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Some Aspects of Apiculture in Minnesota

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ABSTRACT — The modest references to insects in geographic literature have been largely confined to those deriving notoriety os vectors of disease-producing organisms (e.g., the tsetse fly and the anopheles mosquito). Among the beneficial insects, bees have been significant in man's organization of area for agricultural purposes for at least 4,000 years. The management of bees for the production of honey is a widely dispersed economic activity in the United States. Minnesota has been a leading state in honey production for many years. Minnesota's 1966 honey crop of 17,940,000 pounds was the third largest in the United States.

Approximately 90,000 colonies of bees were registered with State Entomologist in 1966. The gross distributional pattern reveals an uneven concentration of colonies within a broad belt draped across the state from northwest to southeast, separating too extensive areas in the northeast and the southwest in which apiaries are much less conspicuous elements of the cultural environment.

Areal differences in bee pasture along with other factors such as protection from marauders, availability of drinking water, a location that will not interfere with normal farm operation, accessibility with a degree of seclusion, and prior territorial claims by other beekeepers will determine the suitability of areas for apiary location within the state.

Geography, according to Hartshorne, involves "the analysis and synthesis of integrations composed of interrelated phenomena" as they exist in the earth-space zone (Hartshorne, 1959:35). Geographers have partly resolved the problem raised by the complexity of their task by limiting themselves to what they consider to be the more significant phenomena and integrations.

The authors of this paper contend that geographers have generally neglected one important class of phenomena in their consideration of earth-space reality. The modest references to insects in geographic literature have been largely confined to those deriving notoriety as vectors of disease-producing organisms (e.g., the tsetse fly and the anopheles mosquito). Insects which play a functional role in the biological community and are beneficial to man have been virtually ignored. Among the beneficial insects, bees have been significant in man's organization of area for agricultural purposes for at least 4,000 years (Crane, 1963:2). That man has been able to semi-domesticate and economically exploit the honeybee (Apis mellifera) makes it an insect especially worthy of consideration by geographers.

In the United States, the commercial apiculturalists or beekeepers [2] are of much greater consequence than the thousands of hobbyists and unknown number of farmers who maintain a few colonies for their own use. Specialization in the management of honeybees has resulted in three major phases of apiculture: (1) the production of bee products, principally honey; (2) the production of package bees and queen bees for stocking purposes; and (3) commercial pollination services. The practice of raising queens and package bees is currently confined to more favorable climatic areas and, as yet, commercial pollination has not become well established in Minnesota. Consequently, apiculture in the state is geared almost exclusively to the production of honey.

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[2] Apiculturalists possessing 50 or more colonies are arbitrarily classified as commercial producers, although most of the smaller enterprises in this category represent supplemental sources of income.

The Economic Value of Apiculture to Minnesota

The management of bees for the production of honey is a widely dispersed economic activity in the United States. While there is a semblance of areal concentration in the northcentral section of the country, the three principal honey producers — California, Florida and Minnesota—are widely separated, and the combined production of the ten leading states is just slightly more than one-half (56.7%) of the national output of nearly 247 million pounds.

Minnesota has been a leading state in honey production for many years and has occasionally wrested national leadership from California, which is subject to drastic fluctuations in output. Minnesota's 1966 honey crop of 17,940,000 pounds was the third largest in the United States (Table 1), slightly below the production of both

HONEY PRODUCTION: MAJOR STATES. 1966*

State	Quantity (pounds)	Value (dollars)	Yield per Colony (pounds)	Pound Value (cents)
California ..	21,242,000	2,846,000	38	13.4
Florida	19,992,000	3,359,000	68	16.8
Minnesota ..	17,940,000	2,763,000	92	15.4
Wisconsin ..	14,910,000	2,565,000	105	17.2
Iowa	14,248,000	2,365,000	104	16.6
Texas	12,189,000	1,914,000	51	15.7
South Dakota	10,640,000	1,532,000	112	14.4
Idaho	10,500,000	1,596,000	50	15.2
Nebraska ...	9,405,000	1,336,000	95	14.2
New York ..	8,856,000	1,461,000	54	16.5
United States	246,972,000	42,927,000	51.8	17.4

* The data are based on estimates from state crop and livestock reporting services: *Honey Production—1966 annual summary*

California and Florida. With an additional 377,000 pounds of beeswax, valued at $173,000, the total value of bee products approached $3,000,000.

The comparatively low monetary value of the honey crop would seem to relegate apiculture to a minor role in the agricultural economy of Minnesota. However, many of the crops grown in the state require the services of pollinating insects or yield more abundantly if such services are available. Because 85 to 90 per cent of the insect pollinators working Minnesota crops are honeybees, their value as pollinators has been estimated at 20 to 25 times the value of the honey and beeswax produced (Haydak, 1962:3). If so, a more realistic approximation of the contribution of apiculture to the state's economy would range between $60,000,000 and $80,000,000.

The Distributional Pattern of Apiculture in Minnesota

Approximately 90,000 colonies of bees were registered with the State Entomologist in 1966. The distribution of these colonies by county is shown on Figure 1. Cook was the only county without a single registered colony; at the other end of the scale were Pennington and Ottertail counties with 7,239 and 6,609 respectively. The gross pattern reveals an uneven concentration of colonies within a broad belt draped across the state from northwest to southeast, separating two extensive areas in the northeast and the southwest in which apiaries [3] are much less conspicuous elements of the cultural environment.

Included in the above statistics are the colonies of non-commercial apiculturalists, whose beekeeping activities may reflect locally favorable conditions that are of limited areal significance. Large-scale commercial operations are more responsive to large-scale areal characteristics and provide a more realistic view of the apicultural industry's spatial pattern. In 1966, there were 225 commercial apiculturalists in Minnesota, of which 43 with operations exceeding 500 colonies controlled nearly one-half of all registered colonies (Floyd, 1967).

Figure 2 illustrates the distribution of commercial apiaries in the state. The same broad zone of concentration that was evident in Figure 1 is again revealed, but in a more meaningful pattern. It is readily seen, for example, that apiaries tend to be grouped in the eastern portions of the counties sharing a common border with North Dakota, rather than being equally distributed throughout. The first map obscures this fact. Notice too, that with the exclusion of a large number of hobbyist beekeepers, the area included in the Minneapolis-St. Paul SMSA is shown to be of much less commercial significance than is suggested by Figure 1.

Apparent contradictions that are brought to light by a comparison of the two maps (e.g., Marshall County had more than twice as many apiaries as registered colonies) simply illustrate the difficulty of procuring data that lends to precise areal expression. A high degree of mobility in

[3] Apiculturalists organize their colonies into apiaries, which are basically groups of hive structures containing the colonies. Apiaries vary in size, depending upon specific conditions, but the majority have from 20 to 50 colonies.

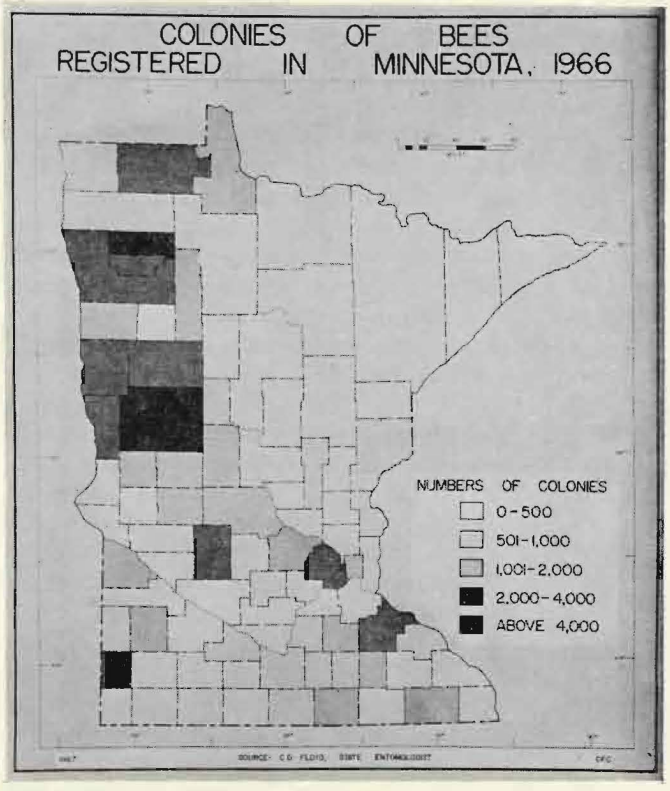

FIGURE 1.

operations and fluctuating colony numbers are factors involved in this problem.

Factors Influencing Apiculture in Minnesota

In order to understand the characteristics and pattern of apiculture it is as necessary to examine Minnesota within its regional and national setting and organizational framework as it is to analyze the local spatial order and areal differences within the state.

Migratory beekeeping, the practice of moving bees from one area to another in response to variations in the blooming of major nectar-secreting plants, is an aspect of spatial interaction that is becoming increasingly significant. Each spring thousands of colonies of bees are trucked into the state from Texas, California, Florida and other places, where they have been built up on fruit bloom or equally satisfactory pasture They arrive just in time to take advantage of the major nectar flows in Minnesota. The increased tempo of the movement is revealed in the fact that, from California alone, the number of colonies certified for shipment to Minnesota increased from 200 to 3,397 between 1960 and 1964 (Foote, 1967).

The availability of seasonal bee pasture serves to attract apiculturalists to Minnesota, but the migratory pattern is also spurred by changing agricultural patterns and practices, over-stocked bee pasture and increasing urbanization in other states. Interconnecting links in the form of improved highway systems and advances in the technology of transportation have lessened the expense and difficulty posed by distance to the point where it is economically sound to migrate.

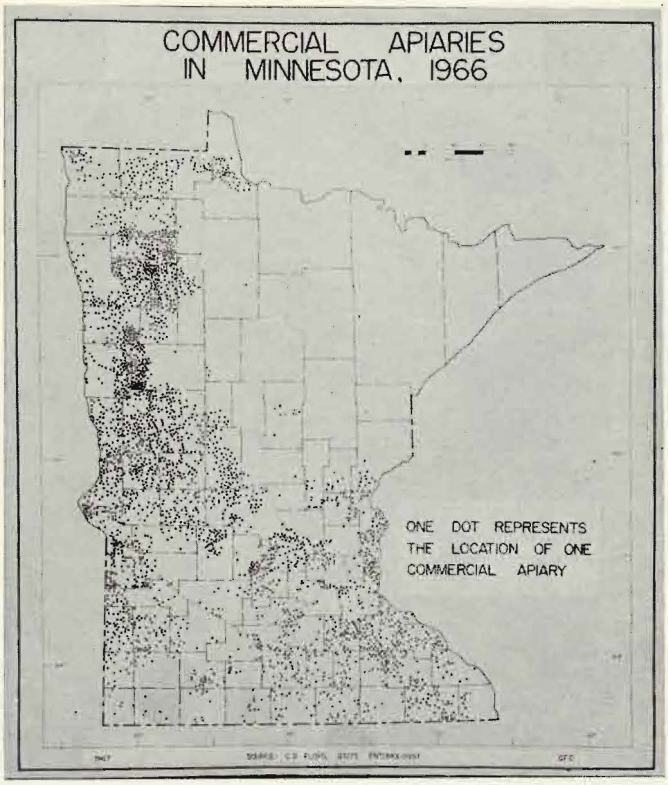

FIGURE 2.

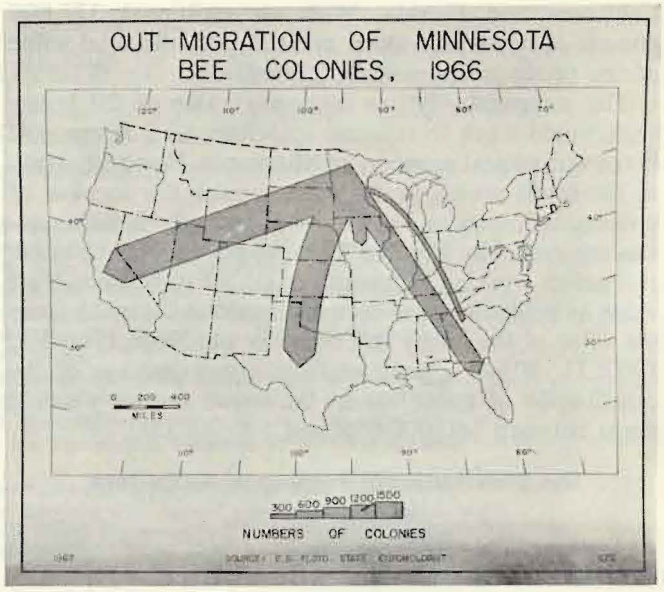

FIGURE 3.

Once the honey crop has been harvested, the migratory beekeepers kill off their weakest colonies, possibly one-half or more of their total, or perhaps overwinter some, and truck the remainder back to localities where they will be able to rebuild their colony-strength. Of the 10,044 colonies licensed for out-of-state movement in 1966, the bulk was destined for California, Texas and Florida (Figure 3). The reciprocal movement to Minnesota during the spring of 1967 will likely result in an inflow of at least 25,000 colonies (Floyd, 1966).

It is easy to overemphasize the importance of migratory beekeeping because of its more spectacular nature. Actually, less than ten per cent of the commercial apiculturalists were involved in long-distance migratory operations in 1966. Even the possibility that migratory specialists controlled a disproportionate share of the commercial colonies cannot discount the greater significance of the more sedentary, Minnesota-based apiculturalists. These respond to the severity of the winter season by killing their bees in the fall and restocking their hives with imported package bees in the spring, or by employing various protective measures to overwinter their colonies. Regardless of the technique employed to deal with the rigorous Minnesota winter, the prime objective of the apiculturalist is to build up his colonies to maximum strength by the commencement of the main nectar flow.

The commercial apiculturalist, with very few exceptions, has little or no control over the pasture his bees forage, yet the symbiotic relationship that exists between honeybees and various flowering plants unites him with other farmers in a mutually beneficial alliance. The farmer can appreciate the possibility that a strong colony of bees may visit nearly one-third of a million flowers in a single day. The apiculturalist on the other hand values the amount of nectar the flowering plants secretes. This is the raw material from which the bee manufactures honey and only a sufficiently large number of high nectar-yielding plants will permit bees to store enough surplus honey to reward the apiculturalist for his investment of time and capital.

While there is some areal variation in the sequence of the major nectar-secreting periods, records compiled from the University of Minnesota's experimental apiaries suggest that from 66 to 90 per cent of the honey surplus is gathered between June 15 and July 30 (Haydak, 1962:31). Climatic conditions throughout the state are most optimum during this period for both the gathering activities of the bees and the secretion of nectar by the plants.

The primary sources of honey are surprisingly few. The bulk of the surplus is derived from a small number of cultivated crops, particularly alfalfa, sweetclover, white clover and alsike clover. On a unit-area basis, the best bee pasture occurs where these legumes are grown for seed, simply because the period of nectar secretion is longer. The basswood tree has long been the major indigenous source of honey surplus.

It would be a mistake to attach too much importance to the major nectar-yielding plants, however. Bees require both honey and pollen for food and the need persists whether or not suitable pasture is available. Thus, a superior apicultural region includes, in sufficiently high density, secondary sources of honey and pollen that yield successively from early spring through the summer, in addition to one or more primary sources of honey surplus. Early pasture is essential to build up colony strength for the main nectar flow and late summer food sources help determine the ability of colonies to survive

the winter. The secondary food sources attain added significance when it becomes apparent that they determine the seasonal stocking capacity of a given area.

Areal differences in bee pasture are incorporated in a map delimiting "Types of Farming" regions in Minnesota (Figure 4). While hay, especially the clovers, dominates the cropping pattern in the Hay-Forest region, the total area devoted to these crops is small and the pasture often dispersed. Moreover, natural forage is sparse.

The Cash Crop region of the Red River Valley and most of the Corn Belt region were once prairie grasslands. Today these are the most intensively cultivated areas in the state and native sources of nectar and pollen occur only locally. Leguminous hay crops, principally alfalfa, fit into rotational schemes characteristic of the Corn Belt, but the agricultural pattern is dominated by corn and soybeans, neither of which is a significant nectar source. Similarly, most of the crops grown in the Cash Crop region—wheat, barley, oats, potatoes, flax and sugar beets—constitute bee pasture of little or no importance. However, potentially good pasture is provided by legumes, which are more likely to be grown for seed in this region.

Perhaps of equal importance in limiting the value of the Corn Belt and Cash Crop regions for apicultural purposes are the cultural practices in vogue, particularly the use of poisonous sprays to control insects and weeds. In fact, the use of insecticides and herbicides may result in

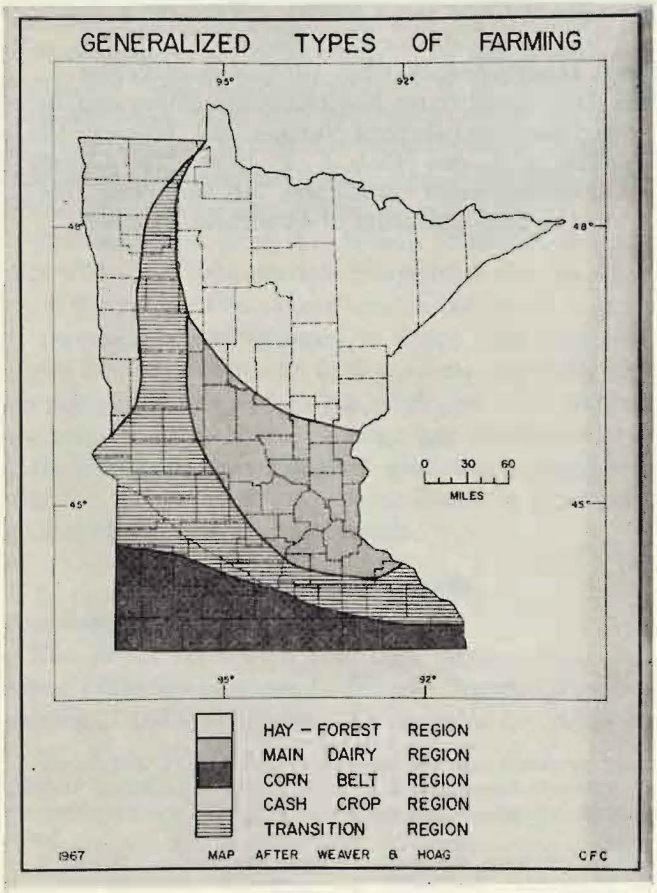

FIGURE 4.

larger honey harvests, but the problems involved in coordinating the operations of so many individuals, not all of whom are likely to be convinced of the necessity, serve to lessen the desirability of intensively farmed areas as bee pasture.

The characteristics of the Main Dairy region are considerably different than those of the Red River Valley and southwestern Minnesota. "Here, in this rather rough terrain, much of it dotted with woods, swamps and lakes, pasture and hay are very secure . . . (Weaver and Hoag, 1954:8)." The same description applies to much of the Transition region, where the boundaries of the more distinctive agricultural regions blend, and it is here and in the Dairy region that is found a combination most favorable for apiculture. The physical geography of these regions makes the intensive use of area less feasible and considerable natural vegetation remains as valuable supplemental food sources for honeybees.

A belt of deciduous forest originally covered much of the Transition region and the remnants of this forest—maples, oaks, poplars, elms, birches and hickories—yield large quantities of pollen, and these, together with the dandelion and other plants, are valuable food sources, particularly during the critical period of colony build up in the early part of the season. Another species of this forest zone is the basswood tree, locally an important source of honey.

While no crop or crop-combination dominates the cropping pattern in the Transition region, hay is the leading crop in many of the counties. Alfalfa is the most important hay, but sweetclover, alsike clover and red clover are also significant. As in the Red River Valley, large acreages devoted to legume seed crops in the north portion of the Transition region provide particularly good bee pasture, with the exception of red clover. In the southern part of this region corn yields pollen prolifically at a time when other sources are scarce, and buckwheat provides forage in some areas of sandy, infertile soil.

The selection of individual apiary sites necessitates the consideration of many local factors in addition to the availability of bee pasture and its condition. These factors include: protection from marauders (including humans), inquisitive livestock, wind and sun; the availability of drinking water; a location that will not interfere with normal farm operations; good drainage: accessibility with a degree of seclusion; and prior territorial claim by another beekeeper.

A full-time apicultural operation may be spread over parts of four or five counties, making it necessary to negotiate agreements with several different farmers and possibly other apiculturalists as well. Competition can be fierce in such a mobile industry and beekeepers have only a moral responsibility to respect each others territorial claims. Crowding may result in overstocking the available pasture, which in turn promotes robbing and the spread of disease.

Considerable time and expense is invested in transportation because of the discontinuity and scope of the large-scale apicultural operation. Roads interconnect the

scattered apiaries and link them all to the organizational focal point of the business. This may be located in a rural setting or in town, but will generally include, in addition to a residential unit, a structure within which honey may be extracted and stored. Provision must also be made for storing honey containers, hive bodies and other equipment and supplies. Some larger operations may have facilities for bottling and packaging honey. A workshop is as necessary as it is for most other types of agricultural operations.

Some of the honey produced in the state is sold independently at roadside stands and from door to door. There are a few large producer-packers, and some smaller ones, with well-established retail outlets. The bulk of the honey crop, however, is marketed through the two main honey packers within the state, the Honey Sales Company of Minneapolis and the Melford Olson Company of Crystal, and the Sioux Honey Association, with headquarters at Sioux City, Iowa. The latter is a co-operative organized on a national scale with plants in six localities other than Sioux City. In 1965, the 100 Minnesota members of the Association were reported to have produced 5,847,559 pounds of honey, of which 4,180,984 pounds were marketed through the Association's plant at Lima, Ohio; most of the remainder was shipped to Sioux City (Sioux Honey Association, 1966). Most of the bulk honey was transported in 55-gallon drums on trucks operated by commercial firms or the apiculturalists themselves.

The Future of Apiculture in Minnesota

There is considerably more bee pasture in the state than is currently being utilized. The result of increased apicultural activity will probably be a filling-in of the existing pattern. Whether or not there will be an intensification of apiculture depends on a multitude of factors, many of which have already been touched upon. Two promising areas of investigation include the possibility of adopting or developing plants which yield consistently high quantities of nectar and the development of improved strains of honeybees.

Changing land use patterns, both within and outside of Minnesota, will have their impact. Honey plants may be incorporated into sound conservation schemes to enhance the basis for apiculture. Foreign competition is an unknown variable, but would seem to be inconsequential in comparison to the problem of domestic over-supply if apicultural potentials were more fully exploited. The industry's two main tasks are to organize a program of national promotion to develop a larger market and convince farmers of the benefits of commercial pollination.

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