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Supply and Price Relationships

FOR

New Hampshire Fluid Milk Markets

by

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Agricultural Experiment Station

Durham, New Hampshire

in cooperation with

The New England Research Council on Marketing and Food Supply

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Supply and Price Relationships for New Hampshire Fluid Milk Markets

By J. R. Bowring
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Introduction

Milk production and sale is one of the major agricultural industries of New Hampshire. An estimated 337 million pounds were produced in 1949, of which 296 million were sold through regular markets to bring a farm income of over 17 million dollars.

The majority of this milk is consumed within the state but over a third is shipped to Boston and other Massachusetts markets.

Table 1. Estimated Disposition of Milk Produced in New Hampshire—1949*

	1,000 lbs.
New Hampshire	185,740.5
Boston	82,930.0
Lowell-Lawrence-Haverhill	23,487.8
Fitchburg-Gardner-Springfield	2,653.3
Portland, Maine	573.3
Total	295,384.9

*Some small amounts are imported from Vermont and Maine, but the above figures on exports are net of imports.

The Boston market, both as a consuming center and as a source of supply for secondary markets in Massachusetts, is the predominant market in northern New England. This means that the prices established in the Boston market are reflected in the prices paid in the supply areas and secondary markets close to that city.

New Hampshire supplies a large proportion of her production to the Boston market. The price paid to these producers are Boston prices, less handling and transportation costs. Therefore, milk prices in New Hampshire must be related to Boston milk prices. This influence will be predominant in those areas close to the Boston market assembly plants in the Connecticut valley.

The relative importance of these plants as sources of supply for the Boston market is shown in Table 2.

Producer-distributors and assembly plants service secondary markets throughout the state. The location of those plants assembling milk from more than 20 producers and those assembling predominately for the Boston market is shown in Map 1.

Table 2. Quantity and Source of Supply of Milk Shipped to Boston From New Hampshire—1947

Source	*Quantity* 1,000 lbs.
Colebrook	38,082
Lancaster	15,455
Enfield	9,415
North Walpole	9,224
North Haverhill	7,203
Lebanon	6,628
Lisbon	3,345
Laconia	1,323
Other	2,255
Total	92,930

Consumption in New Hampshire

A steady supply of fresh milk to consumers in cities or towns is a joint responsibility of producers, dealers, and handlers. The larger the community of people, the greater the job of collection and distribution. The price which consumers pay should be related to the efficiency with which production, processing, and distribution are accomplished. A continued supply of milk is, of course, dependent on adequate returns to these groups.

One of the costs of handling is transportation from the farm to the consumer. If consumers live close to the farms, then it is to be expected that the transportation costs will be lower. With this in mind it will be well to examine the relative location of producers and consumers in New Hampshire.

Table 3. Major Markets of New Hampshire and the Proportion of the State Population in Each — 1951

Market	*Population*	*% of State*
Manchester	82,581	15.5
Concord	27,984	5.3
Portsmouth	18,793	3.5
Nashua	34,666	6.5
Keene	15,631	2.9
Laconia	14,722	2.8
Berlin	16,545	3.1
State Total	529,880	39.6

The milk supplies for these major markets are picked up by dealers or brought in by producer-distributors. The location of producers supplying these markets is approximated in Map 2 showing the major milksheds for wholesale milk assembly in New Hampshire.

Objectives

It is the purpose of this study to show how the distance milk is transported can be reduced to a minimum. In the emergency period we are in, and are likely to be in for some time, tires and trucks will become more scarce and economy in their use will be an important factor in the con-

MAP NO. 1

LOCATION OF MILK ASSEMBLY PLANTS IN

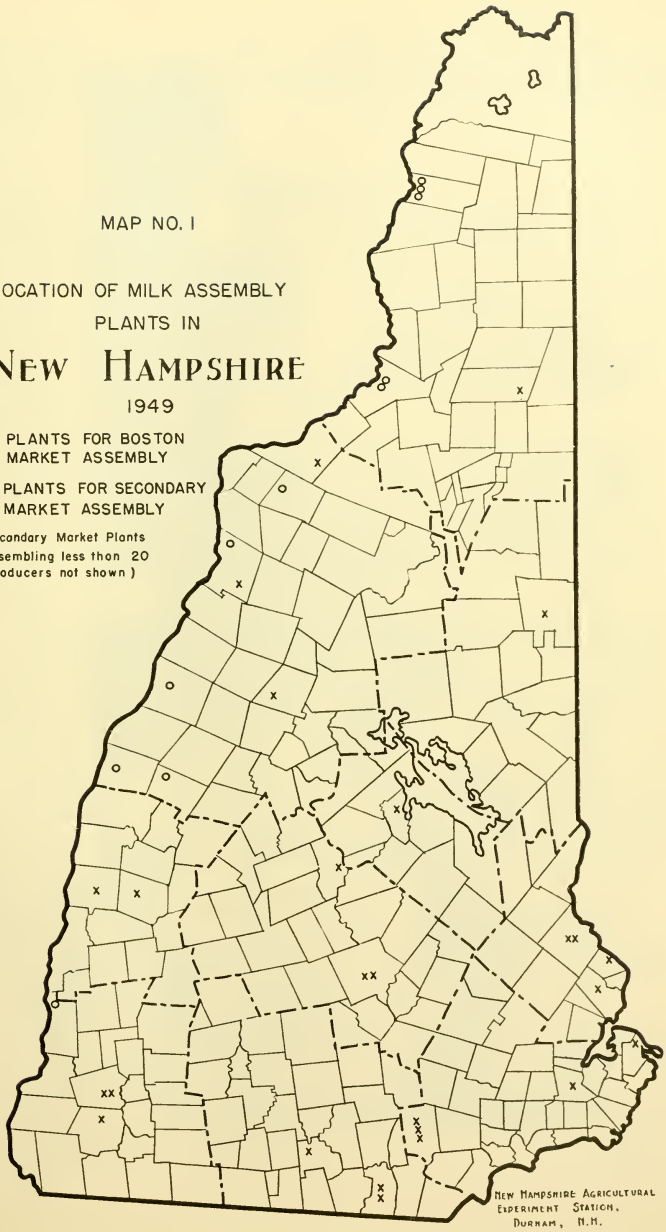
NEW HAMPSHIRE

1949

o - PLANTS FOR BOSTON MARKET ASSEMBLY

x - PLANTS FOR SECONDARY MARKET ASSEMBLY

(Secondary Market Plants assembling less than 20 Producers not shown)



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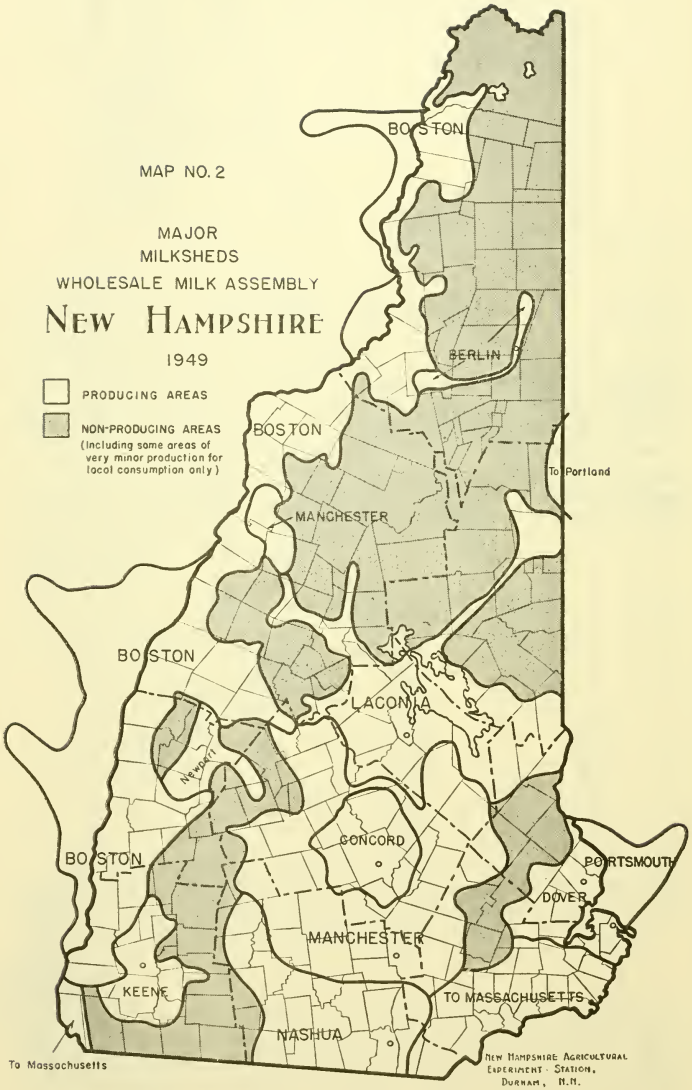

MAP NO. 2
MAJOR
MILKSHEDS
WHOLESALE MILK ASSEMBLY
NEW HAMPSHIRE
1949
PRODUCING AREAS
NON-PRODUCING AREAS
(Including some areas of very minor production for local consumption only)
BOSTON
BERLIN
BOSTON
To Portland
MANCHESTER
BOSTON
LACONIA
Newport
BOSTON
CONCORD
PORTSMOUTH
DOVER
MANCHESTER
KEENE
TO MASSACHUSETTS
NASHUA
To Massachusetts
NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION, DURHAM, N.H.

tinued supply of milk from farms. In addition, if the spread between farm price and retail price is to be minimized for the benefit of consumers and to maintain milk consumption, economies in transportation offer such an opportunity.

Previous Work

Problems of retailing and transportation have been the subject of previous studies in New Hampshire. Rinear and Moore disclosed the advantages of consolidating milk routes in *Retailing Milk in Laconia.**

A description of milksheds and the location of the major markets was completed by Alan MacLeod in 1937.† In the first of a series of studies on the transportation of New Hampshire milk, MacLeod and Geraghty found great disparities in the trucking charges and showed varying degrees of imperfect competition in the establishment of rates which offered possibilities of reduced costs.‡ A further study indicated ways in which transportation costs could be reduced by reorganization and consolidation of trucking routes.

In *The Local Structure of Milk Prices in New Hampshire Markets*¶, MacLeod outlined impediments to producers' response to different market prices. With restrictions on the choice of markets to which producers could ship in New Hampshire, they found it "easier to enter the Boston market than most local secondary markets." MacLeod found elements of monopoly restricting competition without adding efficiency of operation. "Public control . . . has not succeeded in bringing about economies of assembly," he said.

Under the impact of World War II various economies in the assembly and distribution of milk were instituted, such as every-other-day delivery and the elimination of special deliveries.§ Further savings in the distance travelled could reduce the cost of distribution.|| The series of studies on *Efficiency of Milk Marketing in Connecticut* by the Storrs Agricultural Experiment Station provide a detailed background for improving techniques in pricing and assembly of milk.

This study follows in large measure the procedure of number one in the above series, *Supply and Price Interrelationship for Fluid Milk Markets.* A regional study on price relationships in the northeastern milk markets** provides the framework for this study of secondary market pricing in New Hampshire.

Market Prices and the Location of Supplies

The prices paid for milk at the farm are prices at the receiving station or manufacturing plant less the cost of transportation from the farm. The

*Bulletin 272. New Hampshire Agricultural Experiment Station. June 1933.

†*The Milksheds of New Hampshire.* Bulletin 295. New Hampshire Agricultural Experiment Station.

‡*The Transportation of New Hampshire Milk.* 1. Analysis of Trucking Charges. A. MacLeod and M. C. Geraghty. Bulletin 307. 2. Reorganization of Truck Routes. Alan MacLeod. Bulletin 325. New Hampshire Agricultural Experiment Station.

¶Bulletin 332. New Hampshire Agricultural Experiment Station.

§*The Colebrook Plan. Four Years Later* by Holmes, Woodworth, and Bredo. Agricultural Economics Research Mimeograph No. 1. New Hampshire Experiment Station, 1947.

||*Possible Economies in the Assembly and Distribution of Milk in New England* by Alan MacLeod. Storrs, Connecticut, 1911.

**Price Relationships and Supply Areas of Northeastern Milk Markets. Preliminary Draft. U.S.D.A., B.A.E., 1950.

price at the receiving station is the final market price less the cost of transportation to market and all handling and processing charges. The closer the assembly plant and the farm to the market, the higher the price should be at the farm. If prices were free and competitive, then a producer would ship to that market which offered the highest price at the farm. Likewise whole milk assembly plants would tend to be located close to the retail market.

If a choice between two markets is to be made, then the market price less transportation charges will be the measure of preference, and assuming rationality of choice and freedom of entry, milk will be shipped to the market offering the highest farm price. Two markets relatively close together may draw milk supplies from the same area. If the prices in the two markets are the same, then producers will ship to the nearest market. Those producers, if any, who are equidistant from both markets will be undecided as to which market to choose. Something other than price may influence their decision.

An increase in the price at one market relative to the other will broaden the area from which this market will collect milk supplies. Supplies on the lower-priced market will be decreased an equal amount, unless they go elsewhere. It becomes obvious that if milk producers are price responsive, the *relative prices between markets* direct the supplies of milk.

One is aware of impediments to the smooth functioning of the above relationships. Roads or topography may interfere with distance comparisons. Dealers and producers may have established connections, or dealers may refuse to take additional supplies, and so on. However, in terms of the minimization of transportation costs, and given the relative information on production and demand, it should be possible to find those price relationships that will balance supply and demand and minimize transportation. With some allowance for seasonal variations of supply and demand, the calculated distribution pattern can be used as a guide or measurement for planned changes in the existing market to increase efficiency.

Procedure

The problem then resolves into balancing demand and supply for each of the markets and to find those prices which will best stabilize this relationship.

The unit of measurement is the township. Milk production* and consumption† were estimated for each unit in terms of hundredweight per day. As to be expected, some townships have surplus milk and some have a deficit. The amount of surplus or deficit varies with the season of the year. The two extremes of flush production in May-June 1948 and fall shortage in November and December 1947 were estimated.

The sum of consumption of fluid milk, cream, and ice cream per day subtracted from milk sales gives the surplus available for out-of-state markets — in this case 1,263 cwt. per day for the fall and 2,680 cwt. per day for the flush season. The distribution of surplus and deficit counties is shown in Table 5.

*Based on AAA county production payment data allocated to townships by cow numbers. The percentage charge in cow numbers and average increases in milk production per cow were used to estimate 1947 and 1948 supplies.

†Based on sale licenses and audited accounts of handlers as provided by New Hampshire Milk Control Board. Census data were the basis for estimates of non-farm population.

Table 4. Summary of Daily Sales of Milk Equivalent by Farmers and Net Daily Surplus or Deficit Milk Surpluses in New Hampshire by Hundred Weight*

	Daily Milk Sales by Farmers	*Fluid Milk*	*Fluid Milk, Cream, and Ice Cream*	*Farm Sales Minus Consumption of Fluid Milk*	*Farm Sales Minus Consumption of Fluid Milk, Cream, Ice Cream*
Nov.-Dec. 1947	6,358	4,241	5,095	2,117	1,263
May-June 1948	8,610	4,699	5,930	3,911	2,680

*Price Relationships and Supply Areas of Northeastern Milk Markets Preliminary draft. B.A.E. U.S.D.A. 1950.

It was possible to estimate the daily per capita consumption of fluid milk and cream by the non-farm population at 0.945 lbs. milk in the fall months and 1.031 lbs. milk in the summer with an average estimated yearly consumption of .08 lbs. of cream per day.

The development of transfer costs or all costs associated with the movement of milk was based on cost data from the northeast region. The term includes costs of assembling milk in the country, receiving and cooling at country stations, and shipment by truck or railroad to the market. It also includes costs of direct truck shipment from farms nearby the market and costs of receiving at city plants. The price paid to the farmer plus transfer costs equals the supply price f.o.b. the market.†

Table 5. Surplus or Deficit in Counties by Hundredweight Per Day

	Nov.-Dec. 1497	*May-June 1948*
Carroll	20	43
Coos	532	1098
Grafton	972	1369
Sullivan	273	419
Belknap	108	141
Hillsboro	–438	–335
Strafford	–177	12
Rockingham	267	408
Cheshire	204	297
Merrimack	268	370

Given the production and consumption by townships and the cost of transfer, it was possible by a process of adjustment to arrive at those prices which would provide each market with an adequate supply and also to outline the boundaries between markets. The boundaries exist where the farm price, less transportation and handling costs, is equal between adjacent markets. In this way transportation costs will be minimized.

New Hampshire is in the Boston milkshed. Within this milkshed are secondary markets such as Lowell, Lawrence or Manchester competing for supplies. The prices in secondary markets must therefore bear a relationship to the Boston market price. This method of allocating supplies between markets entails the use of price differentials and not absolute prices. The prices in New Hampshire can therefore be expressed as differentials from the Boston price.

The price differences in terms of cents per hundredweight at the farm are shown in Maps 3 and 4. The Map 3 outlines are for the spring flush period and Map 4 outlines for the fall short period. The seasonality of milk production necessitates a shift in market areas as supplies change.

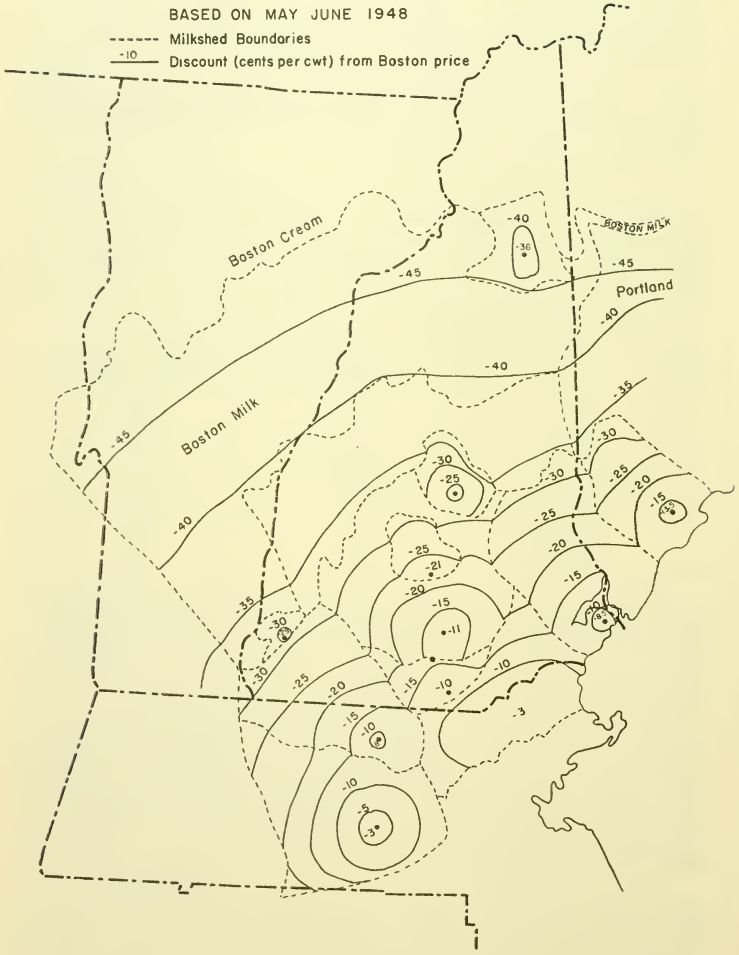
†*Ibid.*

MAP NO. 3

REVISED NEW HAMPSHIRE MILKSHEDS

SPRING SUPPLY PERIOD

BASED ON MAY JUNE 1948



MAP NO. 4

REVISED NEW HAMPSHIRE MILKSHEDS

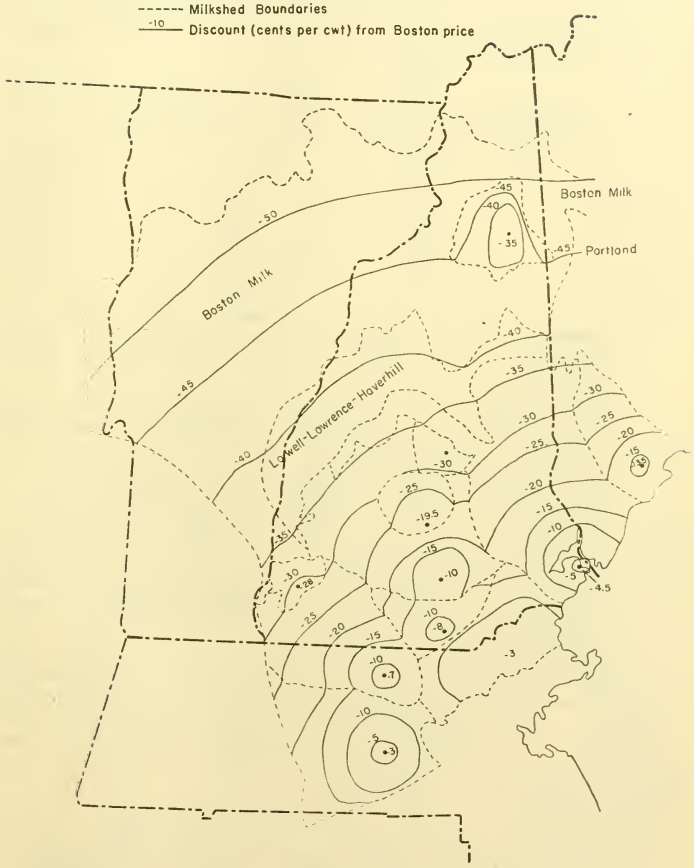
FALL SUPPY PERIOD

BASED ON NOVEMBER DECEMBER 1947

(WITH 15% INCREASE IN PRODUCTION)

------ Milkshed Boundaries

-10 —— Discount (cents per cwt) from Boston price



Comparison With Prevailing Price Difference

Prices on the Boston market are established under the Federal Milk Marketing Order No. 4 by use of the "Boston Formula". The minimum prices at retail and at the farm are established by the Control Board of the New Hampshire Department of Agriculture. This Board acknowledges the influence of Boston prices and establishes differentials with that market so that price changes in the two markets coincide. The state is divided into three price zones, where the Control Board establishes minimum prices. These zones are shown on Map 5 as of January 1, 1950, with a total variation in price between zones of 40 cents per hundredweight. A comparison of market differentials under this competitive pricing procedure and those historically existing is given in Table 6.

Table 6. Comparison of Theoretical Market Price Differences and Those Established by the New Hampshire Milk Control Board*

	May-June	*Nov-Dec.†*	*Control Board*
Boston	0	0	0
Manchester	–11	–10	0
Concord	–21	–19.5	0
Portsmouth	– 8.5	– 4.5	0
Nashua	–10	– 8	0
Keene	–29	–28	0
Laconia	–25	–30	–22
Berlin	–36	–35	–22

*Class I prices delivered city plants Boston and Class I prices delivered plants in New Hampshire.
†November-December 1947 plus 15% production to approximate 1948.

With the recommended price differentials existing through the Boston milkshed, it would pay producers to ship to those markets where transportation costs were least. The total mileage of milk movements would be reduced and savings in scarce materials effected.

The new milkshed boundaries for the fall months which would be the outer perimeter of the annual milkshed are shown on Map 6. Comparison of this with Map 2 will give an approximation of the shifts that would be made and the savings effected. It is inevitable that the supply will vary through the year and the adoption of these milkshed boundaries assumes that adequate facilities are available for handling milk in excess of current fluid requirements for flush seasons.

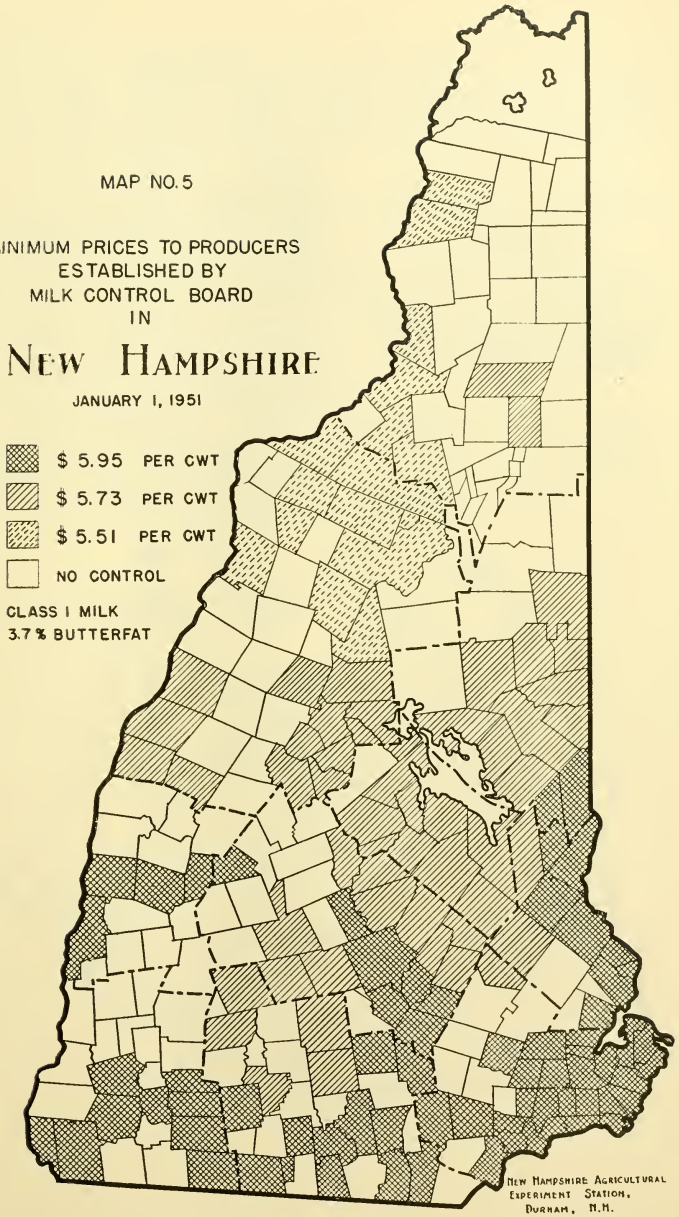
The varying farm prices would then enable similar shifts in retail prices, assuming that processing costs remain the same. Within the outlined milksheds are still other smaller markets competing for supplies with the larger markets. Some slight adjustment of these areas would be necessary if every market were included, but the general areas remain the same.

MAP NO. 5

MINIMUM PRICES TO PRODUCERS
ESTABLISHED BY
MILK CONTROL BOARD
IN

NEW HAMPSHIRE

JANUARY 1, 1951



MAP NO. 6

PROPOSED MILKSHED BOUNDARIES
IN
NEW HAMPSHIRE

Conclusion

The above analysis has been purposely over-simplified. It has been assumed that competitive market pricing is possible and impediments of an imperfect competitive nature can be eliminated for the benefit of society. It has also been assumed that adequate manufacturing outlets for seasonal surpluses will be available.

The legislative controls now present in milk pricing are so numerous that any system once adopted can be changed only with great difficulty. The means of change are beyond the scope of this bulletin.

It is proposed, however, that given the Boston price delivered city plants and given requirements in secondary markets, the supplies can be so allocated between markets by pricing techniques that mileage of hauls and handling charges are reduced to a minimum. Secondary markets will then be in a position to price their milk at retail with greater consideration for the location of supplies, and consumers as well as producers will benefit from proximity to each other.

The technique here outlined, with the complete development of basic production and consumption data, can provide a tool for current and future milk pricing in the Boston milkshed which will go far in reducing assembly costs. A growing scarcity of resources necessitates the adoption of more efficient methods for the use and distribution of these resources.