,094	25,094	25,094	0	36,042
Home Consumption Activities						
Own Produced Vegetables, lb	206	206	206	206	206	206
Own Produced Milk, gal	228	228	228	228	228	211
Milk Purchased, gal	0	0	0	0	0	17
Beef Purchased, lb	653	653	653	653	653	653
Own Produced Eggs, doz	121	121	121	121	0	121
Eggs Purchased, doz	0	0	0	0	121	0

+Indicates above average level of management

*Less than 0.5 acre

**Less than 1000

In this optimal organization the family produces for home consumption all of the vegetables, milk and eggs required. The family requirement for beef is met by purchase.

Optimal Organization IIIb.—With the higher level of management and higher fixed capital financing Optimal Organization IIIb decreases the number of birds producing eggs to 94 and increases the replacement pullets to 5,000. The other farm enterprises remain at approximately the same levels but at the higher levels of management. Twelve acres of vegetables are produced. Ten acres of blueberries are managed and 59 acres of pulpwood are selective harvested. The farm enterprises use \$25,094 in fixed capital loans, Table 4.

Optimal Organization IIIc.—Under the resource restrictions for Optimal Organization IIIc the operator was permitted to work part-time in off-farm employment. He worked the full amount of this restriction, i.e., 500 hours during each season, summer and winter. The farm enterprises include 11 acres of vegetables, 2 acres of wholesale squash, 10 acres of blueberries and 59 acres of pulpwood. Five thousand replacement pullets are raised but the poultry production enterprise is reduced to 8 laying birds, the number required for home consumption.

Optimal Organization IIId.—This optimal organization has the operator and his spouse working off-farm part-time to the full extent that was permitted, i.e., 500 hours per half-year, or season, for both of them. The farm enterprises in this optimal organization include 7 acres of vegetables and 6 acres of wholesale squash. These are acreage reduc-

tions and increases respectively, reflecting adjustments to reduced farm labor. All other enterprises remain at levels indicated in Optimal Organization IIIc, Table 4.

Resource Group IV—Low Cropland, Low Farm Labor

Optimal Organization IVa.—Under Optimal Organization IVa, the benchmark resource situation for this resource group, 12 acres of wholesale squash are grown and 71 acres of pulpwood are harvested selectively at an average level of management. Less than half an acre of vegetables is also grown. One dairy cow is kept, which requires 5 tons of hay to be purchased and 4 acres of permanent pasture used. Less than 500 replacement pullets are also raised, which is essentially an insignificant amount for a contracting operation. This farm operation borrows \$2,674 in operating capital, Table 4.

The operator works 1,000 hours during both of the two seasons, i.e., at the full amount that was permitted by the model. The operator's spouse works 384 hours during the summer and 500 hours during the winter.

The family produces its own vegetables and milk and buys beef and eggs.

Optimal Organization IVb.—Optimal Organization IVb consists of nine acres of wholesale squash, 71 acres of pulpwood, one dairy cow, eight laying hens, three acres of vegetables, and 7,000 replacement pullets, Table 4. These increased farm activities as compared with Optimal Organization IVa are the result of a higher level of management. The higher management level also permits the operator's spouse to work the full 500 hours that she is permitted to work off the farm during the summer.

The family produces all the required vegetables and eggs and 211 gallons of the milk requirements. The other 17 gallons of milk are purchased as is the needed amount of beef.

NET INCOME FROM OPTIMAL ORGANIZATION OF RESOURCES

The combined farm and off-farm employment income made possible by the optimal organizations described above was compared with the net income from farming and the income from off-farm employment that was found for each resource group in the survey. An overhead cost for each resource group was calculated to cover fixed expenses (depreciation, taxes, insurance, repairs, interest) on the farm land, buildings and equipment that were not incorporated as costs in the model. This overhead cost was subtracted from gross returns over variable costs to obtain estimated net income for the various optimal or-

ganizations. No comparison was possible as to the relative amounts spent on food between the optimal organizations and the actual situations.

Resource Group I—High Cropland, High Farm Labor

The net income from farming for the actual farms in Resource Group I was a loss of \$2,725, Table 5. The income from off-farm employment was \$4,388 with a total for both of these income sources of \$1,668.

Optimal Organization Ia, the benchmark resource situation, provides a return over variable costs for the farm enterprise of \$8,005. Since the overhead charge for this resource group is \$4,804, the net farm income from this optimal organization is \$3,201, Table 5.

The off-farm employment income for Optimal Organization Ia is \$4,000. The total for both sources of income is \$7,201 which represents a large increase over the actual income found in the farm operator survey for this resource group. The main reason for this increase is the increase in income from the farm enterprise.

The inclusion of the above-average management levels for the farm enterprises and the increase in the fixed capital that can be borrowed result in a substantial increase in the income received from the farm enterprise. The return over variable cost from the farm enterprise is \$15,094 for Optimal Organization Ib, which, minus the overhead of \$4,804, means a net farm income of \$10,090. Since Optimal Organizations Ia and Ib have the same employment situation, the off-farm employment income is \$4,000. This means the total income from the two sources is \$14,290.

Optimal Organization Ic shows the effect of neither the operator nor the spouse working in off-farm employment. While the off-farm employment income is obviously decreased from the two previous optimal organizations, the net returns over variable costs for the farm enterprise are increased to \$16,075. This return over variable cost for the farm results in a net farm income of \$11,271. This amount is also the total for the two sources. By decreasing off-farm employment the farm income is increased but not enough to off-set the loss in off-farm income.

When both the operator and the spouse are permitted to work off the farm part-time, in Optimal Organization Id, the off-farm employment income increases to \$8,000. However, the net income from the farm enterprise decreases from \$11,271 to \$9,200. The total income from the two sources, net farm income and off-farm employment, increases to \$17,200. This income is the maximum obtained in any resource situation of Resource Group I.

Table 5

Comparisons of Incomes from Farm Enterprises and Off-Farm Employment for Actual Families with Incomes from Optimal Organizations of Small Farm Families in Resource Groups I, II, III and IV

Item	Situation				Situation	
	Bench- mark Ia	Other			Bench- mark IIa	Other IIb
		Ib	Ic	Id		
	— — — — dollars — — — —					
Actual						
Net Farm Income ¹	(2,725)	(2,725)	(2,725)	(2,725)	711	711
Off-Farm Income	4,388	4,388	4,388	4,388	14,012	14,012
Total	1,668	1,668	1,668	1,668	14,723	14,723
Optimal Organization						
Returns Over Variable	8,005	15,094	16,075	14,004	8,810	18,219
Costs from Farm						
Overhead charged	(4,804)	(4,804)	(4,804)	(4,804)	(4,362)	(4,362)
Net Farm Income	3,201	10,290	11,271	9,200	4,448	13,857
Off-Farm Income	4,000	4,000	0	8,000	12,150	12,984
Total	7,201	14,290	11,271	17,200	16,598	26,841
Food Purchased	652	652	652	652	652	652

Item	Situation				Situation	
	Bench- mark IIIa	Other			Bench- mark IVa	Other IVb
		IIIb	IIIc	IIId		
	— — — — dollars — — — —					
Actual						
Net Farm Income ¹	1,400	1,400	1,400	1,400	1,302	1,302
Off-Farm Income	1,176	1,176	1,176	1,176	9,950	9,950
Total	2,576	2,576	2,576	2,576	11,252	11,252
Optimal Organization						
Returns Over Variable	5,554	11,534	11,284	10,711	3,829	10,434
Costs from Farm						
Overhead charged	(2,613)	(2,613)	(2,613)	(2,613)	(3,017)	(3,017)
Net Farm Income	2,941	8,911	8,672	8,098	812	7,417
Off-Farm Income	0	0	4,000	6,300	13,032	6,300
Total	2,941	8,911	12,672	14,398	13,844	20,717
Food Purchased	555	555	555	555	652	581

¹ Farm products sold plus farm products used in home minus farm expenses

Resource Group II—High Cropland, Low Farm Labor

The net farm income for this resource group found in the survey was \$711, which with an income from off-farm employment of \$14,012, provided a total income of \$14,723, Table 5.

Under the benchmark resource situation, Optimal Organization IIa, the off-farm income from this optimal organization is \$12,150. The farm returns over variable costs are \$8,810. The overhead cost charged for this Resource Group is \$4,362 resulting in a net farm income of \$4,448. Therefore, the total income for this resource situation is \$16,598, Table 5.

When higher levels of management are permitted for the farm enterprises and the amount of fixed capital that can be borrowed is increased, the result is that both the net farm income and the income from off-farm employment are increased. The return over variable cost for Optimal Organization IIb's farm enterprises is \$18,219 with a net farm income of \$13,857. This represents a substantial increase over the net farm income for Optimal Organization IIa. The income from off-farm employment is \$12,984. Thus, the total income from both of these sources is \$26,841.

Resource Group III—Low Cropland, High Farm Labor

The net farm income that was found in the survey for this resource group was \$1,400. The actual off-farm employment income was \$1,176. The total income from these two sources for Resource Group III was \$2,576, Table 5.

Under Optimal Organization IIIa, the benchmark organization for this resource group, neither the operator nor the spouse is permitted to work off the farm. Thus, all the income comes from farming. The returns over variable costs for the farm enterprise under this Optimal Organization are \$5,554. The overhead costs that are charged to all of the optimal organizations in Resource Group III are \$2,613. Therefore, the net farm income is \$2,941, and the total income is also \$2,941, Table 5.

Under Optimal Organization IIIb, where a higher level of management is used in the farm enterprises and substantially more fixed capital is borrowed, the income from farming increases substantially, as compared with Optimal Organization IIIa. The return above variable costs for the farm enterprises is \$11,534, which provides a net farm income of \$8,911. Since there is no off-farm employment permitted in this optimal organization, the total income is also \$8,911.

Optimal Organization IIIc involves the operator in part-time employment off the farm. The off-farm income is \$4,000. There is a net farm income of \$8,672. Thus, the total income derived from this optimal organization is \$12,672. These results indicate that some off-farm employment would have little effect on farm income but could increase total income substantially.

Optimal Organization III d increases the total time spent by the family in off-farm employment by permitting the spouse to work off the farm part-time also. Income from off-farm employment increases to \$6,300. The returns from the farm enterprises result in a net farm income of \$8,098. The total income from both sources of income in this organization is \$14,398, or the maximum obtained in any resource situation of Resource Group III.

These results indicate that under resource restrictions of a low amount of cropland and modest credit, an adequate income cannot be gained from farming alone when lower levels of management are employed. Incomes are increased through higher levels of management in the farm enterprises and/or through off-farm employment.

Resource Group IV—Low Cropland, Low Farm Labor

The actual farms that represented this resource group had a net income of \$1,302 per farm. The income from off-farm employment was \$9,950. The total income from these two sources was \$11,252, Table 5.

Unlike the benchmark optimal organizations for the other resource groups, the net farm income that results from Optimal Organization IVa, \$812, is less than what was found in the actual resource group farms. This net farm income represents returns over variable costs from the farm of \$3,829 minus the overhead charged to the farm enterprise in the resource group of \$3,017.

However, the off-farm income that results from Optimal Organization IVa, \$13,032, is greater than what was found in the actual family situations of the survey. As a result, the total income from the farm enterprise and from off-farm employment that is achieved by this optimal organization is \$13,844. The farm enterprises, under average management in this optimal organization, cannot contribute much to family income because of the low amount of cropland and capital available. Most income must be gained through off-farm employment.

When the above average level of management and a larger amount of fixed capital are utilized, in Optimal Organization IVb, a net farm income of \$7,417 results. The income from off-farm employment rises

to \$13,300. The total income that results from Optimal Organization IVb is therefore \$20,717. Thus limited farm resources can contribute substantially to family income if well managed. When combined with off-farm employment income, income from farm enterprises of a modest size provides a good family income.

COMPARISONS OF OPTIMAL ORGANIZATIONS

In comparing the optimal organizations for the four resource groups, ten points are made. These points are partially interconnected, but are discussed individually.

1. *The highest income is achieved in Optimal Organization IIB, where the operator works full-time off the farm at employment that pays an above average wage, and the spouse works part-time during the winter.* This organization involves an above average level of management for the farm enterprises, and the maximum use of long term credit. This permits farm enterprises that use a relatively large amount of operating and fixed capital in relation to the amount of land and labor. The farm operation is not completely relegated to secondary importance in relation to the off-farm employment of the family in that the spouse does not use all of the time that is permitted her in off-farm employment. The highest income is achieved by a combination of off-farm employment and a large amount of well managed land and capital resources.

2. *Throughout all the optimal organizations there is a trade-off between the vegetable enterprises and the wholesale squash enterprise.* Generally, this follows the pattern that when the amount of off-farm labor is increased the vegetable enterprises become less important and the wholesale squash enterprise becomes more prominent. The vegetable enterprises use labor both in the harvesting and marketing phases, whereas, the wholesale squash enterprise does not. Thus, when farm labor is scarce the expansion of the wholesale squash enterprise and contraction of the vegetable enterprise is understandable.

3. *Large amounts of fixed capital usually are used when an above average level of management for the farm enterprise is employed.* The only exception to this is in Optimal Organization IIIa where there was a limited amount of cropland, 12 acres, and no off-farm employment by either the operator or the spouse.

The fixed capital is usually used in the above average management level replacement pullet activity. In two resource groups benchmark optimal organizations where the average level of management replacement pullet activity is included in the solution, it is a very small sized operation.

In the benchmark optimal organizations which include an average level of management, the dairy cow activity is prominent. The restriction on the level of this activity is more the amount of permanent pasture and cropland than fixed capital. But, when the higher level of management is permitted, the size of the activity is reduced to that required for home consumption, indicating that the dairy enterprise is also limited by the amount of fixed capital and is competing with the replacement pullet enterprise for the fixed capital.

4. *When the amount of cropland is restricted the optimal organization tends to utilize all of the land resources available, and to pick activities that do not require land.* An example of this is seen in comparing Optimal Organization Ic and IIIb. Optimal Organization IIIb uses all of its land resources, i.e., cropland, permanent pasture, blueberry land and forest land. It also uses non-land-using activities such as replacement pullets, poultry production and a dairy cow enterprise where all its hay is purchased.

In comparison, Optimal Organization Ic does not fully utilize any of its land resources. The limiting resources are more the amount of labor available during the summer and the amount of operating capital.

5. *Increasing the amount of off-farm employment, the amount of fixed capital or the level of management employed in the farm enterprises does not greatly affect the optimum organization when the amount of cropland is restricted.*

Optimal Organization IIa and IVa provide examples where the amount of off-farm employment permitted was the same, but where the amount of available cropland was less, 12 acres, for Optimal Organization IVa than for Optimal Organization IIa, 63 acres.

Optimal Organization IIa uses the full amount of forest land available, but has a surplus of cropland, permanent pasture and blueberry land. The main resource restrictions are the summer labor and operating capital. Optimal Organization IVa uses all of its land resources with the exception of the blueberry land. It does have a dairy cow enterprise that is smaller, but which purchases the hay that it requires. The replacement pullet operation is small, 500 birds, but still present. The limit is set by the amount of summer labor and operating capital that are available to the resource situation.

The effect of raising the level of management that is employed by these two resource groups, i.e., Optimal Organization IIb and IVb, is basically that more fixed capital is employed relative to land and labor. Therefore, in Optimal Organization IIb there appears a large replacement pullet enterprise, and the total amount of cropland used is smaller due to a decrease in the size of the dairy herd.

In comparison, Optimal Organization IVb does not decrease the amount of cropland or woodland used, but increases drastically the size of the replacement pullet operation and brings 8 birds under poultry production. Optimal Organization IVb therefore maintains the pattern of utilizing all types of land.

6. *Family income can be increased through off-farm employment until the point is reached when all highly labor intensive enterprises have been eliminated.* When this point is reached the returns from the farm enterprise as compared to the wage from the family's off-farm employment favor the use of the family's labor in the farm enterprise instead of in off-farm employment. Because the spouse's labor in this analysis is more valuable in on-farm employment than in off-farm employment, increasing employment does not always increase income. Optimal Organization IIa shows that when the operator's off-farm employment is full-time, at an above average wage level, the spouse does not work off the farm the full amount of time that is permitted her during the summer. The spouse works at the wholesale squash enterprise, which is apparently more remunerative than summer employment off the farm.

7. *A higher level of management applied to the farm enterprises permits increased participation by the spouse in off-farm employment during the summer.* This can be seen in comparing Optimal Organizations IIa and IIb and in comparing Optimal Organizations IVa and IVb. In both cases the amount of off-farm employment that the spouse engages in increases with the inclusion of higher levels of management for all enterprises. As was noted earlier, when the higher levels of management are permitted the amount of fixed capital that is utilized increases substantially. In this case at least the increased capital substitutes for labor and permits more time for the spouse to work off the farm.

8. *Summer labor is almost always a resource restriction, whereas, winter labor is never a restriction.* Summer labor is used up in all Optimal organizations but two: IIIa and IIIb, which have no off-farm employment for either the spouse or the husband and a small amount of cropland. In contrast, total family winter labor is not used up by any optimal organizations.

9. *The only real variation found in meeting the home consumption requirements was in whether or not the eggs are produced by the family or purchased.* The eggs are produced by the family only under the situation where the family has a limited amount of land and a surplus of labor.

10. *When lower levels of management are employed more land, both cropland and other types, is employed than under higher levels of management.* In Optimal Organization Ia a diversity of land is used

completely: 58 acres of cropland, 57 acres of woodland, and 5 acres of permanent pasture. When a higher level of management is introduced the amount of cropland used is reduced to 23 acres, the woodland is not used at all, and 4 acres of permanent pasture are utilized. The use of all land is restricted by the amount of capital available since enterprises that involve a higher level of management are also capital intensive.

SUMMARY AND CONCLUSIONS

Summary

This study explored ways in which the income of small farm families living in the coastal counties of Maine could be maximized.

Information was gathered on the human, physical and financial resources, the sources of income, and expenditures of 30 small farm operations in Knox, Lincoln and Washington counties. The farms were divided into four resource groups according to the amount of cropland and farm labor resources they possessed. For each resource group, a benchmark optimal organization was developed, using the amount of off-farm employment and the amount of current indebtedness found in the sample, and average levels of management for the farm enterprises. For each of the four resource groups an optimal organization was found which permitted a greater amount of fixed capital to be borrowed and a higher level of management employed. For the two resource groups with low levels of off-farm employment in the benchmark resource situation, the amount of off-farm employment of either the operator or both operator and spouse was increased to assess the effects on the farm enterprises.

A linear programming model was developed which used the resources found in the resource groups as resource restrictions. The model had three activity sectors: off-farm employment by the operator and his spouse broken down seasonally and with two different wage levels; farm enterprises with the possibility of two different levels of management; home consumption of milk, beef, eggs, and vegetables, which could be met by either producing the goods or purchasing them. Secondary data provided the production coefficients and the costs and return for the activities.

The following optimal organizations were obtained for each resource group assuming the use of above average management in farming. Where both cropland and operator farm labor are plentiful the optimal

organization is to produce 9 acres of vegetables for home use and roadside marketing, grow 12 acres of squash for the wholesale market and raise 7000 replacement pullets. In addition one cow is kept for home milk use and some retail sales.

When cropland is plentiful but little operator farm labor is available the optimal organization is to grow 28 acres of squash for the wholesale market and raise 9000 replacement pullets.

Where little cropland is available but operator farm labor is plentiful, the optimal organization is to produce 12 acres of vegetables, harvest 10 acres of blueberries, cut selectively 59 acres of woods for pulpwood, raise 5000 replacement pullets and keep 94 layers for home use and sale of eggs.

Where little cropland and little operator farm labor are available the optimal organization is to produce 3 acres of vegetables, 9 acres of squash, selectively cut pulpwood on 71 acres, raise 7000 replacement pullets and keep 8 layers for home use of eggs.

When an average level of management is used, the optimal organizations showed greater use of all land facilities with dairy rather than poultry enterprises predominating. When land resources were limited the adjustment was to grow more squash for the wholesale market and less vegetables for the retail market.

With increased off-farm employment the less labor intensive farm activities are pursued. However, if the wage from off-farm employment is low there is a point at which full-time off-farm employment is not feasible and the labor is devoted to the farm enterprises.

The home consumption activity usually meets requirements by producing vegetables and milk and purchasing the needed beef and eggs. The exception to this is where land is limited and there is family labor available, then the production of eggs for home consumption becomes feasible.

Under all optimal organizations the total income from farming and off-farm employment is above the average income found for actual farms in the various resource groups studied. When cropland resources are plentiful, substantial increases in income are indicated; but where cropland is limited, only small increases over existing income result, when average management is used. With above average management maximum incomes are substantially above those of the actual farm organizations in all resource situations.

The family income is highest, \$26,841, when a high amount of cropland is available, where the operator works full-time off the farm, his spouse works part-time, an above average level of management is used in all the farm enterprises and the maximum allowable amount of operating capital and fixed capital is borrowed. The average actual income of farms in this resource group was \$14,723.

Conclusions

Combinations of off-farm employment and farm enterprises, utilizing available farm and family resources, can be found that provide higher family incomes for small farm families than currently exist. Small farms can provide an important source of income to supplement income from off-farm employment. The level of income depends on the level of management that is employed in the farm enterprises, the amount of capital available and the amount of cropland available. Severe limitations on the amount of cropland available influence greatly the amount of income that can be achieved and are difficult to offset by better management and more capital. Where the amount of cropland is relatively limited, a higher income is achieved primarily through off-farm employment. Thus, an inability to find off-farm employment, to obtain an adequate land base, to obtain adequate credit, or to improve management may mean that farm families in these situations cannot maintain an adequate standard of living and are less likely to remain on the farm.

It must be recognized that the optimal organization for individual small farm families will be influenced by their specific situations. This includes taking into account variable factors considered fixed for the purposes of this study, such as land quality, local market demand and price situations. Nevertheless, this study indicates there are advantages to be gained from seeking an optimal organization.

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 Resource Restrictions for Resource Situation Ib, 1975

Item	Resources	Operator				Spouse	
		+Summer hr	+Winter hr	Summer hr	Winter hr	+Summer hr	+Winter hr
Cropland, ac	61.2						
Hay Trans TDN							
Pasture, ac	5						
Pasture Trans TDN							
Blueberry, ac	1.4						
Forest, ac	56.8						
Operating Capital, \$	2844						
Short-Term Credit, \$	7608						
Fixed Capital, \$							
Long-Term Credit, \$							
Operator Summer, hr	500			1			
Operator Winter, hr	500				1		
+Spouse Summer, hr	500					1	
+Spouse Winter, hr	500						1
Total Family Sum, hr	2440	1		1		.9	
Total Family Wint, hr	2440		1		1		.9
Building, sq ft	8120						
Milk Req, gal							
Milk Trans, gal							
Meat Req, lb							
Meat Trans, lb							
Egg Req, doz							
Egg Trans, doz							
Veg Req, lb							
Veg Trans, lb							
Home Use Limit	1						
Cow Req							
Net Returns		5.5	5.5	4	4	4	4

+ Above average management level or wage

Appendix Table 1 (Continued)

Item	Spouse		Children		Veg Prod		Sell Veg	Blueberry	
	Summer hr	Winter hr	Summer hr	Winter hr	acres	+acres	pounds	acres	+acres
Cropland, ac					1	1			
Hay Trans TDN									
Pasture, ac									
Pasture Trans TDN									
Blueberry, ac								1	1
Forest, ac									
Operating Capital, \$					206.75	229	.02	56	86
Short-Term Credit, \$									
Fixed Capital, \$									
Long-Term Credit, \$									
Operator Summer, hr									
Operator Winter, hr									
+Spouse Summer, hr									
+Spouse Winter, hr									
Total Family Sum, hr	.9		.75		78	68	.012	14.7	32
Total Family Wint, hr		.9		.75	2	2		3	2.4
Building, sq ft									
Milk Req, gal									
Milk Trans, gal									
Meat Req, lb									
Meat Trans, lb									
Egg Req, doz									
Egg Trans, doz									
Veg Req, lb									
Veg Trans, lb									
Home Use Limit									
Cow Req									
Net Returns	2.3	2.3	1.73	1.73	-206	-299	.14	2.5	48.33
					-4245	-6432	1		

+Above average management or wage

Appendix Table 1 (Continued)

Item	Squash Whlse		Squash		Contract		Pulp		Hay		Sell Hay tons
	acres	+ acres	acres	+ acres	+ acres	acres	+ acres	acres	+ acres	tons	
Cropland	1	1	1	1	1				1	1	
Hay Trans TDN									-1316	-2193	1020
Pasture, ac											
Pasture Trans TDN											
Blueberry, ac											
Forest, ac						1	1		56.76	92.26	60
Operating Capital, \$	433	455.25	168.25	178.25							
Short-Term Credit, \$											
Fixed Capital, \$											
Long-Term Credit, \$											
Operator Summer, hr											
Operator Winter, hr											
+Spouse Summer, hr											
+Spouse Winter, hr											
Total Family Sum, hr	48	38	54	54					6	9	
Total Family Wint, hr	2	2	2	2					.8	1	
Building, sq ft						2	4		25	42	15
Milk Req, gal											
Milk Trans, gal											
Meat Req, lb											
Meat Trans, lb											
Egg Req, doz											
Egg Trans, doz											
Veg Req, lb											
Veg Trans, lb											
Home Use Limit											
Cow Req											
Net Returns	257	534.75	31.75	101.75	5.5	8			-56.75	-92.25	-60

+Above average management level or wage

Appendix Table 1 (Continued)

Item	Cropland Pasture		Pasture Permanent		Production Beef		Beef Sell		Milk Production		Retail Whise	
	acres	+acres	acres	acres	head	head	pounds	pounds	head	+head	Sell	Whise Milk
Cropland, ac	1	1										
Hay Trans TDN					2400		3820		5050			
Pasture, ac												
Pasture Trans TDN	-1200	-1800	-750		2100		2272		3004			
Blueberry, ac												
Forest, ac	24.14	38.71	10		31.33		499.63		570.58			
Operating Capital, \$												
Short-Term Credit, \$												
Fixed Capital, \$					22.4		699		699			
Long-Term Credit, \$												
Operator Summer, hr												
Operator Winter, hr												
+Spouse Summer, hr												
+Spouse Winter, hr												
Total Family Sum, hr	2	2	2		3.3		37.5		37.5		.036	
Total Family Wint, hr					5.7		42.5		42.5		.036	
Building, sq ft					70		70		70			
Milk Req, gal												
Milk Trans, gal												
Meat Req, lb												
Meat Trans, lb												
Egg Req, doz												
Egg Trans, doz												
Veg Req, lb												
Veg Trans, lb												
Home Use Limit												
Cow Requirement												
Net Returns	- 24.14	- 38.71	- 10		- 31.33		.258	365.88	- 435.82	1.25		.8

+Above average management level or wage

Appendix Table 1 (Continued)

Item	Sheep Head	Poultry Production 20 Birds	Sell Egg dozen	Replace Pullet thousand	Replace Pullet +thousand	Shrt-Trm Loan dollar	Lng-Trm Loan dollar	Home		Own		Buy	
								Consump.	Consump.	Milk gallon	Milk gallon	Milk gallon	Milk gallon
Cropland													
Hay Trans TDN	350												
Pasture, ac	600												
Pasture Trans TDN													
Blueberry, ac													
Forest, ac	33.28	235.12	.03	78.75	78.75	-1							1.5
Operating Capital, \$						1							
Short-Term Credit, \$							-1						
Fixed Capital, \$	22			6750	5012		1						
Long-Term Credit, \$													
Operator Summer, hr													
Operator Winter, hr													
+Spouse Summer, hr													
+Spouse Winter, hr													
Total Family Sum, hr	1.3	20		14	14								
Total Family Wint, hr	4.2	20		14	14								
Building, sq ft	20	45											
Milk Req, gal													
Milk Trans, gal									100		-1		.44
Meat Req, lb									653		2.28		
Meat Trans, lb													
Egg Req, doz													
Egg Trans, doz		-300	1										
Veg Req, lb													
Veg Trans, lb													
Home Use Limit													
Cow Requirement									1				
Net Returns	26.03	-208.17	.7203	596.25	798.75	-0.85	-0.85		10000		.01		-1.5

+Above average management level or wage

Appendix Table 1 (Continued)

Item	Home Use Beef head	Buy Beef pounds	Home Use Egg dozen	Buy Egg dozen	Home Use Veg pounds	Buy Veg pounds
Cropland, ac						
Hay Trans TDN	2150					
Pasture, ac						
Pasture Trans TDN	800					
Blueberry, ac						
Forest, ac						
Operating Capital, \$	189.75	.85	.06	.8	.03	.26
Short-Term Credit, \$						
Fixed Capital, \$						
Long-Term Credit, \$						
Operator Summer, hr						
Operator Winter, hr						
+Spouse Summer, hr						
+Spouse Winter, hr						
Total Family Sum, hr	2.5				.03	
Total Family Wint, hr	4.5					
Building, sq ft	30					
Milk Req, gal						
Milk Trans, gal						
Meat Req, lb	-653	-1				
Meat Trans, lb	528.15					
Egg Req, doz			-1	-1		
Egg Trans, doz			1			
Veg Req, lb					-1	-1
Veg Trans, lb					1	
Home Use Limit						
Cow Requirement						
Net Return	189.75	-.85		-.8	-.03	-.26

+Above average management level or wage

Appendix Table 2

Unused Small Farm Family Resources in Optimal Organizations for All Resource Groups

Item	Situation			Situation		
	Bench- mark	Other		Bench- mark	Other	Other
		Ia	Ib			
Cropland, ac	9	38	37	39	11	33
Permanent Pasture, ac	0	1	1	1	0	14
Blueberry Land, ac	1	1	1	1	2	2
Forestland, ac	0	57	57	57	0	74
Operating Capital, dol	0	0	0	0	0	0
Short-Term Credit, dol	0	0	0	0	0	0
Long-Term Credit, dol	11,240	0	0	0	5,087	0
Spouse, Off-Farm Summer Labor, hr	0	0	0	0	500	138
Total Family Labor, hr						
Summer	0	0	0	0	0	0
Winter	1,112	1,767	2,216	1,269	0	841
Building Space, sq ft	6,744	7,953	7,953	7,953	2,850	4,382

Item	Situation				Situation	
	Bench- mark	Other		Bench- mark	Other	Other
		IIIa	IIIb			
Cropland, ac	0	0	0	0	0	0
Permanent Pasture, ac	0	0	0	0	0	0
Blueberry Land, ac	0	0	0	0	6	6
Forestland, ac	0	0	0	0	0	0
Operating Capital, dol	0	0	902	492	0	0
Short-Term Credit, dol	2,145	2,145	2,145	2,145	1,380	41
Long-Term Credit, dol	0	0	0	0	9,975	0
Spouse, Off-Farm Summer Labor, hr	0	0	0	0	116	0
Total Family Labor, hr						
Summer	500	253	0	0	0	0
Winter	2,004	2,016	1,602	1,152	338	499
Building Space, sq ft	2,673	3,068	3,261	3,261	2,128	2,132