

## The Urban Region of Sendai: A Study of Urban Concentric Zoning in its Actual Pattern

著者	Watanabe Yoshio
雑誌名	The science reports of the Tohoku University. 7th series, Geography
巻 号	2 1
ページ	30-52
発行年	1953-03
URL	<a href="http://hdl.handle.net/10097/44780">http://hdl.handle.net/10097/44780</a>

**The Urban Region of Sendai :**  
**A Study of the Urban Concentric Zoning**  
**in its Actual Pattern in Japan**

by

**Yoshio Watanabe**

**Introduction.**

Since Burgess and his co-workers made their detailed analysis of the Chicago urban region and proposed the famous Burgess' scheme of urban concentric zoning,<sup>1)</sup> many interpretations and expatiations have been added to this point of urban view. McKenzie, who had been a leader in this field, offered his opinion several times and gave the foundation to some technical terms in reference to the process of such zoning.<sup>2)</sup>

Queen and Thomas interpreted Burgess' scheme and reported the result of their correlative study on St. Louis-city. They proposed their new classification: urban region, metropolitan district, semi-urban fringe, variety of suburbs and central city.<sup>3)</sup> Davie examined the actual pattern of this conception by the land-use map of twenty cities in the United States and Canada.<sup>4)</sup> It is quite natural that geographers soon should pay attention to this conception and considered it in correlation with the geographic idea of "areal differentiation", which had been given in 1923 by Sten De Geer, together with such words, "considered from such a point of view Stockholm may be divided into four concentric zones".<sup>5)</sup> Mosheles illustrated the practical availability of this conception in Europe in Prague.<sup>6)</sup> Haughton described in his Dublin study four zones of central district, city residential zone, suburban belt and villages zone<sup>7)</sup>. In recent days, Taylor discussed this conception correlatively in his

- 1) E. W. Burgess, *The Growth of the City*, in the *City*, by R. E. Park, E. W. Burgess and R. D. McKenzie, 1925
- 2) R. D. McKenzie, *The Metropolitan Community*, 1933 p. 180
- 3) S. A. Queen and L. F. Thomas, *The City*, 1939 pp. 247-259
- 4) M. R. Davie, *The Pattern of Urban Growth*, 1937, by Dickinson's *City Region and Regionalism* 1947, p. 116
- 5) S. De Geer, *Greater Stockholm : A Geographical Interpretation*, G. R. 1923
- 6) J. Mosheles, *The Demographic, Social, and Economic Regions of Greater Prague ; A Contribution to Urban Geography*, G. R. 1937
- 7) J. P. Haughton, *Social Geography of Dublin* G. R. 1947

special study on Toronto city<sup>8)</sup>, and Dickinson repeated in detail this conception in his book of urban geography. The latter proposed, his own classification: urban tract, city settlement area, and city circulation or trade area, and further explained in another chapter the discrimination between the central, middle and outer zone.<sup>9)</sup>

Considered as a whole, the concentric pattern of the urban region seems to be recognizable in most cities. However, objections still remain in their description. Mosheles found in each zone some characteristics different from Burgess'. Davie found that the distribution of first and second-class housing showed no universal pattern even as an ideal one. Dickinson denoted "that the orderly and typical fashion of operation of selective process from center to periphery, though, real, is not nearly so important in the European as in the American city, as compared with contrasts districts by districts" and the "axiate design" together with the "ribbon building" in suburban zone.<sup>10)</sup> Even in America, still more explicit objection was given by Taylor, who noted "problem of environmental control, of functional patterns and of distribution in general do not seem to interest the authors to any large degree" and "these zones are, however, determined by the site; for the houses are not quite free to spread equally in all directions" and besides "the outer edge of a city is, usually stellate in pattern, with the rays extending some distance along the main railway and road"<sup>11)</sup> In Japan, S. Kiuchi explained these delicate problems, saying "these conception of concentric zoning is most useful when it is treated with the actual pattern of physical setting or the city building, while, it is much available to simplify the complicated urban aspects in accounting of the urban development and its areal differentiation"<sup>12)</sup>

This paper, mainly descriptive, is a result of an examination concerning to such conception. The emphasis of the analysis is laid on the suburban zones, which the author considered so suggestive for this purpose that, in spite of the number of reports on these zones the study has to be tried again from the whole view point of the urban patterning.

8) G. Taylor, *Urban Geography*, 1949 p. 72, 192

9) R. E. Dickinson, *City Region and Regionalism; A Geographical Contribution to Human Ecology*, 1947 p. 107, 113

10) R. E. Dickinson, *op. cit.* p. 111, 116, 123

11) G. Taylor, *op. cit.* p. 173

12) S. Kiuchi, *Urban Geography*, Tokyo, 1951 (in Japanese)

### General features of Sendai.

Sendai, the capital city of the northeastern district of the Main Island of Japan, lies on the eastern marginal portion of the dissected table land, which widely develops in the western half of the prefecture of Miyagi. On the east, the city faces to the Pacific Ocean, beyond the Sendai Coastal Plain, stretching southwards with a width of 10 km. Most part of the city lies on a funnel-shaped terraced basin of the Hirose River. The city is separated on the south by a promontory of the table land from a similarly shaped terraced basin of the Natori River, while, on the north, by another promontory from the straight valley of the Nanakita River. A

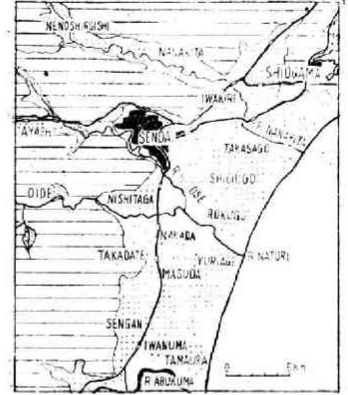


Fig. 1

marked tectonic line, trending northeastward, truncates the east terminal of these promontories and terraces in a straight line and passes the eastern part of the city area. Outside of this, some indistinct fans or deltas are found on the plain from the north end of the Sendai terraced basin to the south of the Natori River. Notable natural levees are also found on both sides of the Hirose and Natori Rivers, which join at a distance southeastward from the city. The largest of these levees is on the south side of the Natori River, and attains to 2 km in width. Another group of distinct natural levees develops, but not so widely, along the Nanakita River. The terminals of these levees are connected incompletely by two or three parallel coastal dunes, enclosing a marshy low land.

The development of the city essentially began in the end of the 16th century, when a feudal lord set up the first city planning on the terraces with a fortress on the western table land. After the revolution of Meiji in 1871, the feudal agency has been replaced by the function as the cultural and political center of the district with some commerce and communication facilities. The population, 86,000 in 1889, increased to 220,000 in 1940 and reached more than 320,000 in 1950, including suburbs. During this period, the city growth has been supported mainly by the traditional back-ground and by the favourable site as a district center, but not by any remarkable addition of industrial function. The present city has a character consumptive rather than productive. Among its non-farm employed population, 83,921 in total, 19,180 are of governmental, public and personal service and 21,131 are engaged in

communication, commerce and finance. They are added by another number of high-grade students, estimated at more than 27,000, including more than 10,000 of university and colleges.

The areal expansion of the city has stagnated for a long time within the funnel-shaped terraces. The dissected table land on the southwest, west and north of the city had limited the expansion of the city occupance very distinctly till the quite recent days and even now bound the city tract with marked lines. On the other hand, the wet low land, mainly covered by rice field, on the eastern side had also restricted the city expansion, but it has been rapidly suburbanized for the last two decades.

#### The primary and the secondary service area.

Fig. 2 shows the bus service pattern in the southern and central Miyagi Prefecture. The primary service area<sup>13)</sup> (II), which is served by radial lines of Municipal Bus and other two bus companies in Sendai city, covers nearly the whole area of three counties of Kurokawa, Miyagi and Natori, with a radius of about 20 km. Farther areas are served by buses of other cities and towns such as Furukawa (17,600), Ishinomaki (52,351), and Shiroishi (17,792). However, in this case there is no distinct radial pattern focussing to particular towns, but the lines are planned to connect the isolated towns and countries with the railway. This means that the area is secondarily influenced by the strong service activities of major urban centers, Sendai in this case. The radial pattern of express bus lines to Sendai is its another evidence. This is the secondary service area (I) of Sendai.

In this area, the inhabitants depend on the city mainly for their costly consumption, their city visiting being less than once a month. They also depend, though a matter of rarity, on it for some specialized medical experts, perhaps several times at most in a farmer's life, and for the amusemental visiting in their yearly leisure time such as new year and "Bon" festival in August, or for the whole sale business of local shops (Table I). There are also some agricultural products to be marketed at sendai, where they are transported by auto-tricycle or by men themselves, who make use of train<sup>14)</sup>.

13) This does not mean merely a bus service area but a hinterland of whole urban service by Green. See, *Urban Hinterland in England and Wales; An Analysis of Bus service*, by F. H. W. Green, *Geogr. Jour.*, Sep. 1950 pp. 64-88

14) These are not a simple extension of suburban market gardening but are a type of truck farming for Sendai in their intention. The products are not large in amount but some of them are famous as fastened or retarded supplies of vegetables and others.

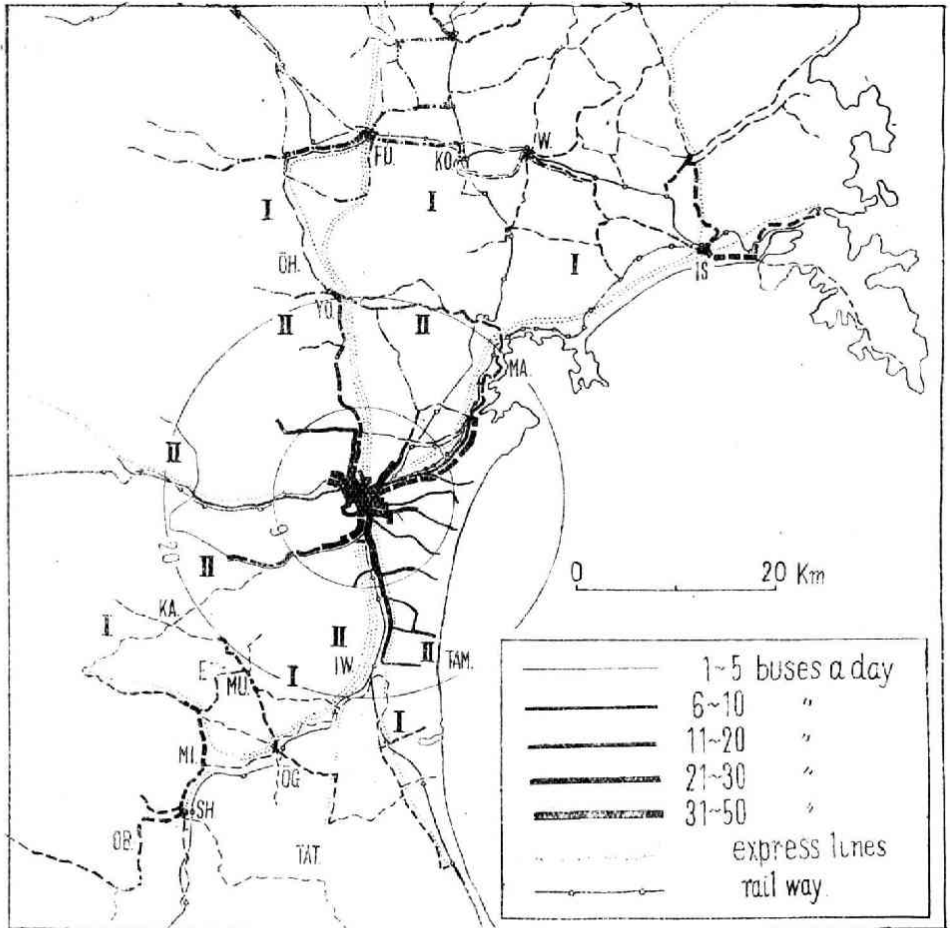


Fig. 2 The bus service pattern in the central and southern part of Miyagi Pref.

FU: Furukawa, IS: Ishinomaki, OH: Ohira, YO: Yoshioka, MA: Matsushima,  
 OB: Obara, SH: Shiroishi, IW: Iwanuma, TAM: Tamaura,

The commuters, who attend the city from this zone, are usually less than 500 per railway station and most of them are dwellers of the towns along the railway. They are distributed to a distance of 50-100 km from Sendai, beyond the boundary of the prefecture (Fig. 3).

In the primary service area have prevailed the buying habits of many kinds of commodities, except daily necessities, groceries and other cheapest ones. It is affected partly by intermediating carriage of a large number of city attendants, who widely dispersed throughout the area under the facilities of train, tram and bus, and rarely on bicycle. The amusement and cultural interest is well satisfied in Sendai, though some trivial facilities, if any,

place	Rokugo	Tamaura	Ôhira	Obara	Omatsu
zone	III	II	II-I	I	I-0
distance from Sendai	7 km.	17	20	45	65
buying-habits					
daily necessities	N.S	N.S	N	N	N
condiments	N.S	N.I	N	N	N
groceries	N.	N	Y.N	N	N.W
fresh fish	N.H	N.H	H.Y	N	H.W
refreshers	N.S	N.I	Y.N	N	W
teas	N.S	N.I	N.Y	N	N.W
Sake (Japanese wine)	S	N.I	N.Y	N	N
ready made wears	S	S	Y.S.K	S.Sh	W.S
under shirts	S	S.I	Y.N.S	Sh.S	W
cloth	S	S	Y.S.K	Sh.S	W
woollen yarn	S	S	Y.S	Sh.S	W
neck-tie or ribbon	S	S	S.Y	S	S.W
rubber water proof	S	S.I	Y.S.K	Sh.N	W
umbrella	S	S	S.Y.K	Sh.S	W
Japanese umbrella	S	S.I	Y	Sh.N	W
wooden clogs	S	S.I	Y	Sh.S	W
shoes	S	S.I	Y.S	S.Sh	W.S
jap boots	S.N	N.I	Y.S	N.Sh	W
bicycle	S.N	N	Y.N	N.S	W
furniture	S	I.S	S	Sh.S	W
radio and others	S	I.S	Y.K	Sh.S	W
glasses	S	S	S.K	S	W
hard wares	S	S.I	Y.K	Sh.S	W
books	S	S	Y.S.K	Sh.S	W
medicines	S.H	H.S	Y	H.Sh	H.W
farm chemicals	N	N	Y.N	N	N
farm instruments	S.N	N.S	Y.N	N.Sh	N.W
farm machines	S.N	N.S	Y.N	Sh.N	H.W
trousaeu	S.N	S	S.Y	S	W.S
things for entertainment and others	S	S	Y	Sh.S	W
repairs					
farm instruments	S.N	N.I	Y	N	N.W
farm machines	S	N.S	Y.S.K	N.S	W
radio and others	S	I.N	Y.K	Sh.N	W
watch or clock	S	I.S	Y	Sh.N	W.S
services					
barber	N.S	N	Y	N	N
beuty-parlors	S	S.I	Y	Sh.H	W
tailors	S	S.I	Y.S.K	S.Sh	N
sewer of ordinal wears	N.S	N	Y.N	N	N
medicines					
internal	N.S	N.S	N.Y	N	N
sergical	S	I.S	Y	N.Sh	W
pediatry	S	I.S	Y	N.Sh	N
dental	S	I.S	Y	Sh	W
ophthalmic	S	S	Y.S	S.Sh	W
culture and amusements					
high schools	S	S	Y.S.K	Sh.S	W
library	S	S	(S)	(S)	(S)
oratorical meeting	S	S.I	Y	Sh	W
cultural association	S	S.I	Y	Sh	W
cinema	S	S.I	Y.S	Sh.S	W
dancing hall	S	(S)	(S)	(S)	W
playing games	S	S.I	Y.S.K	Sh	W
variety shows	S	I.S	Y.S	Sh	W
amusemental visiting at farm leisure	S	S	Y.S.K	Sh.S	W

Table I Buying-habits and other social contacts

N: Neighbourhood, I: Iwaura-town, Sh: Shiroishi.

K: Furukawa or Nakaniida-town (between Furukawa and Ôhira).

Y: Yoshioka-town, W: Iwagasaki town, H: Hawker

are provided in local towns. These are cinemas, theaters, dancing halls, oratorical meetings, large bookstores, libraries and schools higher than lower secondary ones. The area is also the stable circulating zone of the evening paper of Sendai within a day. Further, the carriages of some large whole sale shops in Sendai circulate the rural shops in this area weekly or more frequently to deliver their commodities and to call for new orders. The market gardening in connection with bicycle transportation has arisen, though not important, in the coastal plain, especially on the coastal dunes and natural levees of the Abukuma River.

### The Suburban zone.

Inside this service area, suburbs are to be treated as an area of direct urban influences. The boundary is unobvious, but when a circle of about 10 km in radius is taken,<sup>15)</sup> a rapid increase of population is characteristic (Fig. 4). It nearly coincides with the area, where the emigration to Sendai is highly prominent.<sup>16)</sup> Its eastern half accurately corresponds to the area of

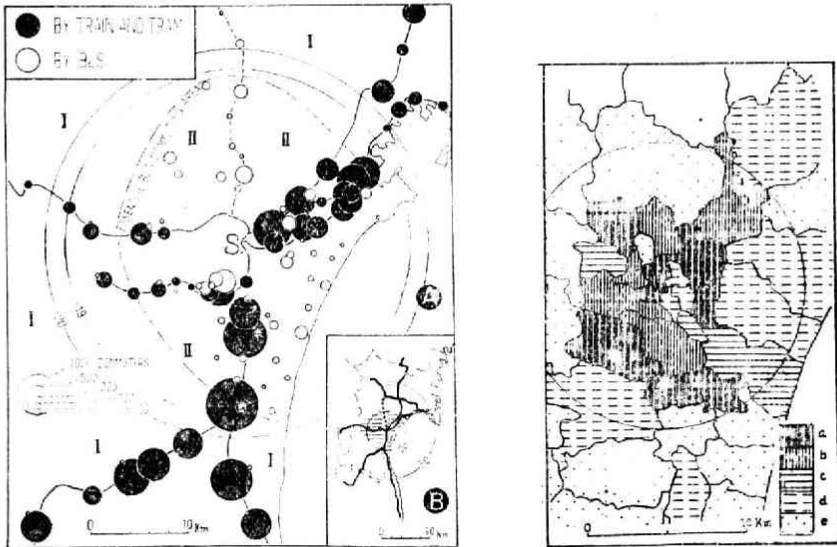


Fig. 3 The distribution of commuters around Sendai (B) The rail way pattern, distributed by commuters. a: the area where inhabitants come to the city for purchasing modest commodities (hard wares and others). (right)

Fig. 4 Population increase (1947-1950) a: more than 16%, b: 15-11%, c: 10-7.6%, d: 7.5-5.1%, e: less than 5%, (left)

- 15) The area includes six municipal administrative communities of Iwakiri, Takasago, Rokugo, Shichichigo, Nakada and Nishitaga, and seventeen city census tract.  
 16) A Study of Immigration for the City Sendai, by A. Haga, Ann. Tohoku Geogr. Assoc., Mar. 1949, pp. 63-72. (in Japanese)



dominant market gardening (Fig. 5). Hence it is reasonable to refer this zone as suburb (III-VI). The area is originally connected by walking with Sendai (Fig. 6), and though its significance decreased at present, such a factor was so important before the rapid increase of bus service mainly in a last decade, that a circle of special social sympathy was formed in such days. These features are succeeded undoubtedly upon the present pattern and was much inspired by the administrative annexation of five communities in this zone to Sendai in 1941<sup>19)</sup>. This factor is not merely a matter of past, but means perhaps more importantly, at present, the distance of easy intercourse by bicycle between this area and Sendai and also means farmers' frequent city visiting

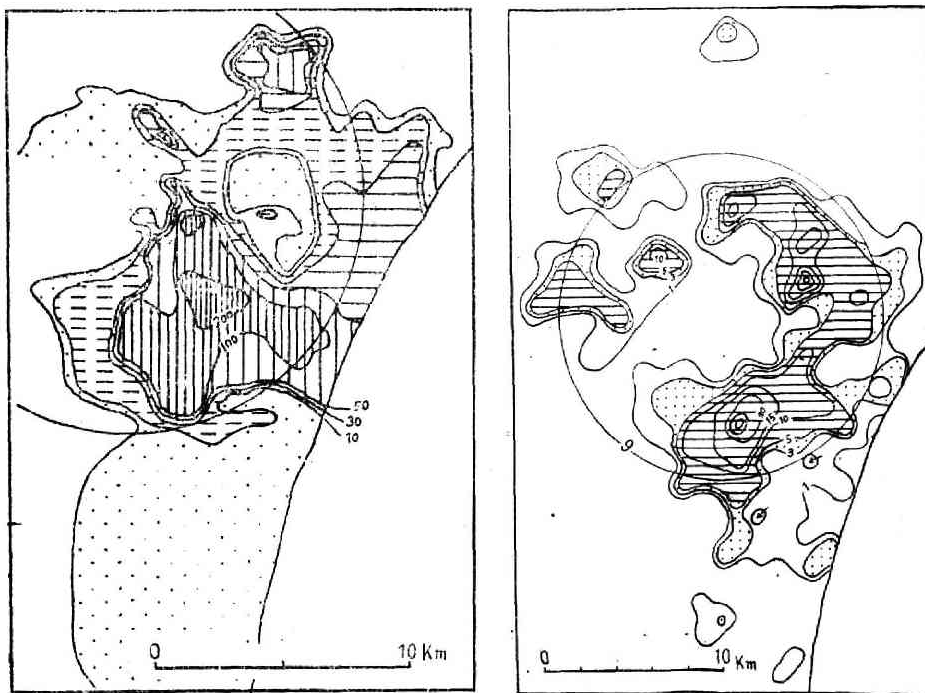


Fig. 5 Index of intensity of market gardening, expressed by amount of vegetable (kan) / acreage of dry fields (chō) (by A. Haga)<sup>17)</sup> (right)

Fig. 6 Index of city visiting on foot, the distribution of country-inhabitants who visit the city on foot in Nov. 20, 1949. (Figures show its number per 4 sq. km) (calculated from the data by A. Haga)<sup>18)</sup> (left)

- 19) Those are the communities except Nishitaga, which was annexated before then in 1931.  
 17) Geographical Structure of the Vegetable Supply Region, Vicinity of Sendai city, by A. Haga, Ann. Tohoku Geogr. Assoc. Mar. 1951 pp. 33-39. (in Japanese)  
 18) Traffic Analysis of Background of Sendai, by A. Haga, Ann. Tohoku Geogr. Assoc. Oct. 1952, pp. 14-21 (in Japanese)

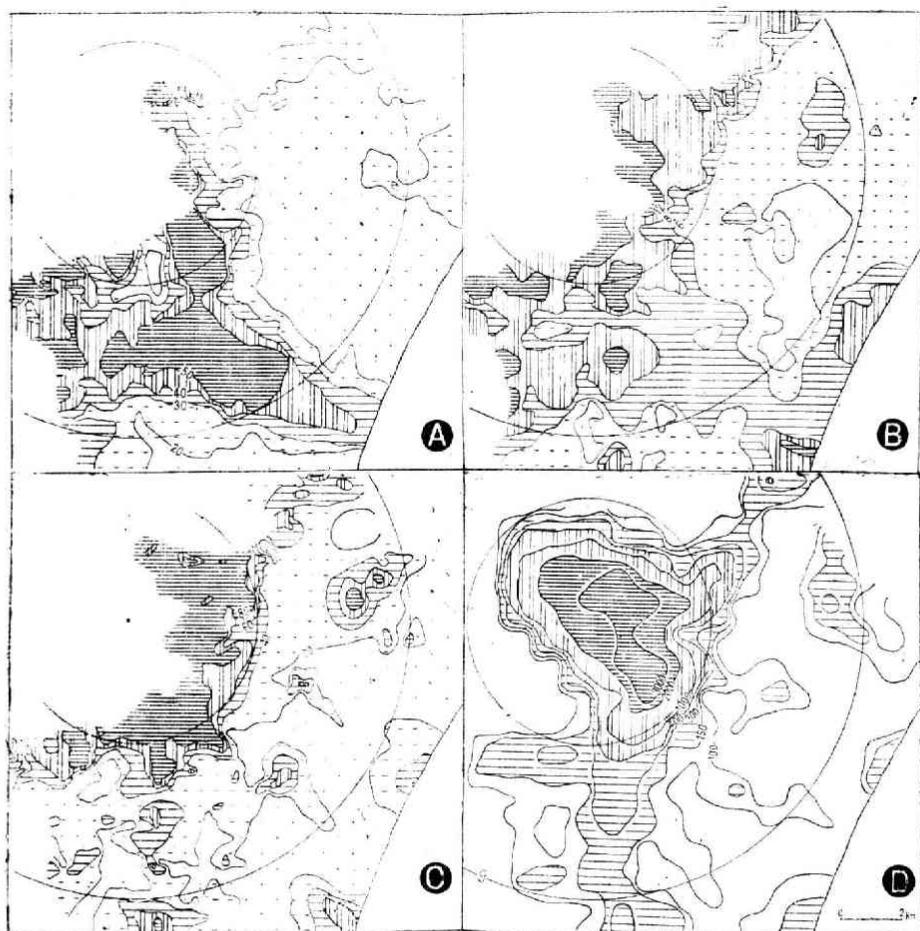


Fig. 7

Some sheets of isopleth maps. (by the data on address units)

A : cultivating dry fields / whole cultivating land of farms (%)

B : Population in farm households / cultivating land (pop. / chô)

C : Non-farm homes / non-farm, part time farm and farmhomes (%)

D : Population per sq. km.

accompanying their horse (cattle) cart or hand cart. This raised in this area vigorous market gardening with the utilization of city wastes as fertilizer. Concerning the former, the number of city attendants from this area is much enlarged by those, who used their own or official bicycles to save the heavy expense for commuting, besides nearly 4,000 of commuters. Furthermore, the young men in this area can habitually share the night atmosphere of the city with the city dwellers, socially, culturally, or amusementally without any worry

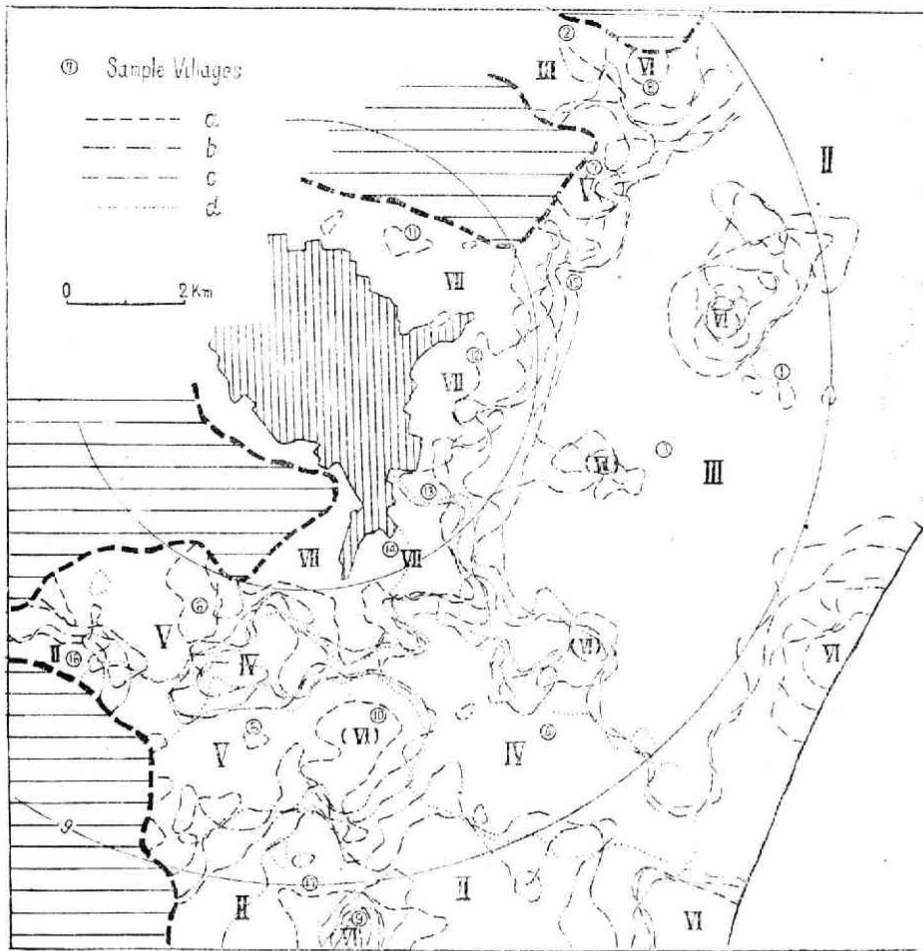


Fig. 8

Synthesized areal pattern in the suburban zones. (data by address units)

- a : Ratio of non-farm homes (Fig. 7-C). 44, 80 %
- b : Average farm scale. 0.75, 1.25 chô
- c : Population in farm homes per cultivating land (-B). 6, 8 pop. per chô.
- d : Farms cultivating more than 1 chô of dry field / whole farms. 60 %.

for returning home, for instance by visiting his fellows, enjoying the night shows of cinema or amusements varieties. Such close combination is also found in the buying-habits. Thus the area is associated with the city in the major part of their social and economical life.

However, this does not mean in itself an areal homogeneity. There seems to exist striking areal differences within this zone especially in the appearance of farming and dispersed urban houses. To study this zone in

detail, the isopleth maps of some elemental factors are provided by the data on the minimum units of addresses (Fig. 7). The city built-up area is discriminated by the field observation and by the distribution of the farm land which was admitted legally to be used for other purposes<sup>20)</sup>. These are synthesized into Fig. 8 and the five areas are divided according to the assembly of the lines. Next, the sampled villages, one or two in each area, are studied by means of questionnaire cards<sup>21)</sup>. In this procedure, 567 homes were surveyed and the result is as follows.

			A	B	C	D	E	F	G
1	III	Okada	33.5	8.8	15.4	65.2	13.3	2.3	3.3
2		Daiyashiki	51.3	4.5	17.2	45.2	19.0	4.5	16.1
3		Arai	0	0	0	62.1	3.5	1.1	0
4	IV	Fukurobara	97.4	25.7	51.2	89.0	0	2.2	0
5		Yanagiu	69.0	17.5	43.2	26.7	24.4	3.8	20.6
6	V	Sanganbashi	29.4	3.6	19.4	29.5	82.3	10.0	38.2
7		Yoshigasawa	47.3	1.0	12.5	47.4	21.1	5.8	28.4
8	VI	Imaichi	23.8	3.2	18.5	50.0	31.8	6.6	27.0
9		Kitamachi	10.0	4.4	25.3	37.7	25.0	8.2	21.6
10	IV-VI	Machi(Nakada)	69.2	19.1	35.3	57.9	13.8	4.7	15.9
11	VII <sub>n</sub>	Takamatsu	75.8	14.5	66.2	86.7	3.5	4.8	34.6
12		Minaminome	80.8	15.1	64.2	80.0	25.9	6.5	19.2
13	VII <sub>s</sub>	Minamikoizumi	94.8	44.2	77.0	84.4	26.4	5.8	9.4
14		Matsubara	95.2	46.2	64.4	83.8	79.2	2.9	10.2
15	III-VII	Shinden	42.9	3.0	13.9	60.9	14.3	2.1	0
16	II-V	Kuriki	55.7	7.5	14.5	72.2	5.6	1.1	11.2
17	II-IV	Tako	39.1	5.4	23.3	52.1	0	3.0	9.4

Table II Average figures of each sampled villages (card survey)

- A : The ratio of farms selling vegetables for Sendai. (%)  
 B : The ratio of incomes by selling vegetables in whole incomes. (%)  
 C : " " " " in the incomes from dry fields.  
 D : The ratio of farms using city wastes as fertilizer. (%)  
 E : The ratio of farms purchasing rice. (%)  
 F : City attendants per farm, (people)  
 G : The income by city attending in whole incomes

- 21) The data are recorded by the Farm Land Committees in and out of Sendai, and they record both the actually housing estates together with such lots as called "institutional desert" in America. High values of such data for the limitation of city area was confirmed in Japan several times. See, *The Agricultural Aspects in Suburban Area*, by S. Sasaki, *Geogr. Rev. Jap.* 1932, *Structure of City Development*, by K. Kagami, *Geogr. Rev. Jap.* 1942. and *City Index and City Boundary*, by Y. Ogasawara, *Geogr. Rev. Jap.* 1941. (in Japanese)
- 21) The card contains more than fifty items of the questions, concerning to farm scale, family, cropping aspects, city attendants, usage of city waste, and rough estimation of home economics. The figure is not reliable as absolute data by its nature of the method, but some cares were taken for it to be accurate enough to indicate areal variation. The data were analysed through two procedures; a comparison of each village as an average, and that through a same farm scale. The detail of it were reported in the author's graduation thesis of Tohoku Univ. in 1951. (in Japanese)

### The Northeastern and Eastern Grain Farming Area (III)

In the low rice field area of Takasago, Shichigo, Eastern Iwakiri and Northern Rokugo, the farm economics are mainly supported by their grain cultivation. The vegetable incomes are less than 5 % of the whole income even in the levee area of the Nanakita River, where the most part of the dry field in this area are concentrated, in a notable amount. There is a physical condition to restrict the increase of dry field cultivation, and the farmers are forced to lay stress on the rice cultivation, which led the whole management into large-scaled and extensive one. Their average farm scale (more than 1.25 chô<sup>22)</sup>), and the ratio of dry field (below than 30 %) show the condition enough to support the farm economics and to exhaust the farm labour only with paddy cultivation. Hence, the dry fields are occupied initiatively by the extensive crops, wheats and soy-beans.

While the head crop of vegetables, Chinese cabbage, an extensive one, is yielded only for marketing to the remote larger cities, such as Tôkyô, Kyôto and Ôsaka and is forwarded in co-operation with those from other areas in the central and northern Miyagi Prefecture.

Here the vegetable sale for Sendai is practised only when trifling cashes are wanted and the vegetables of the field exceed the self-consumption. The women take the role, who carries the vegetables by hand-cart or more often in bundles and sell it from door to door in the city, and it is another phase of this custom that the sale frequently combines both in economic and in time with other purpose of city visiting, such as purchasing commodities or amusement. The ratio of the farms selling vegetables for Sendai changes from 50 % in Nanakita levee area to zero in Shichigo paddy monocultural area. The utilization of city waste is everywhere remarkable, for there are many farms who possess horse and cart, the inevitable property for transportation.

#### Market Gardening Area on the Natural Levees of the Rivers Natori and Hirose.

The area is clearly restricted to the levees, east of the Sendai-Iwanuma highway, on both sides of the Rivers Natori and Hirose. There are also distributed the large farms with more than 1.25 chô but the relative ratios of cultivating lands are quite different form the former area. Here the fertile dry field on the levees occupies a half of each farm and produces a large amount of vegetables for Sendai. Stout young farmers, including

22) The scale of the acreage in Japan. It is approximately equal to 1,000 sq. m.

masters of the families, pull their hand carts 3 times a week in the most active season for selling vegetables at the city market. Their income from vegetables is approximately computed at 20-25% of the whole incomes and about a half of dry field incomes. The other half of the dry field is devoted to grain crops, wheats and soy-beans. The kind of vegetables for sale is not so diversified, and they are only spinach, carrot, burdock, cucumber, eggplant and some others. The cultivation is rather extensive, though the use of hot-beds is often observed. This is not the very character of the so-called suburban market gardening but is to be understood as a type, mixed with the aspect of truck farming for remote markets. For examples, more than a half of the spinach, the most dominant vegetable in this area, is transported to northern cities in Hokkaido and Aomori Prefecture through the hand of brokers dwelling near the market in Sendai, whereas all of fruitage vegetables in this area have always to rival, in Sendai market, with products from the warmer countries such as Gumma, Fukushima and Yamagata Prefectures. The latter is not so large in its amount as compared with the suburban supply, but its unperiodical massive inload in dumped price often causes a great disorder on the suburban farm plan and a severe blow to their economics. Only large farms with enough paddy fields, as seen in this area, can be tolerable in such profitless and loose forwarding and endure such competition. The utilization of city waste is also large for the same reason as in the grain farming area besides the natural demand in vegetable cultivation.

Throughout the above two regions, the ratio of non-farm homes is below 40 %. The city attendants from farm homes are relatively few, as the farmers are generally rich and generous. They are in majority students and brain workers who attend the city not directly for cash income but in order to catch an opportunity for urban immigration on good conditions. The dispersion of city dwellers is also few. It is due partly to the insufficient urban atmospheres, as is usually brought in by city attendants, and partly to the wet land, frequent floods and the lack of natural obstructers against the severe west wind in winter.

#### The Nishitaga and Iwakiri Commuting Area.

Another different type is found in the major part of the area west of the Sendai-Iwanuma highway and also in the area along the Sendai-Iwakiri throughfare at the foot of northeastern table land. The ratio of the dry field is as high as in the Natori River levee area but the vegetable sale is not so active. This is because the farm sale is too small, or, in other words, the total cultivated land is scarce for population. Such character originated in connection

with topographical traits in feudal days and have been preserved by the inhabitants' conservatism<sup>23</sup>. There were subsidiary works, such as making paper or devil's tongue. These remains still now in the southern bank of the Natori River and were replaced by the striking suburbanization on the Nishitaga terraces. The farms maintain only less than 0.75 ch<sup>2</sup> in most villages, and the dry fields are divided into too many units of self-consumption. There are many self-supporting or food purchasing farms. The utilization of the city waste is not successful because of the too small scaled farm management to own the horse and cart. In stead of the vegetable sale, the farm economics are usually highly dependent on the cash brought by workers attending the city. It is approximately estimated, in average, at 20-30% of the whole income, while the income from vegetable sale at 5-20 %. The attendants are mostly lower class workers making use of tram, bus and more frequently by bicycle. The housing of city dwellers is not small in number. The dry sunny land on the terrace or on the southern slope of the table land, the protection from the west wind, increasing facilities of pendurum traffic to the city and, above all, the urbanized air, caused by many city attendants, all favours the dispersion of city dwellers in this area. The ratio of non-farm homes is more than 40 % and it amounts to 80-100 % on Nishitaga terrace.

#### The Isolated Patches of the Former Rural Center Villages (VI)

The type can be found as isolated patches around the old nucleal settlements of Imaichi, Fukudamachi, Arai, Nakada, Masuda, Arahama, Yuriage and the recently developed hamlet of Monkure. Most of them have developed from Meiji Era to recent days as the service centers of surrounding rural areas. Among them Nakada and Masuda originated as post-towns and Arahama and Yuriage are combined with fishery. The aspects are somewhat analogous to that of Nishitaga area. The many small farms and part-time farms have been produced owing to their old function, and after the fail of it by suburbanization, caused the similar aspects as Nishitaga area. The commuting forms the largest dependence on the city, and the communication facilities and semi-urbanized facilities of daily consumption, which are both secured by the former function, afford an attractive foundation to the city

23) These areas are occupied since the most early days because of its aridity, and the residents had no opportunity to earn their new farm land by reclamations in the recent days. A. Haga explains it privately to the author with his several proofs. The conservatism is partly due to their unreasonable self-consciousness of inferior ability. It is expressed in their disinclination at the emigrants, especially for other rural areas, and they are obedient to the power of large city, Sendai.

dwellers' dispersion, which is given by good physical conditions in Nishitaga area. These patches will grow up in near future to be modernized satellites. The character of this type stretches out to some degrees to smaller towns along the railway, in the primary and secondary service area.

#### The Residential Suburban Zone (VII)

Inside the above mentioned area, the concentric zone of the residential suburb is inserted around the city built-up area. It is at first the rapid housing zone of city dwellers and other establishments. The legal use-changing admission of the farm land, afore said, and the distribution of non-farm homes, both clearly decrease outside of this zone at a distance of about 2 km from the built-up area (Fig. 9, 10). The population of this zone increased from 71,032 in 1947 to 84,166 in 1951, and its high density is also a characteristic aspect of this zone. These residents are accepted completely as citizens of Sendai in their social life and in enjoying the city service facilities. Another research shows the "array of expensive" such as factories, public mass dwelling, the jails, the turfs and such others, arranging on the

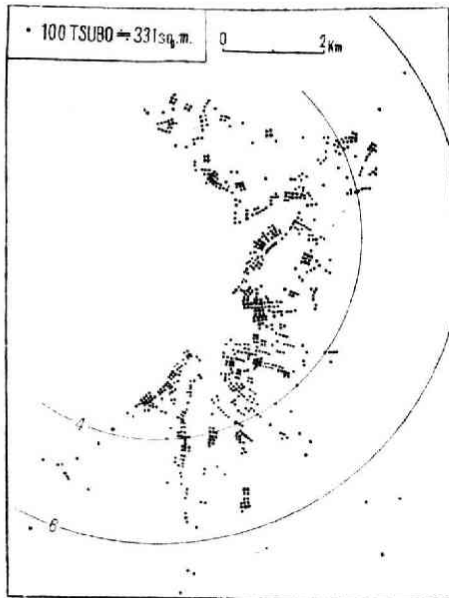


Fig. 9

Distribution of the farm lands, which are admitted legally to use for other purposes. — Change of land use for housing and other building.



Fig. 10

Distribution of non-farm households.



outer rim of this zone (Fig. 11). Among these, the residential one, public mass dwellings, predominate on the northern fringe zone and there the zone itself expands a little outwards. This is the effect of the city center excentrically north.

In the residential suburban zone, the urban air tends to destroy the neighbourhood organization of the remaining farm villages, and to drive outward the multiple thatched roofs, which are the symbol of active agricultural organization. In these retiring stages, several villages in southern suburbs, still keep their ground in the marginal zone of this area and are engaged in the farming, favoured by their situation not far from the Sendai vegetable markets in Nagamachi and Kawaramachi.

The farming is an intensive market gardening. In the area north of Sendai-Arai throughfare farmers devote their dry field, which is though less than 40 % of farm land largely to vegetables cultivation, especially to leaf vegetables, and are used to sell them to surrounding city residents or to green grocer's shops. Whereas in the area south of the Sendai-Shichigo throughfare, highly intensive market gardening has been carried on with high ratios of dry field (40-100 %). The latter is the nucleus of Sendai suburban market gardening and here the careful management of diversified vegetables has prevailingly developed with high skills and deep concerning on the commercial price, which have been mastered through the long period of professional market gardening. The estimated vegetable incomes amount to 60-80 % of that from dry-fields.

Both in the south and north areas, such intensive vegetable cultivation is mainly supported by small

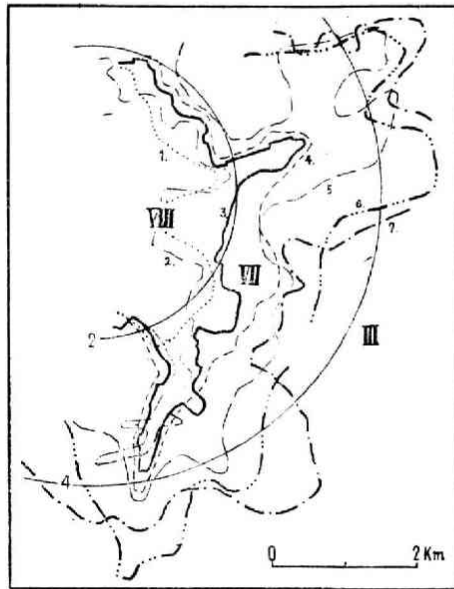


Fig. 11

Some indice of suburban pattern.

- 1: Inner limits of remaining farms
- 2: Gas service area
- 3: Built up area
- 4: The area accommodated by sewage
- 5: Water service area
- 6: Outest arranging of various expensive establishments
- 7: Inner limits of agglomeration of thatched roofs

sampled villages	means of carrying		role of carrying	
	with hand cart	with others	men	women
northern half of the suburb	35	67	18	84
southern half of the suburb	154	24	113	65

Table III The modes of vegetable sale (card survey)

owning horse cart	do		not	
	do	not	do	not
using city wastes				
sampled villages in VII	74	0	35 <sup>*</sup>	13
others	184	19	19	167

Table IV The modes of using city wastes (card survey)

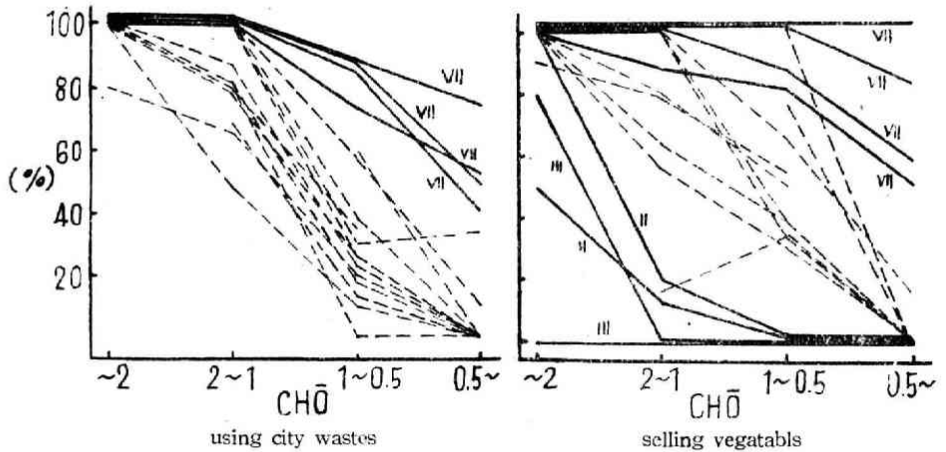


Fig. 12 Ratio of farms using city wastes or selling vegetables in whole farms and their farm scale in each sampled village. (card survey)

scaled farms cultivating less than 0.75 chô. It is due to the housing and, more essentially, to building of new factories and other large establishments. The farm land in this zone decreased from 1872 chô in 1935 to 1229 chô in 1950, while the active farms increased from 1485 to 1798 because the cessations of the farm are less in its number than the divergencies of independent farms into many part-time farms. Consequently, the shortage of the farm scale occurs. Many small scaled farms, thus formed and economically demanded an intensive land use, are, however, favoured by near by city-dwellers, green grocers and the markets, who act in the vegetable sale as the customers free from any worry of transportation by horse or cart. The farms are also free from severe blow due to the lack of information from the markets. Further,

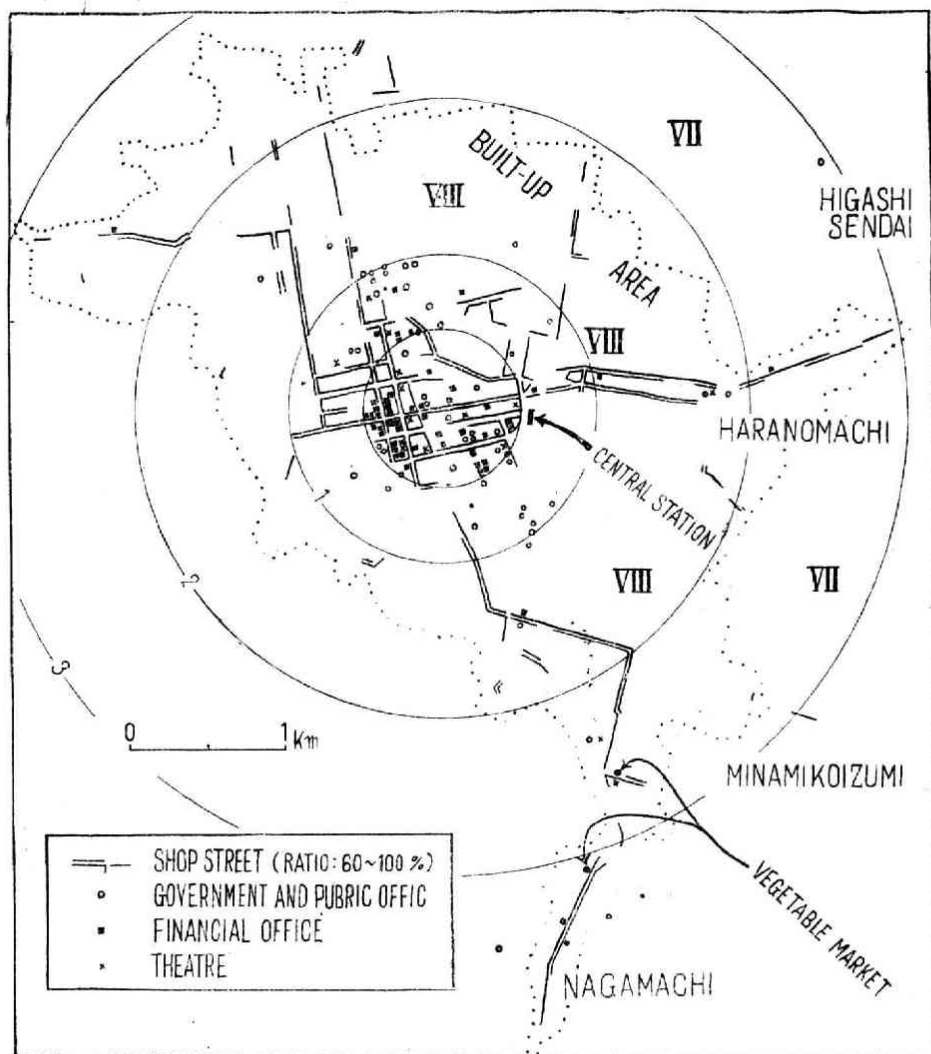


Fig 13 The patterns in the inner district.

it may be added that the utilization of city waste plays an important role on such intensive cultivation, as the waste can be used here without any horse and cart. (Fig. 12, Table III, IV)

#### City Central District and Residential Area

Though in many papers particular attentions have been paid on the structure of the built-up area of the central city, the present author is compelled to picture it in disproportionally short words, as the city destruction

by bombage during the war was so severe that the study of the central area has to be postponed till the reconstruction is completed. There are at least two zones. The central business district is clearly discriminated on the map as an area, west of the central station (Fig. 13). There is a dense pattern of retail streets, and in the same area but along different streets very clear bank quarters are found. The public and administrative offices agglomerate here and there near them, the largest of which are surrounding prefectural and municipal offices in the northern portion. The theaters, department stores, co-operative market blocks, high-class restaurants, first class hotels and many game casinos are distributed at intervals along these shop streets.

Immediately embracing this district, the city residential area is found without intercalated by any decay area. The limbs of the central shopping district stretch out into this area. They are connected with local demands of the surrounding residents. They are shown in the map in a radial pattern of homocentrical arrangement. However, these are not decentralized modern ones but are the remnants of feudal shop streets, which still reveal the original city build at the first feudal planning. Among these only Nagamachi block is the result of small scaled conurbation with an original post town. The area partly tends to decay in a similar manner as the blight area in America. It is due to the loss of such old functions owing to the development of the modern city central district.

The city residential areas fill up the spaces between these shop stretches together with many scattered neighbourhood shops. The zone is broad, but the differentiation according to the dwellers' class is not clear. The alternative layering was suggested by K. Tanabe in 1950, based on the distribution of municipal tax<sup>24)</sup>.

#### Pattern of Sendai Urban Region and Some Considerations

##### I

The areal pattern of Sendai urban region has been stated above. The concentric pattern is surely recognizable also in this city. The author classified the region into : Primary Service Area, Secondary Service Area, Farming Suburban Zone, Residential Suburban Zone, City Residential Zone and City Central District.

24) The Urban Structure of Sendai from the View Point of the Geographical Distribution of Municipal Tax, by K. Tanabe, *Ann. Tohoku Geogr. Assoc.* Oct. 1952 pp. 1-5. (in Japanese)

The primary and the secondary service areas, here used, are similar to the secondary and the tertiary service areas by Kolb<sup>25)</sup>. But his secondary area includes the character of the farming suburban zone of Sendai, which lacks his primary area as he forecasted on the case with the large cities. The secondary service area of Sendai seems to have a little weaker influence of the city than Kolb's tertiary area in cultural and amusemental aspects, except in buying-habit and in commuting from the narrow area along the railway. This discordance may probably due to both the lower level of rural life and the inferior communicational facilities other than railway in open country. To express the farming suburban zone, the most approximate synonym is the Houghton's villages zone, if not referred to some degrees to the cultural and institutional independence in his zone. This may be due to the original inferiority of such functions of rural neighbourhood villages in Japan. It corresponds also to Queen and Thomas' semi-rural urban fringe and to Dickinson's city settlement area, but the facilities, served by city, is far inferior. The residential suburban zone is just a synonym of rural-urban fringe by Dickinson. Queen and Thomas limited their metropolitan district to the area with the aspect of this zone in this study on Sendai, though they introduced the term semi-rural urban fringe, just mentioned, to this district. It is often mentioned that high class residents predominate in this zone. But this is not the case in Sendai or in Japan, where they are replaced in this

	IX	VIII	VII	III-VI	II
Population / sq. km.	14220	10030	3495	440	142
population increase (1947-1950)	38.7 %	11.1	18.3	7.4	5.0
number of member per family	4.66	4.68	4.68	4.70	4.73
pop. of multiple homes in total pop.	1.46	1.62	1.78	1.09	0.58
foreigners in total pop.	2.50	0.33	1.06	0.12	0.06
pop. of productive ages (21-40) in total.	21.9	20.0	18.8	17.0	16.8
pop. of 0-5 ages / females of 21-40 ages.	0.669	0.830	0.972	1.168	?
pop. per physicians	106	308	1049	2670	3720
" dental surgeons	384	2190	5980	15990	9650
" whole sale shops	75	915	364	∞	3630
" dry goods, apparel and accessories retailers	59	576	975	2170	1480
" eating, drinking places	45	573	1907	7940	5720
" all kinds of retailers	11	61	97	192	119
farm homes in whole homes	-	-	15.0	58.8	62.3
population in farm homes/farm land (cho)	-	-	10.4	5.9	7.5
farms with regular worker/total farms	-	-	0.3	11.8	6.3
part time farms/total farms	-	-	60.9	37.4	56.8

Tabel V Various Aspects, calculated for each zone.

25) J. H. Kolb and E. de S. Brunner, A Study of Rural Society, 1935 p. 128

zone by many residents not so favoured. This discordance arises from the inferior suburban communicative facilities, especially the scarcity of self-owned automobiles, and from the insufficient public service of water supply, gas supply, telephone, street pavement or lightning and others throughout the area. In reference to the city central district of Sendai, there is no objection to use this term in an usual sense, except that the distribution of blight area is much different from what the predecessors have informed. Table 5 shows some figures of various aspects, computed for each zone.

## 2

Some factors of distance or time appear to act a part in the formation of such a concentric pattern. The outer boundary of the secondary service area is to be expressed accurately by such words as "the area from which a majority of the country people come for a majority of their service" but the practically active area is circumscribed within limit of from three to four hour journey to the city on foot or by various facilities, including railways usually as a major one. This means one day pendulum of the rural people with time sufficient for their business. The commuting area is limited to a similar distance of from two to three hour journey by railway. This means the maximum of a stout man's physical capacity to continue his daily pendulum after the eight hour labour in the city. Of the secondary service area, the three quarter or one hour journey by bus limits the areally scattered city influence. The effective bus use gives rise in turn to the frequent bus service as economic lines in a radial pattern focussing at the city. It is an adequate distance for rural wives, to visit the city periodically under their economic and physical conditions. It is also approximately the same distance with the limit of two hour journey on bicycle, which is the maximum physical capacity for stout men to visit the city for their vegetable selling, amusemental purpose or attending their offices and factories.

Regarding to the farming suburb, it was mentioned afore that the factor of easy city visiting on foot had formed a special area, socially connected with the city, in the days when the bus service was inferior, and the one day pendulum compass of farmer's cart and easy intercourse on bicycie have raised another close relation to the city.

On the residential suburb, many factors are notable, among which the following will be of importance. All public service, such as water supply, gas supply, sewage, street pavement, street lightning, waste disposal or the uniform rate area of public communication, is usually relating to the distance

from the city central area, and the water and the gas supplies are depending especially on the distance from the ready provided area. A quarter hour distance on foot either from the terminal of street car lines or from the limits of uniform bus charge is an important factor both in economy and in frequency of communication. Moreover, one hour walk is an inevitable limit for the people who have to back home often in the midnight. The formation of more inner zones is to be traced back to the feudal days, but it is supposed that the similar factor of walking distance was also concerned in those days.

Generally the significance of all such factors is not undergoing, in their nature, gradual changes according to distance but making steplike ones, in other words, "limitations". The zoning of Sendai Urban Region is a result of such limitations together with the motive of "orderly fassion of urban growth", which refers only to a process of the movement of urban dwellers and other occupances.

## 3

However, the diversities within each zone are not negligible also in Sendai as Taylor and others denoted. Inside of the residential suburb, the aspects are either axiate or rather disorderly in its details than concentrical within the sharp boundary of two zones. Within the residential suburb, the concentric city expansion causes the adaptive changes of farm management through the decrease of farm land and others. Therefore the concentric pattern is relatively clear in its full sense. If the city area is defined by the character of its relatively weak effects of physical lay-out, as compared with the strong law of areal organization in the social and economic functions, this zone is undoubtedly an outer fringe of the city area in such a sense. Yet, it is noticed in this zone that the concentric city expansion, the promoter of other concentric aspects, is in itself composed of following three subjects having the location of their own: the high-class residents on the southward slope of the table land or on dry sunny land of the terrace and the fan; the infantile shop cluster along the main throughfares; and the factories, other expensive establishments and low class residents on the wet rice field between them.

In the more outer zone the diversity within a single zone is so conspicuous that the author illustrated it in the study of the farming suburban zone. The promoter in the area is farms, which have much to do even with the dispersion of city dwellers, and it leads all the areal pattern under the strong controle of physical setting, and nextly, of historical traits. It will be noticed that the

differences in this zone are not caused directly by natural features themselves, but the areal difference through the farm economics and activity of rural neighbourhood organizations. Such characters are more evident in the service area.

As the concentric pattern is formed by "steplike limitation", it is natural that the diversities should occur within such limitations under the influence of topography and others. It occurs in the outer zone more conspicuously, and these diversities together with its concentricity are all important as what is succeeded to an inner zone which will move from the present inner zone in the next stage. If such fashions come succeedingly, the concentric pattern with its local diversity will be easily formed, though the significance of each limiting factor will differ in every stage.

In conclusion, the author's hearty gratitudes are offered to prof. Y. Tomita and Assist. prof. K. Tanabe for their kind advices. Thanks are also given to A. Haga for his figures, here cited. The favours given by Sendai Municipal Office and its branches and by the chieives of Agricultural Associations during this survey are deeply appreciated.