# DATABASE AND DESKTOP MAPPING OF THE POPULATION AND HOUSING OF MOSCOW FOR THE ATLAS OF EUROPEAN CITIES

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ABSTRACT

This work has been realised in four stages. The first, collection of statistical data and preparing the basic map, was done at Moscow University in 1991. The second stage, desktop mapping and working out of the database, was realised in the Free University of Brussels in 1992. The third, work with the database and a search of the main trends in urban development, was done in IFRESI in 1993. The last, mapping, was done in the University of Leeds.

GIS as a new technology of spatial analysis and interpretation of databases can be used by different ways. Our goal is to use GIS for scientific analysis of trends of urban development and to present results for city planners and decision makers.

To achieve that goal we undertook statistical analysis of the database, including parameters of population and housing of Moscow with the help of correlation and cluster procedures.

Series of analytical maps were made to show the distribution of characteristics of housing stock in Moscow. Synthetic maps were also produced on the base of clusterisation procedures.

As a result we can see the distribution of housing blocks in Moscow which belong to different types of housing. Some specific zones are determined in Moscow, different in terms of age of housing, types of buildings and living conditions of population.

**Acknowlegements** - The author would like to thank Christine Leigh, John Stillwell and Liang Rao in the University of Leeds who gave an opportunity to realise the present work.

## 1. INTRODUCTION.

The formation of a united Europe gives a chance for undertaking common scientific programmes, that enable us to realise the intellectual potential of researchers from many countries.

European governments nowadays are facing the necessity of making use of GIS as the newest technology for planning and decision making in the process of city and region management.

In order to support that practical task and in order to achieve the scientific goals of the investigation of urban development trends, universities and scientific organisations in Europe are undertaking an increasing amount of research based upon GIS.

Urban investigations by GIS can be effective if several questions are approached at the same time: the selection of suitable hardware and software for production of maps, graphics and calculations; the formation of the statistical database and the selection or creation of basic maps; the selection of statistical procedures and models for analysing the database.

The main idea of the Atlas of European Cities, which is being produced at Brussels Free University, is to show the most important capitals and cities at the same scale and on the same themes, for appropraite analysis and comparison.

Moscow is one of these cities, and many general and also specifically ex-soviet difficulties were encountered while producing the database and the maps themselves.

## 2. BASIC MAP.

The first stage of the work was the creation of a basic map of Moscow showing realistic boundaries. At present, there are no detailed maps in existence of the city and agglomeration of Moscow. Basic topographic maps (Scale 1:10 000) were analysed for the delimitation of industrial, green and residential areas.

A major problem was the absence of coherent administrative divisions for Moscow and surrounding areas. Sources of information on the city (administrative boundaries of Motorway Ring) and on the region (oblast) are completely unconnected.

This is a result of the administrative and economic separation of city and region over a long period, which was a characteristic of the highly centralised politics of the former USSR.

Digitalisation was completed using the AutoCAD system.

## 3. DATABASE.

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The Moscow city database is not yet computerised. So it was necessary to do a lot of preparatory work in order to link statistical information on population and housing to the territorial units - in the case of Moscow, housing blocks.

The parameters which were taken into consideration were as follows: the number of inhabitants; distribution of housing of different ages; construction materials; number of storeys; number of persons per flat and per room; overall living space per capita, and certain others, (a full list of parameters is given at note 1).

The collection of information was quite difficult, as data from the last census of population (1989) are either expensive to obtain, not available or not detailed enough in terms of territorial units. Consequently, information on housing was collected directly at housing departments of local district municipalitets ("Soviets").

That database consisted of information on each residence, which demanded some further work on aggregation and the presentation of characteristics of the housing blocks (a total of more than 400 units).

## 4. TRANSFER.

One of the problems of multi-aspect analysis is the transfer of the data matrix and basic maps from one program to another. We have tried to make use of different database, statistical and graphic programs (Paradox; Lotus 1-2-3, Quattro-Pro, Excel; Statgraphics, SPSS; AutoCAD, Corel Draw, Atlas-GIS). However, it was frequently not easy to find the best solutions because of the difficulties of file transfer.

## 5. CALCULATIONS.

The database was analysed by statistical programs to find any links between variables and cases. We are certain that this is a very important part of any qualitative mapping. It allows the possibility of producing not only analytical, but also synthetic maps.

Analysis of statistical ranges also allowed us to produce representative intervals of parameters for mapping.

The main barrier which now exists in the way of the creation of a satisfactory GIS for cities is the lack of software, including at the same time blocks of detailed statistical analysis and cartographic interpretation of the database.

Perhaps such a combination would lead to the creation of very

NOTES:

1. The database includes the following parameters:

1.1. Share of housing built:

A. before 1917 (the year of the socialist revolution in Russia);
B. 1918-1959 (the period of "Stalin's Renaissance" in architecture);
C. 1960-1964 (the period of "Khrushchev`s construction" - mass construction of 5-storey wainscot buildings);
D. 1965-1969 (the post-Khrushchev period with multi-storey wainscot construction);
E. 1970-1979 (a period of multi-storey blocks construction);
F. after 1980 (the newest series of high-storey buildings).

1.2. Number of floors:

G. <= 4;
H. 5;
I. 6,7,8,10,11;
J. 9,12;
K. 14,16,22 and more.

1.3.

L. Share of brick-built housing;
M. Share of brick-built housing built after 1960 (the year of the beginning of mass wainscot construction).

1.4.

N. Number of persons per flat;
O. Number of persons per room;
P. Overall living space per capita;
Q. Share of housing stock provided by house-building co-operatives.

unwieldy software, but on the other hand, it would abolish the necessity to keep trying to solve the problem of files transformation from one program to another.

In any case, the necessary analysis of quite complicated databases has to include statistical analysis: correlation, factor and cluster. Moreover, at the first stage of investigation, it is necessary "to see" the distribution and links of parameters in order to realise their specificity, which means it is necessary to have representative software for graphics drawing.

### 5.1. CORRELATION.

Some of the parameters mentioned in note 1 are closely linked. In order to present this knowledge quantitatively, a matrix of correlation was calculated (Table 1).

Certain links are quite essential to the analysis, for instance that between the amount of housing built before 1917, the number of 4-storey buildings and the amount of brick-built housing.

These links show that a homogeneous socio-architectural landscape exists in the city centre. There are also analogous links for other periods of construction.

### 5.2. ANALYSIS OF PARAMETER LINKS.

With the classification of parameters having been completed, the results are demonstrated in Table 2 and on Figure 1.

The proximity clusterisation algorithm from SRSS for Windows was used here.

The most satisfactory variant contains 8 clusters and confirms the previous correlation analysis.

### 5.3. ANALYSIS OF UNITS GROUPS.

At the first stage of cluster analysis, 3 groups of parameters were taken into consideration separately.

Quick clusterisation algorithm with iterations from SPSS for Windows software was used here. Other algorithms could not be used because of a large number of spatial units.

The first group included characteristics of housing age (variables A-F); the second one consisted of parameters describing types of buildings (variables G-M), and the third group had variables concerning the standards of living

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | 0.1 | | | | | | | | | | | | |
| C | -0.2 | 0.1 | | | | | | | | | | | |
| D | -0.2 | -0.2 | 0 | | | | | | | | | | |
| E | -0.2 | -0.4 | -0.4 | -0.2 | | | | | | | | | |
| F | -0.2 | -0.3 | -0.4 | -0.3 | -0.1 | | | | | | | | |
| G | **0.5** | **0.8** | 0.1 | -0.2 | **-0.5** | **-0.5** | | | | | | | |
| H | -0.3 | -0.1 | **0.5** | 0.4 | -0.1 | -0.3 | 0 | | | | | | |
| I | **0.8** | 0.3 | -0.2 | -0.2 | -0.3 | -0.2 | **0.6** | -0.2 | | | | | |
| J | -0.2 | -0.4 | -0.4 | -0.3 | 0.2 | **0.8** | **-0.5** | -0.3 | -0.3 | | | | |
| K | -0.1 | 0.3 | **0.7** | 0.3 | **-0.5** | **-0.5** | 0.3 | 0.4 | -0.1 | **-0.5** | | | |
| L | 0.3 | **0.7** | 0 | -0.2 | -0.3 | -0.3 | **0.7** | -0.1 | 0.2 | -0.3 | 0 | | |
| M | -0.4 | **-0.5** | -0.3 | 0.2 | **0.7** | 0.1 | **-0.6** | 0.1 | **-0.5** | 0 | **-0.5** | -0.4 | |
| N | **0.5** | 0.1 | -0.3 | -0.2 | -0.1 | 0 | 0.3 | -0.3 | 0.4 | 0 | -0.2 | 0.3 | -0.2 |
| O | -0.2 | 0 | 0 | 0 | 0 | 0.1 | -0.1 | 0 | -0.1 | 0 | 0 | -0.1 | 0 |
| P | 0.4 | 0.1 | -0.1 | -0.2 | -0.1 | 0 | 0.3 | -0.2 | 0.3 | 0 | -0.1 | 0.2 | -0.2 |
| Q | -0.2 | -0.4 | -0.2 | 0 | 0.4 | 0.3 | **-0.5** | -0.2 | -0.3 | 0.4 | -0.3 | -0.3 | 0.3 |

| | N | O | P |
|---|---|---|---|
| O | 0.2 | | |
| P | 0.2 | -0.3 | |
| Q | -0.2 | -0.1 | 0 |

Table 1. Matrix of correlation.

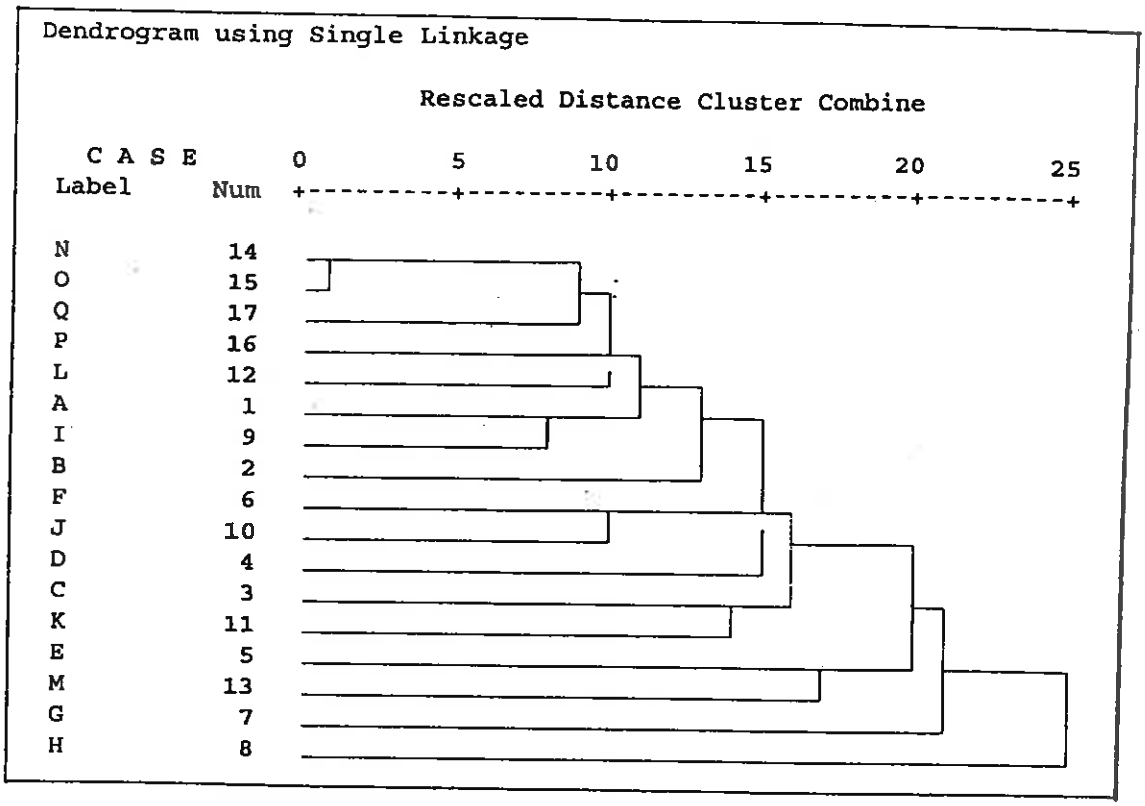



Figure 1.

| | | Number of clusters | | | | | |
|---|---|---|---|---|---|---|---|
| Label | Case | 10 | 9 | 8 | 7 | 6 | 5 |
| A | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| B | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| C | 3 | 3 | 2 | 2 | 2 | 2 | 1 |
| D | 4 | 4 | 3 | 3 | 3 | 1 | 1 |
| E | 5 | 5 | 4 | 4 | 4 | 3 | 2 |
| F | 6 | 6 | 5 | 5 | 1 | 1 | 1 |
| G | 7 | 7 | 6 | 6 | 5 | 4 | 3 |
| H | 8 | 8 | 7 | 7 | 6 | 5 | 4 |
| I | 9 | 1 | 1 | 1 | 1 | 1 | 1 |
| J | 10 | 6 | 5 | 5 | 1 | 1 | 1 |
| K | 11 | 9 | 8 | 2 | 2 | 2 | 1 |
| L | 12 | 1 | 1 | 1 | 1 | 1 | 1 |
| M | 13 | 10 | 9 | 8 | 7 | 6 | 5 |
| N | 14 | 1 | 1 | 1 | 1 | 1 | 1 |
| O | 15 | 1 | 1 | 1 | 1 | 1 | 1 |
| P | 16 | 1 | 1 | 1 | 1 | 1 | 1 |
| Q | 17 | 1 | 1 | 1 | 1 | 1 | 1 |

Table 2. Variants of variables clusterisation

(variables N-Q).

The results of clusterization are in table 3.

Ten clusters on housing age demonstrate ten zones (circles) in the city, from very old inner city centre to younger city periphery.

Classification of types of buildings shows that there are 2 groups of quite homogeneous brick-built housing stock, one mainly 4-storey and the other 5-storey buildings.

The next group contains mainly brick-built buildings, but most of them were built after 1960, when wainscot construction has being started, and these are mainly 5,6,7,8,10-storey constructions.

The fourth group is similar to the previous one, but the buildings all have 5 or 9 storeys.

The next cluster consists of 2 unique units, where half of the buildings are in brick, the main part of which were built after 1960 and half of them having less than 4 storeys.

The next groups do not have a high percentage of brick housing and differences between them concern mainly the number of floors.

The third clusterization gave us 5 groups of housing blocks with differing living conditions. The first group contains units from the inner city centre, with the highest parameter of inhabitants per flat and at the same time with the highest indicator of flat living space per person. This is the area of the so-called "communal" flats.

The two last groups are characterised by a high percentage of housing stock being provided by house-building cooperatives, and also by quite good indicators of living space per capita. These are housing blocks for families with high incomes and quite good living conditions.

The majority of housing blocks belong to the cluster with the highest parameter of persons per room, and quite high numbers of persons per flat. Parameters of the last group are middle in any terms.

At the second stage, all the parameters (A-Q) were used for clusterization. The main problem in such an investigation is to find **the golden mean** between what is unique and what is general. That means that it is quite difficult to find optimal number of clusters to describe real urban situation correctly.

In order to realise this particular goal, ten variants of clusterization were produced in order to discover the best quantity of clusters, and their number was increased from 10

to 20. The variant from ten clusters is shown in Table 4. This classification is a little different from the first one, when variables were taken separately, but the main idea is retained.

## 6. MAPPING.

Maps were produced using ATLAS*GIS software. They show density of population (Figure 2), structure of land use (Figure 3), age of housing stock (Figures 4-10), quality of housing stock (Figures 11-17), quality of life of Muscovites (Figures 18-22). The resulting clusterisation is shown on Figure 23.

There is a considerable problem when undertaking computer mapping if only poor quality printing facilities are available. In these cases, maps do not look professional, especially where it is impossible to use enough colours and styles of drawings.

The series of maps on Moscow showing the aspects mentioned above gives good support for spatial urban analysis and decision making.

They allow us to see real differences in types of construction; "waves" of city area development; and more or less problematical housing blocks in terms of living conditions of their inhabitants, (eg. blocks with low living space per capita or with a number of "communal" flats).

Typical periods of construction, as mentioned in note 1, are characterised not only by specific types of buildings but also by the place in the city where they were built. Therefore as a result there are quite specific zones in Moscow with different housing stocks.

## 7. RESULTS: GROUPING OF MOSCOW CITY BLOCKS BY HOUSING STOCK AND POPULATION.

### 7.1. CENTRE.

Central Moscow is characterised by a high proportion of housing built before 1917. A considerable part of housing here has no more than 4 floors, and is brick-built.

But the central area is not only the oldest part of the city in terms of housing, it is also already the most altered area. In the case of Moscow, the normal processes of reconstruction were aided by the unfortunate process of the destruction of historic and valuable houses during soviet period.

In this way, 40% of the buildings pulled down in Moscow at this time were historically and architecturally valuable,

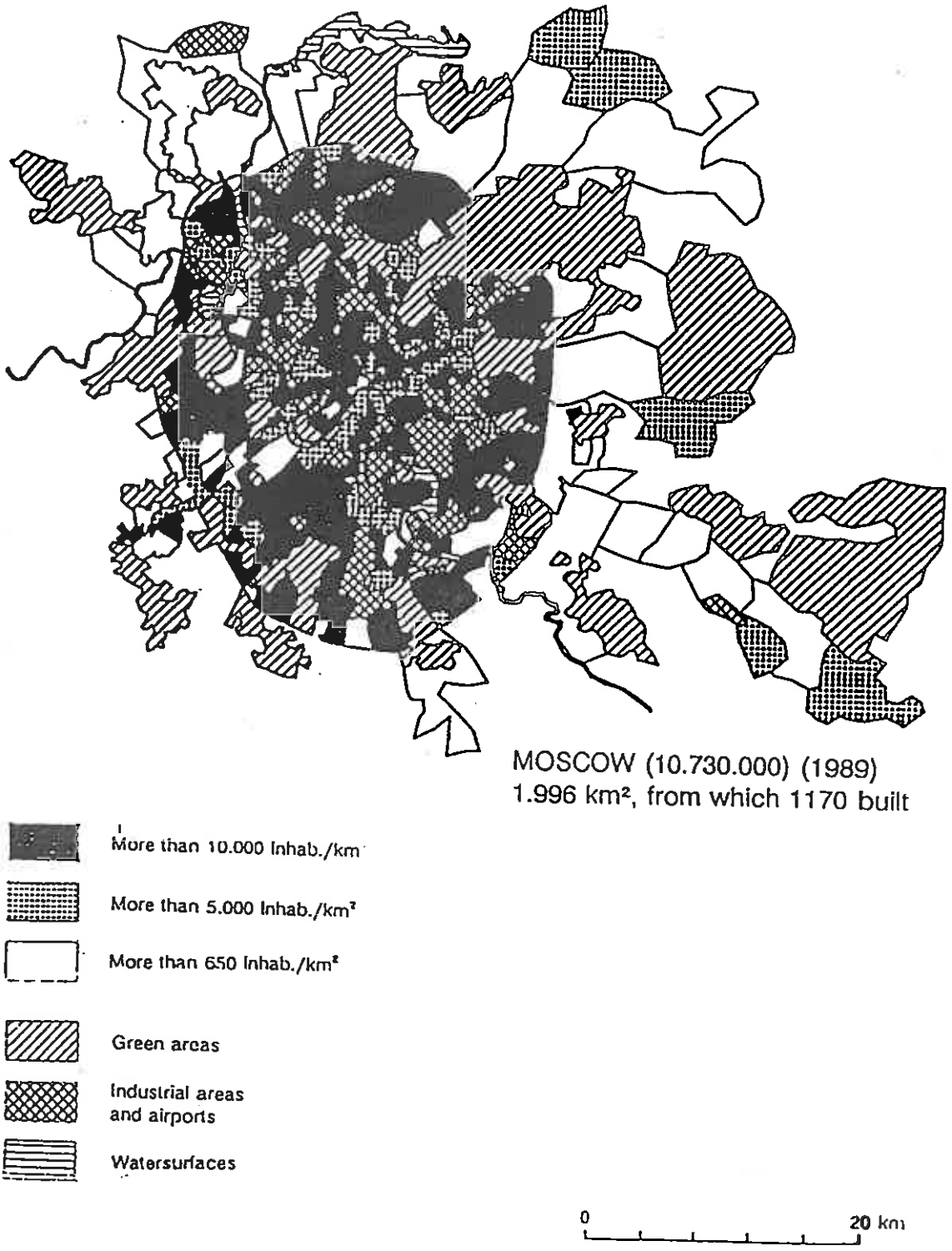



Figure 2. Extensial of the morphological agglomeration and population density.

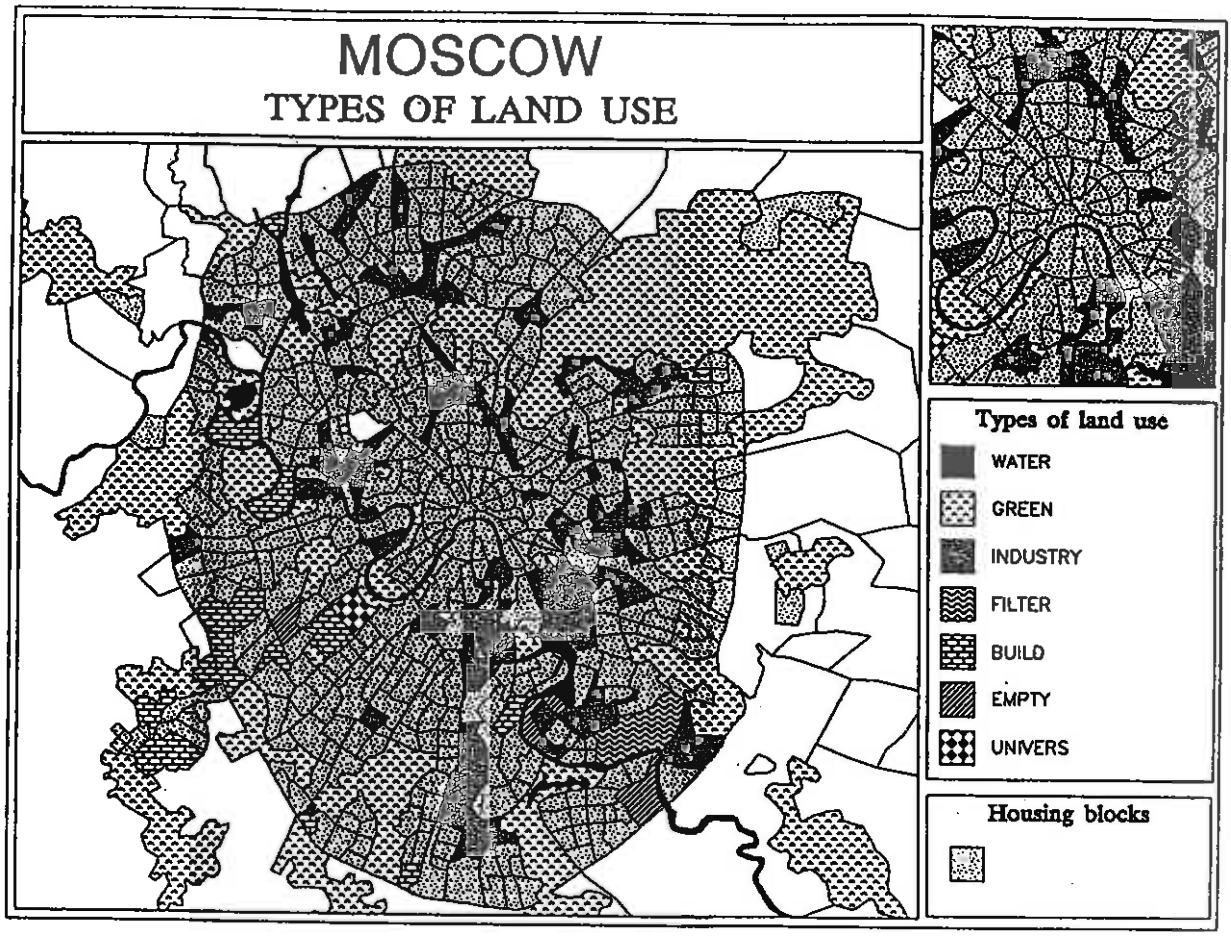

MOSCOW
TYPES OF LAND USE
Types of land use
WATER
GREEN
INDUSTRY
FILTER
BUILD
EMPTY
UNIVERS
Housing blocks

Figure 3.

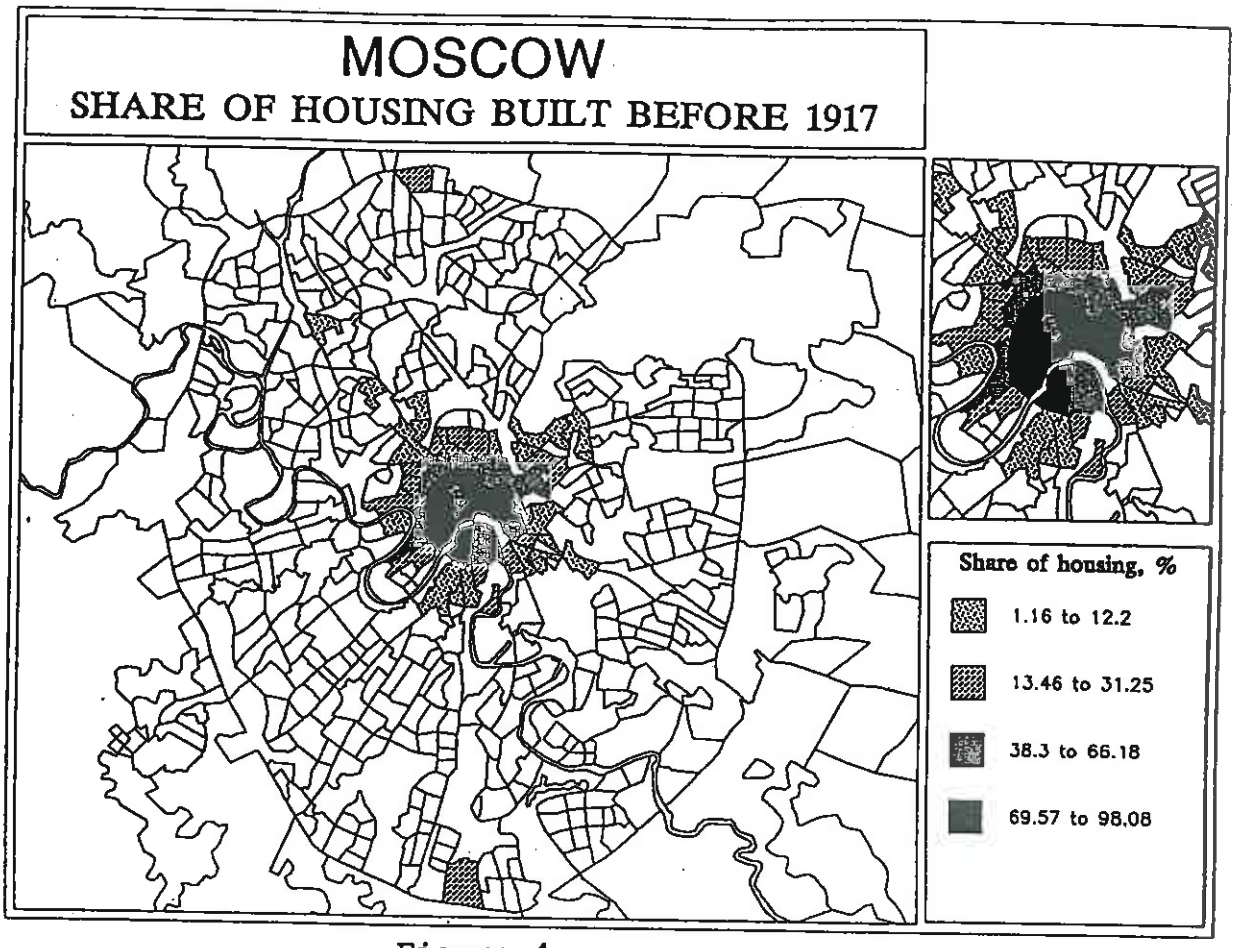



Figure 4.

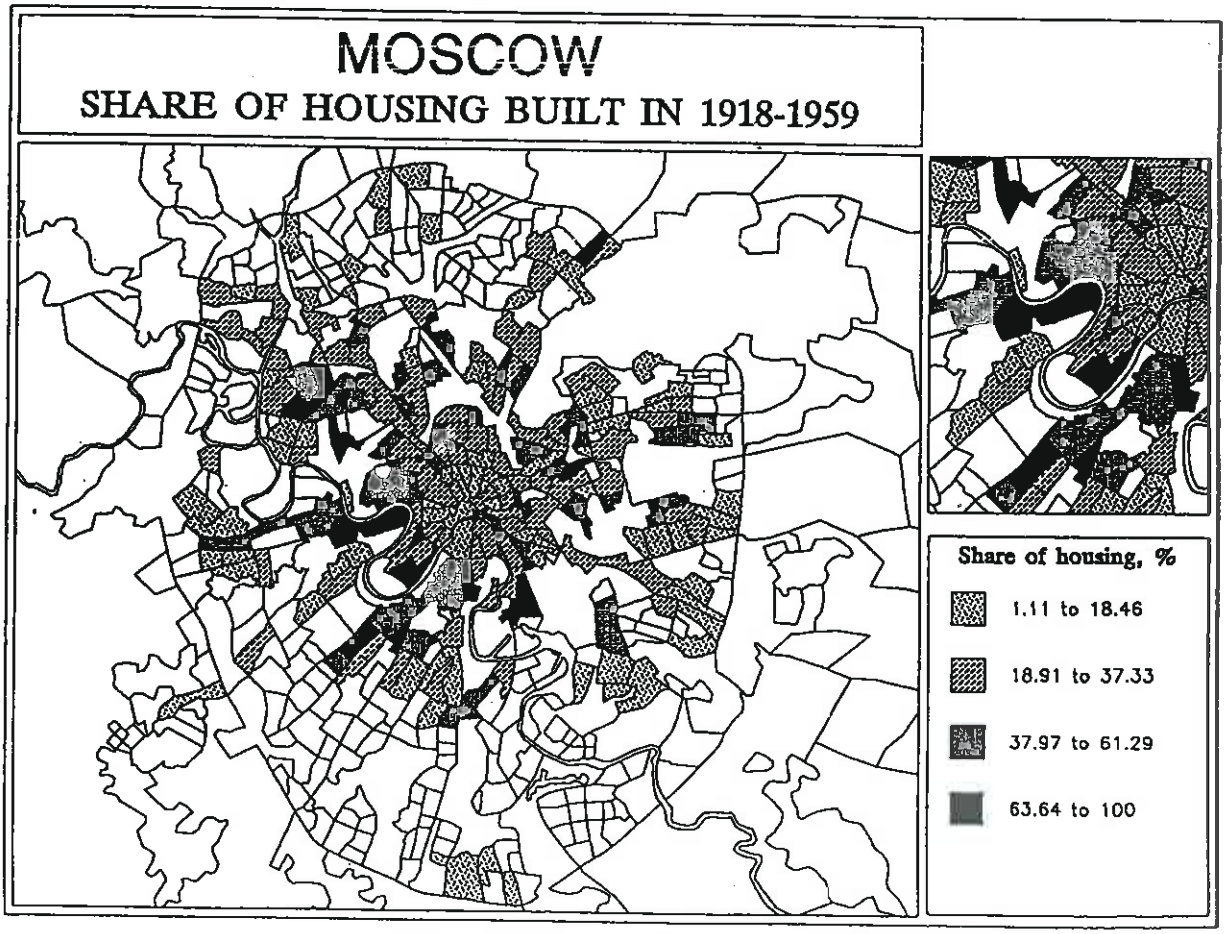



Figure 5.

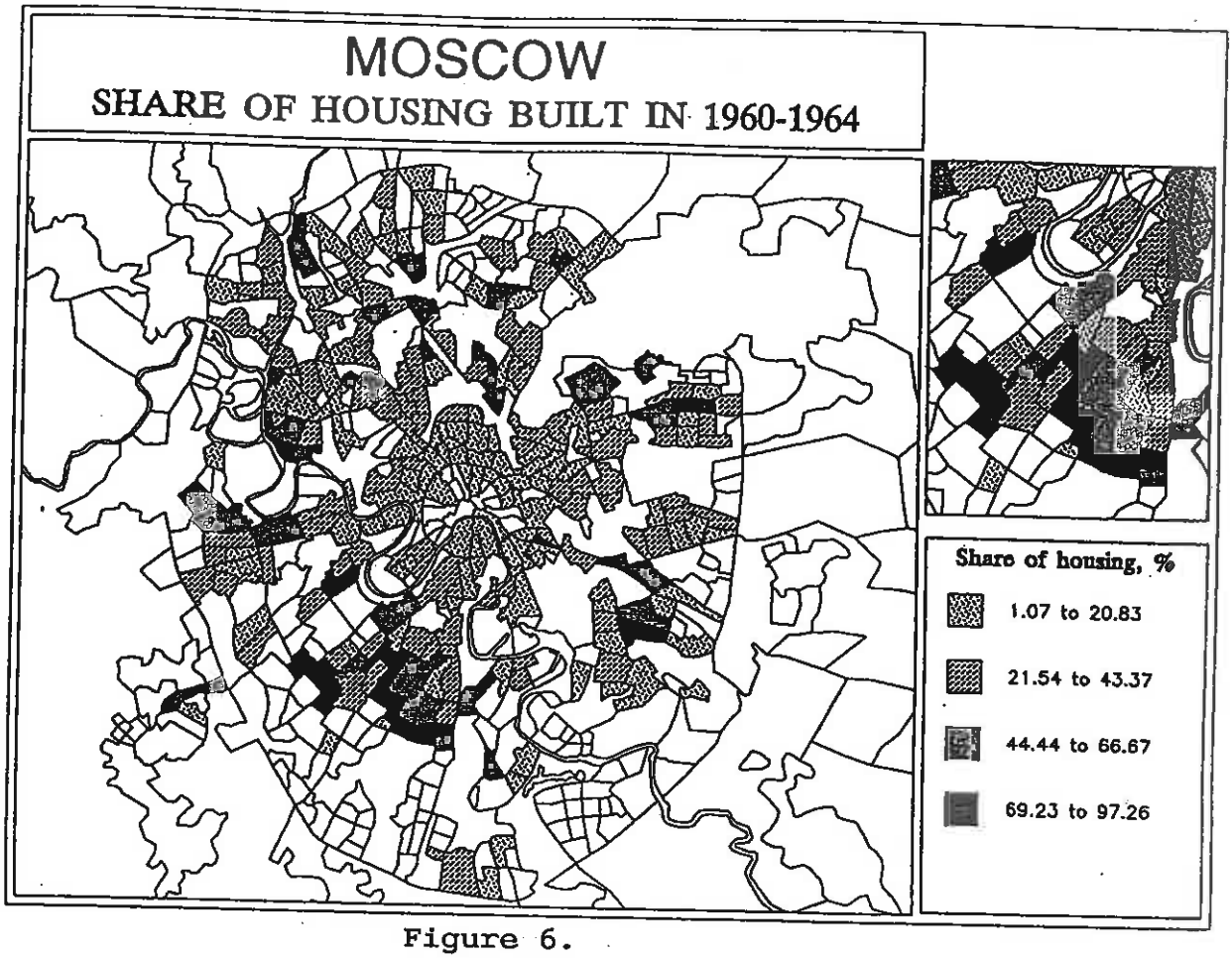



Figure 6.

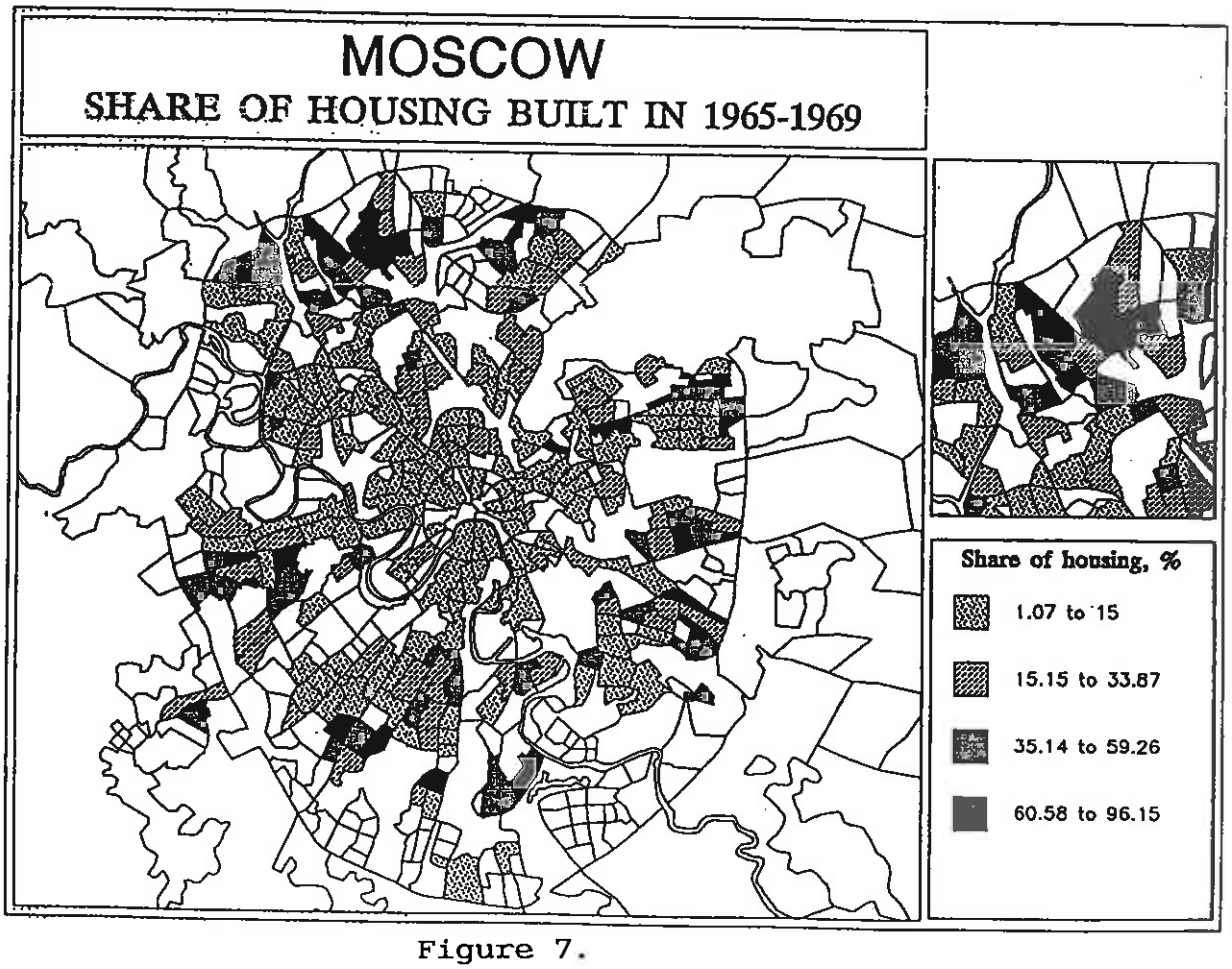



Figure 7.

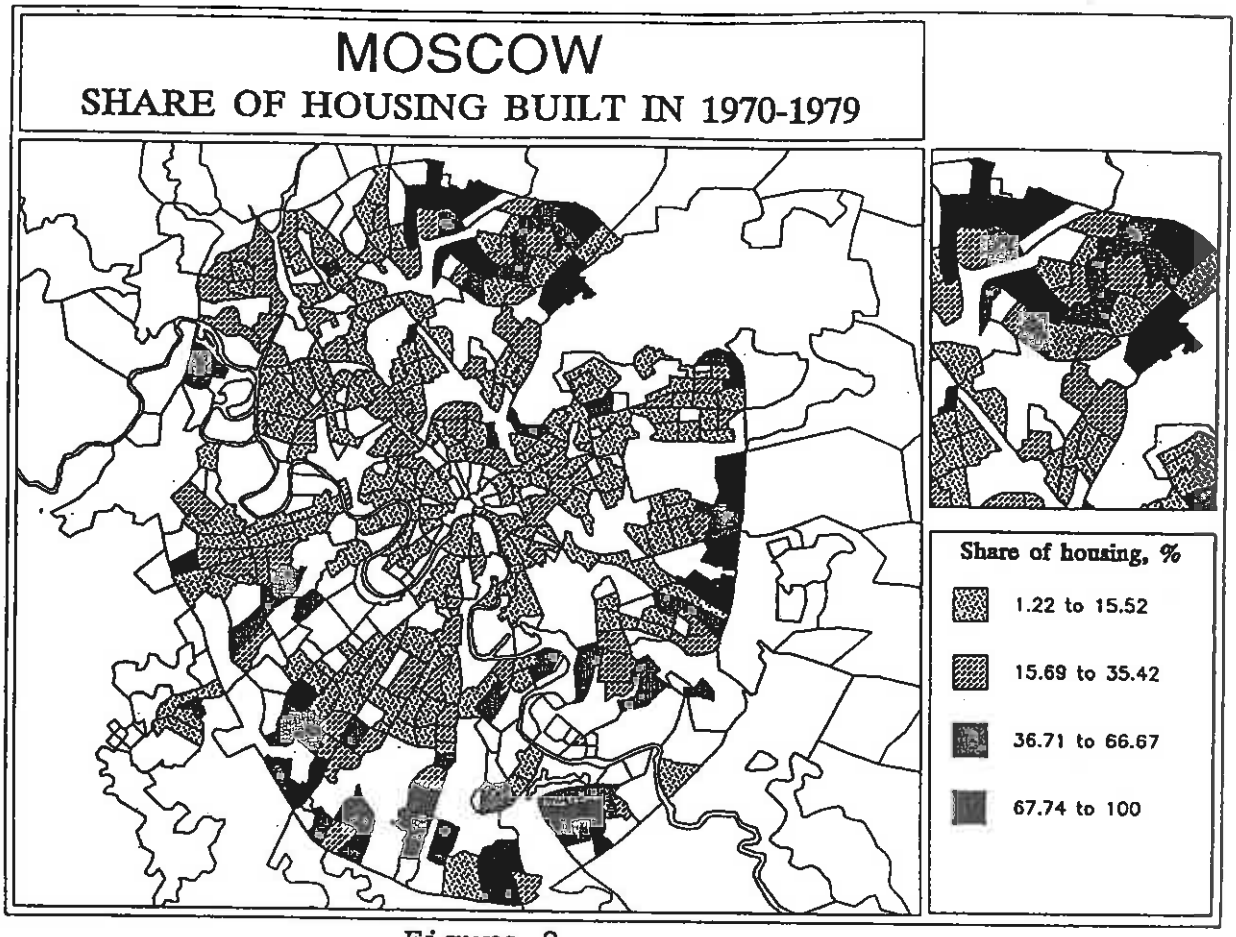



Figure 8.

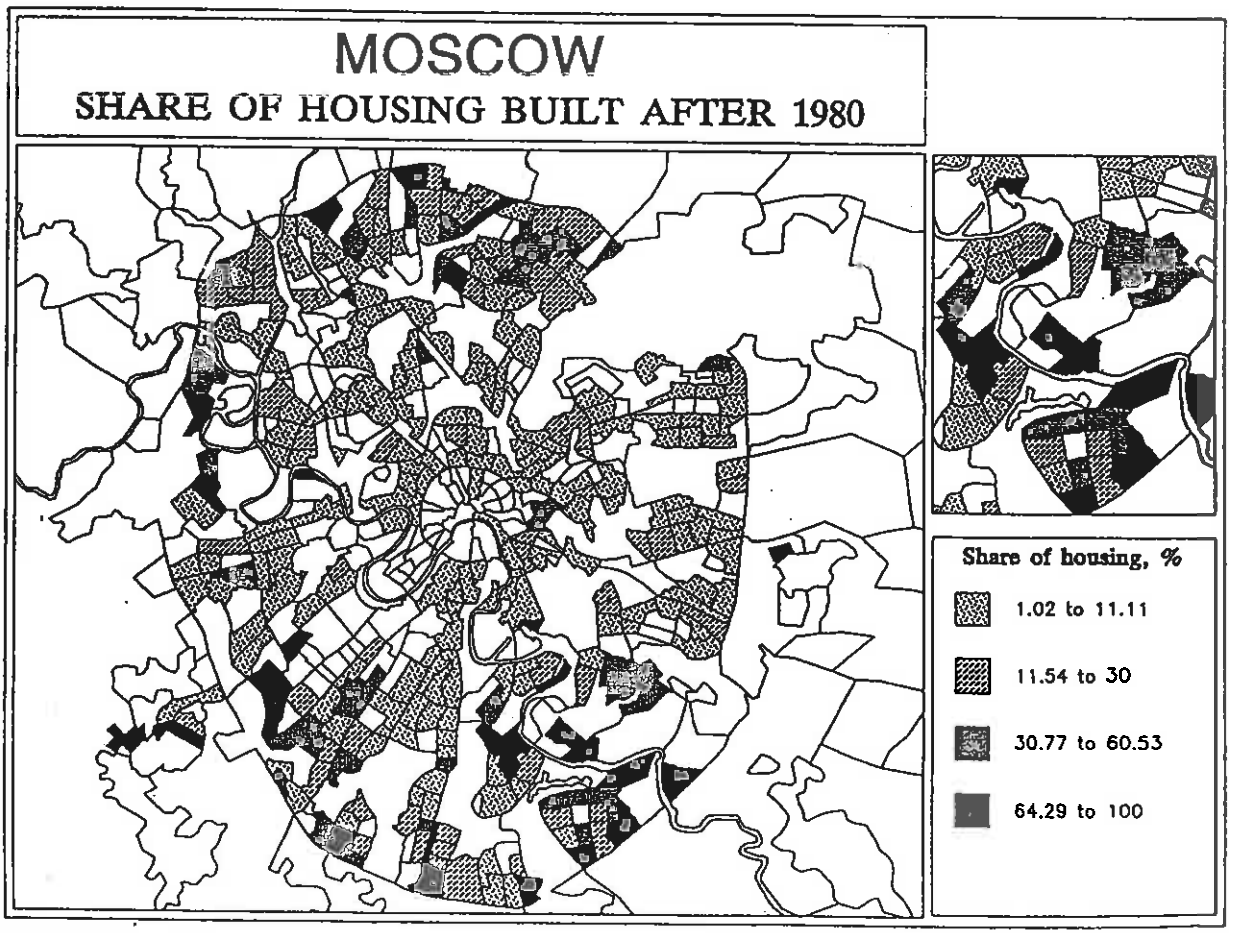



Figure 9.

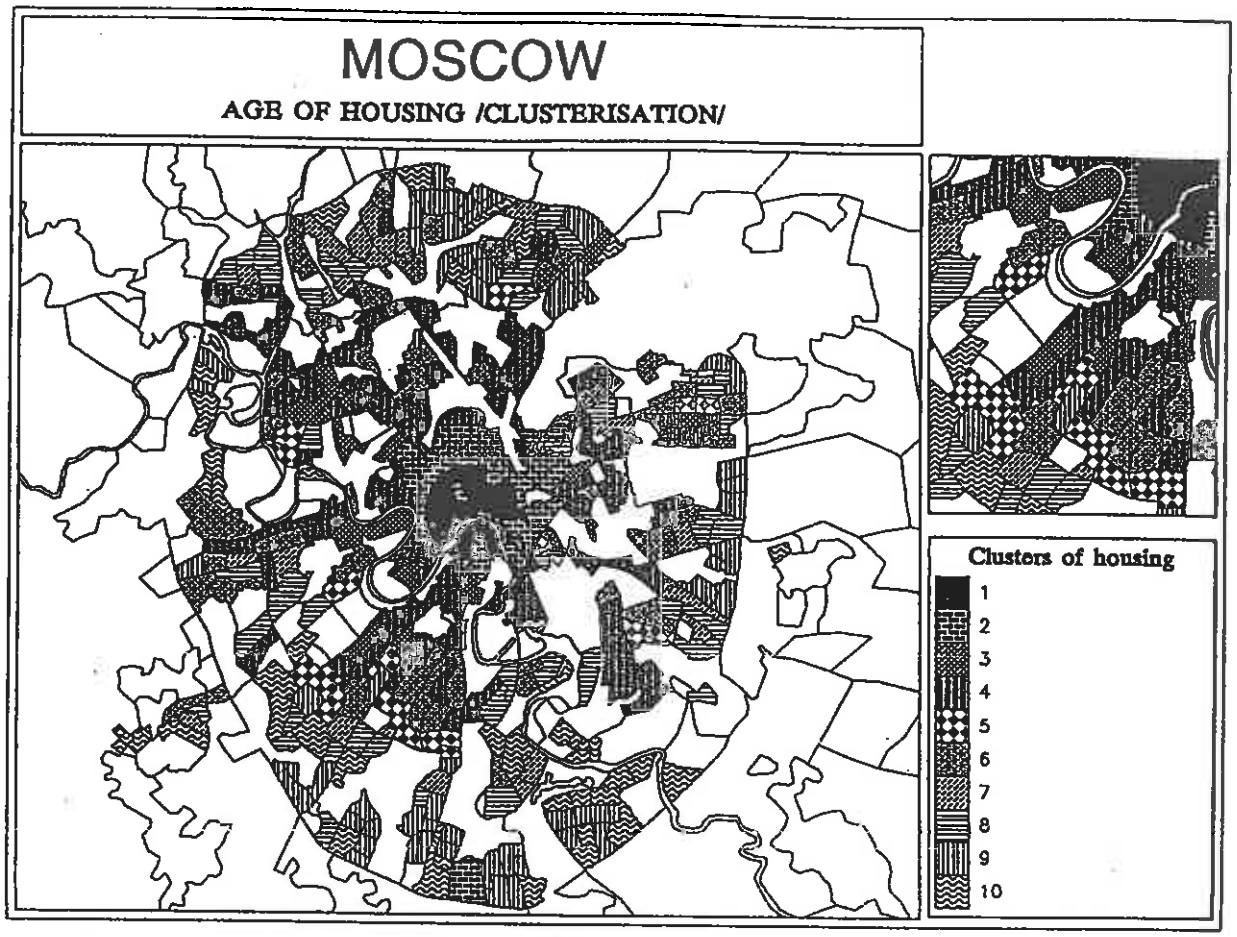



Figure 10.

Final cluster centers

| Cluster | A | B | C | D | E | F | Number of cases |
|---|---|---|---|---|---|---|---|
| 1 | **81.7** | 14.2 | 1.2 | 1.6 | 1.1 | 0.1 | 19 |
| 2 | **24.2** | **27.3** | 11.1 | 7.3 | 18.3 | 11.7 | 47 |
| 3 | 0.6 | **80.2** | 6.9 | 4.3 | 4.5 | 3.5 | 22 |
| 4 | 1.2 | **39.7** | **33.7** | 10.8 | 10.4 | 4.2 | 78 |
| 5 | 0 | 4 | **79.4** | 7 | 6.9 | 2.8 | 20 |
| 6 | 0.1 | 7.1 | **43.1** | **30.8** | 11.5 | 7.4 | 53 |
| 7 | 0 | 0.7 | 5.9 | **75** | 11.1 | 7.2 | 24 |
| 8 | 0.1 | 4.8 | 6.9 | **36.8** | **37.6** | 13.8 | 43 |
| 9 | 0 | 0.3 | 0.6 | 0.7 | **82.1** | 16.3 | 59 |
| 10 | 0.3 | 1.4 | 0.6 | 0.4 | 9.1 | **88.2** | 45 |

Table 3. Clusterisation of housing on age (A-F)

(Glushkova 1988).

In place of these older buildings are now other houses put up at different periods of construction. The share of housing built between 1918 and 1959 is especially high.

But at the same time, there are many houses built during more recent decades. All these buildings have various number of floors, up to 16-storeys, but fortunately most are brick-built, (even the newest ones), which makes them more suitable for the urban landscape of the city centre.

In any case, central Moscow is now an area of very heterogeneous architecture.

The situation with respect to the varying uses of housing stock in the city centre was considered next.

At first there were many so called "communal" flats here. "Communal" flats are those where there is more than one tenant; these tenants having one or two rooms in multi-roomed flat, and using the same kitchen and bathroom.

This phenomenon has existed in the centre of Moscow since 1918, when the decree concerning abrogation of rights of private property (real estate) in the cities was promulgated, and residences of noblemen and merchants were populated by workers.

Thus the share of workers' families within the limits of the Garden Ring (the inner centre of Moscow) was 50% in 1920, whereas in 1917 it was only 5%. Nowadays in the central part of Moscow, there are 60% of people living in "communal" flats, while for Moscow as a whole this figure is 20%.

In the city centre, the housing stock provides more living space per capita than in other parts of city, as the rooms in the older houses in this area are more spacious than normal. At the same time, the communal flats sometimes do not have modern conveniences - for example many flats do not have bathrooms.

Specific social-demographic strata of the population tend to live in "communal" flats in the citycentre. In the main these are elderly single women, divorced middle-aged men, single women with babies, and families of "limiters" with large families.

"Limiters" are unskilled workers, systematically hired by Moscow industrial enterprises. After several years of working, they receive the right to register their passports and to take up more permanent residence in their flat in Moscow.

This group in the population creates a specific social climate

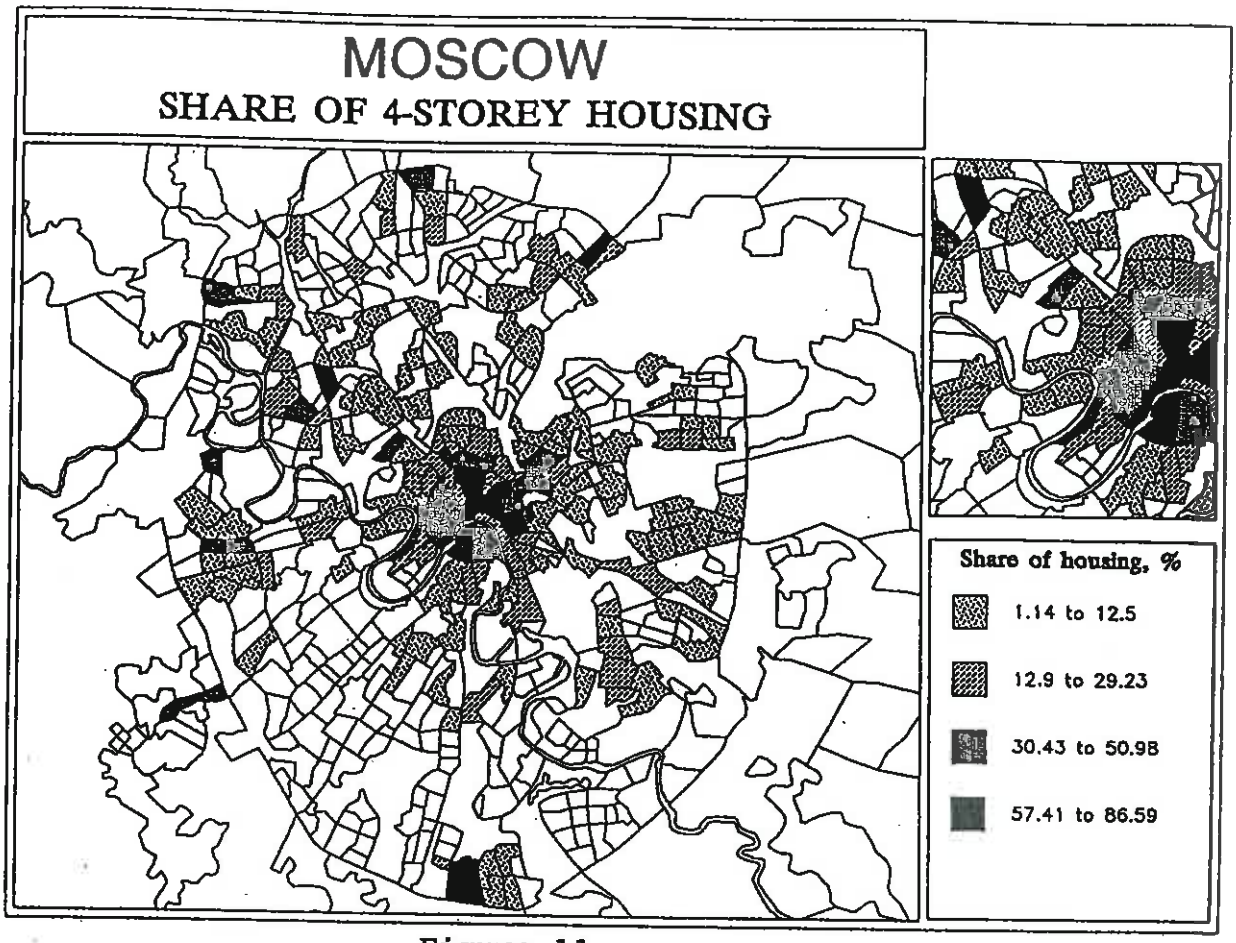



Figure 11.

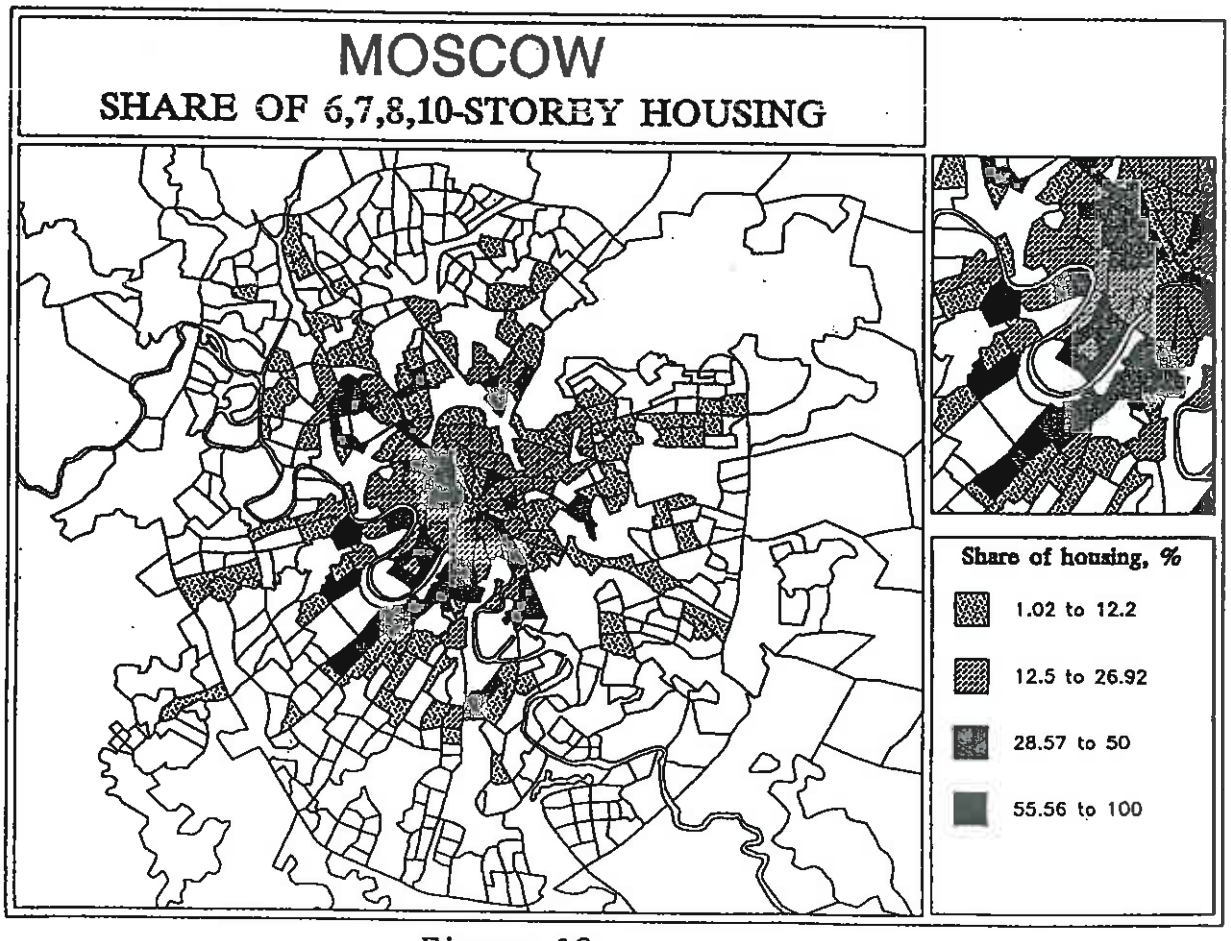
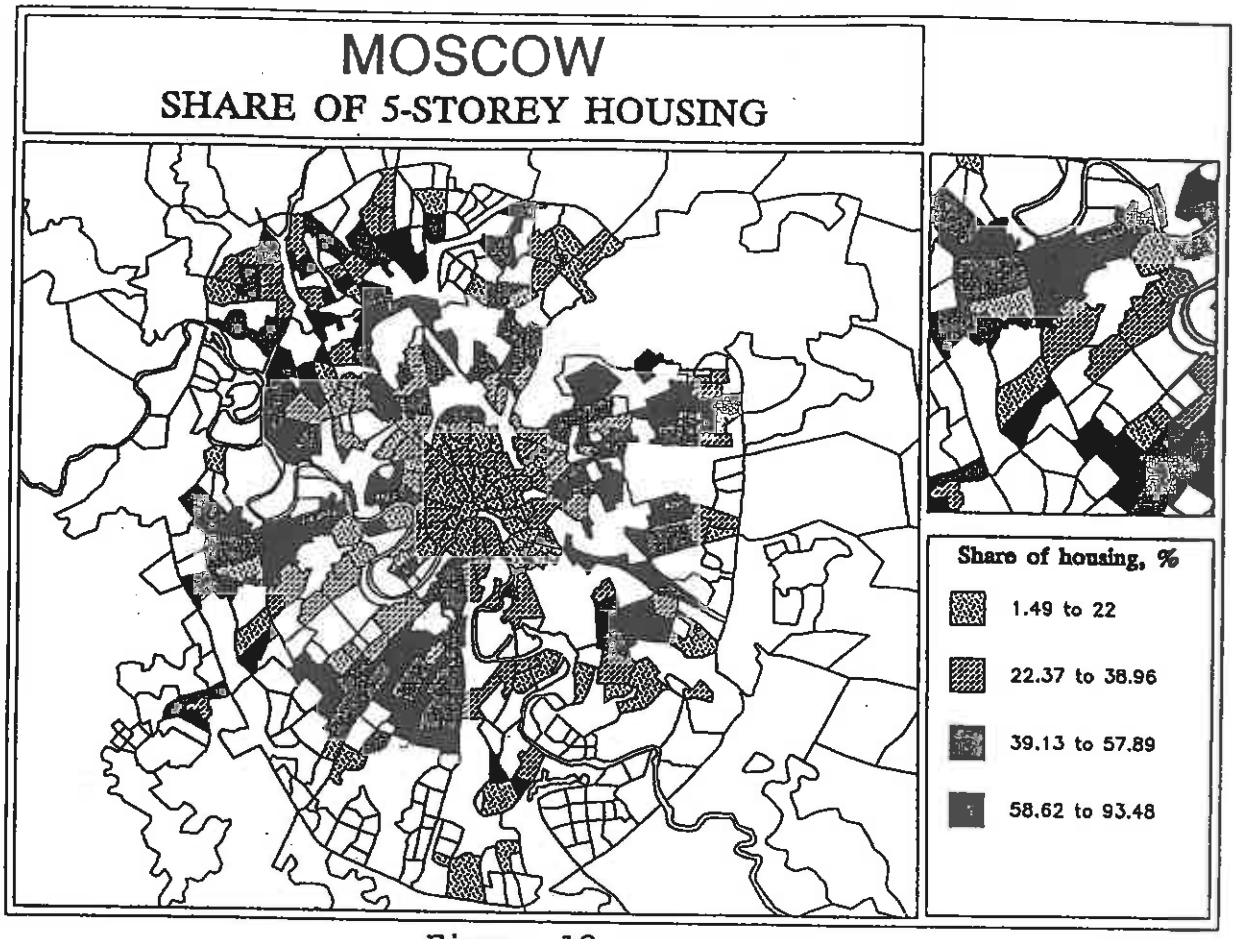



Figure 12.

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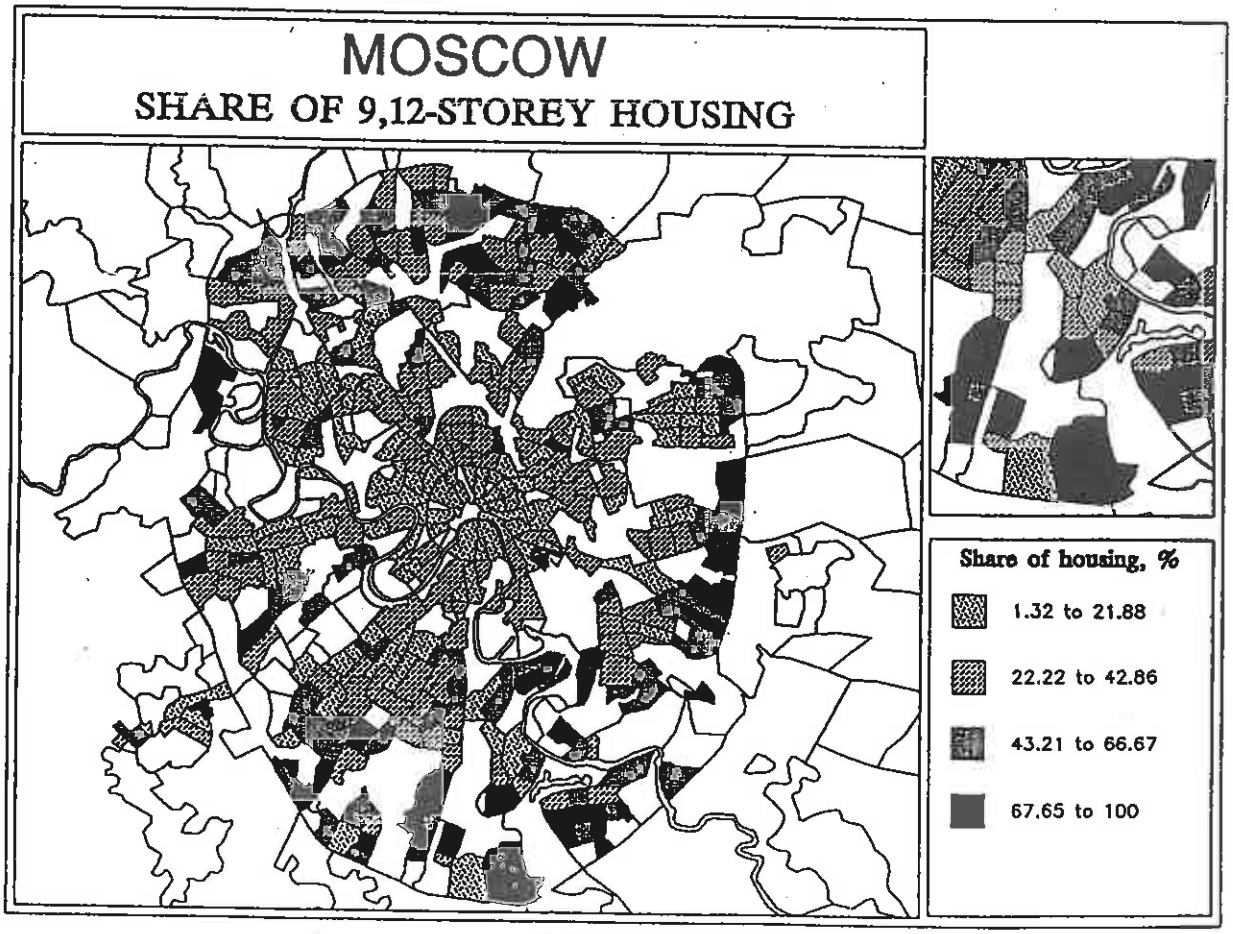


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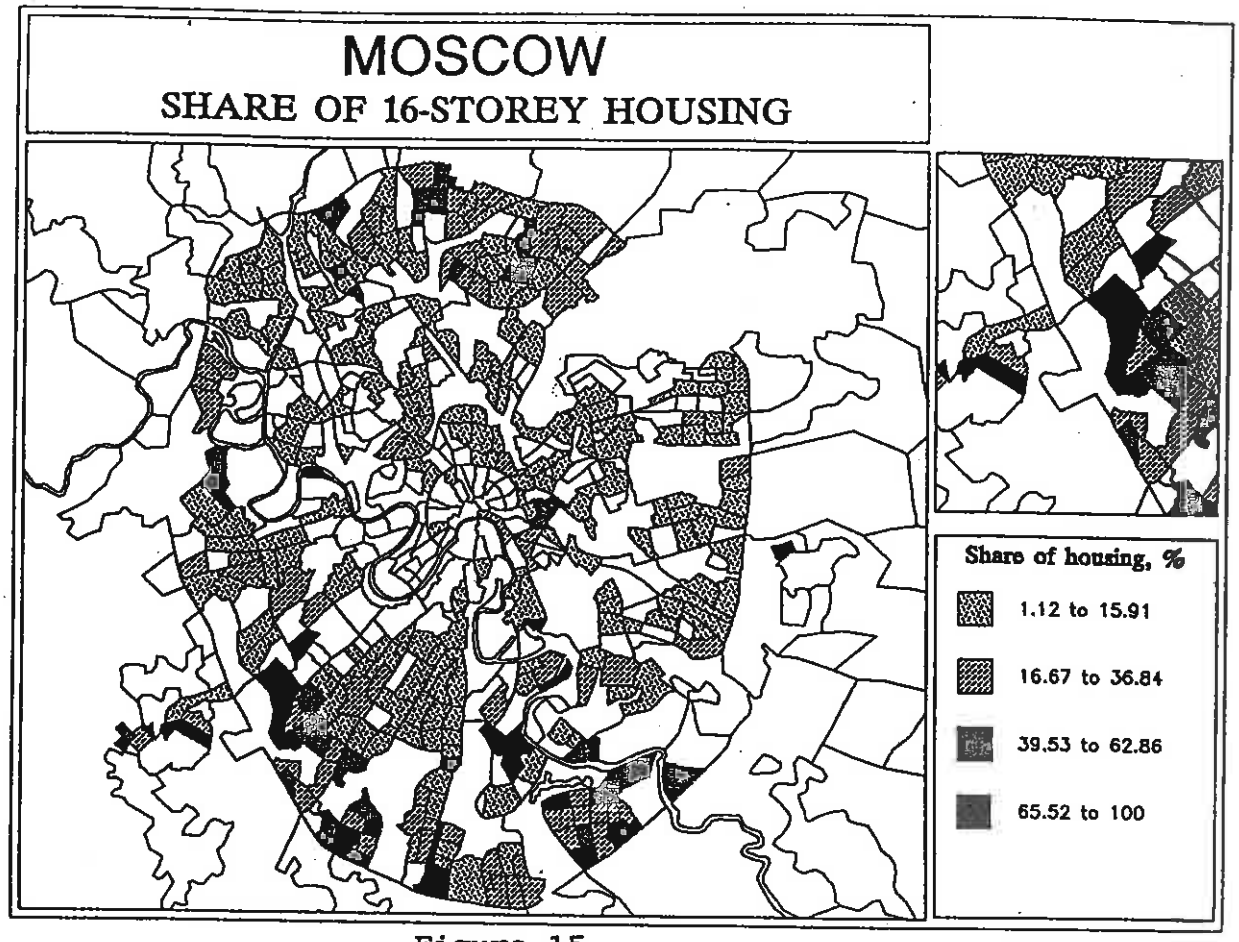


Figure 15.

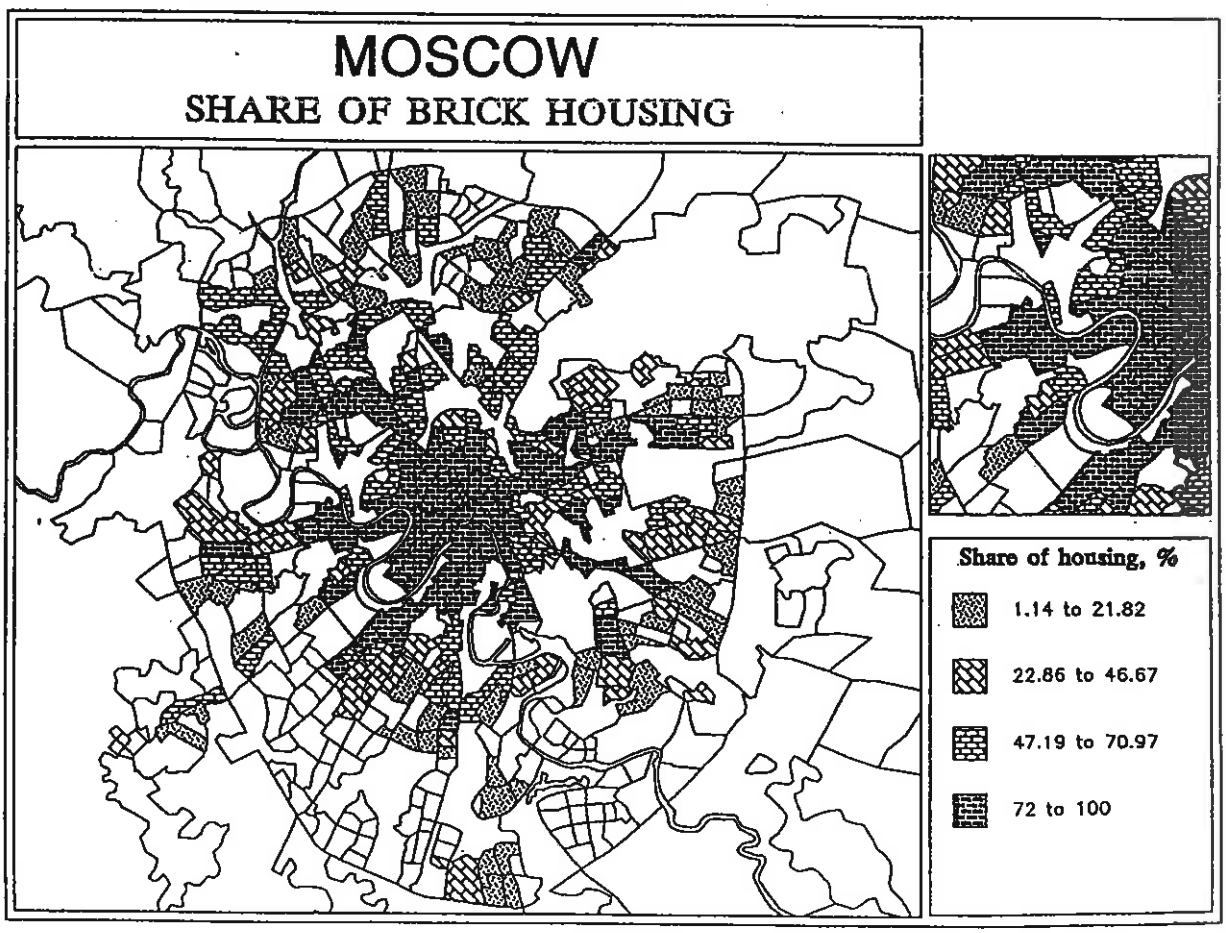


Figure 16.

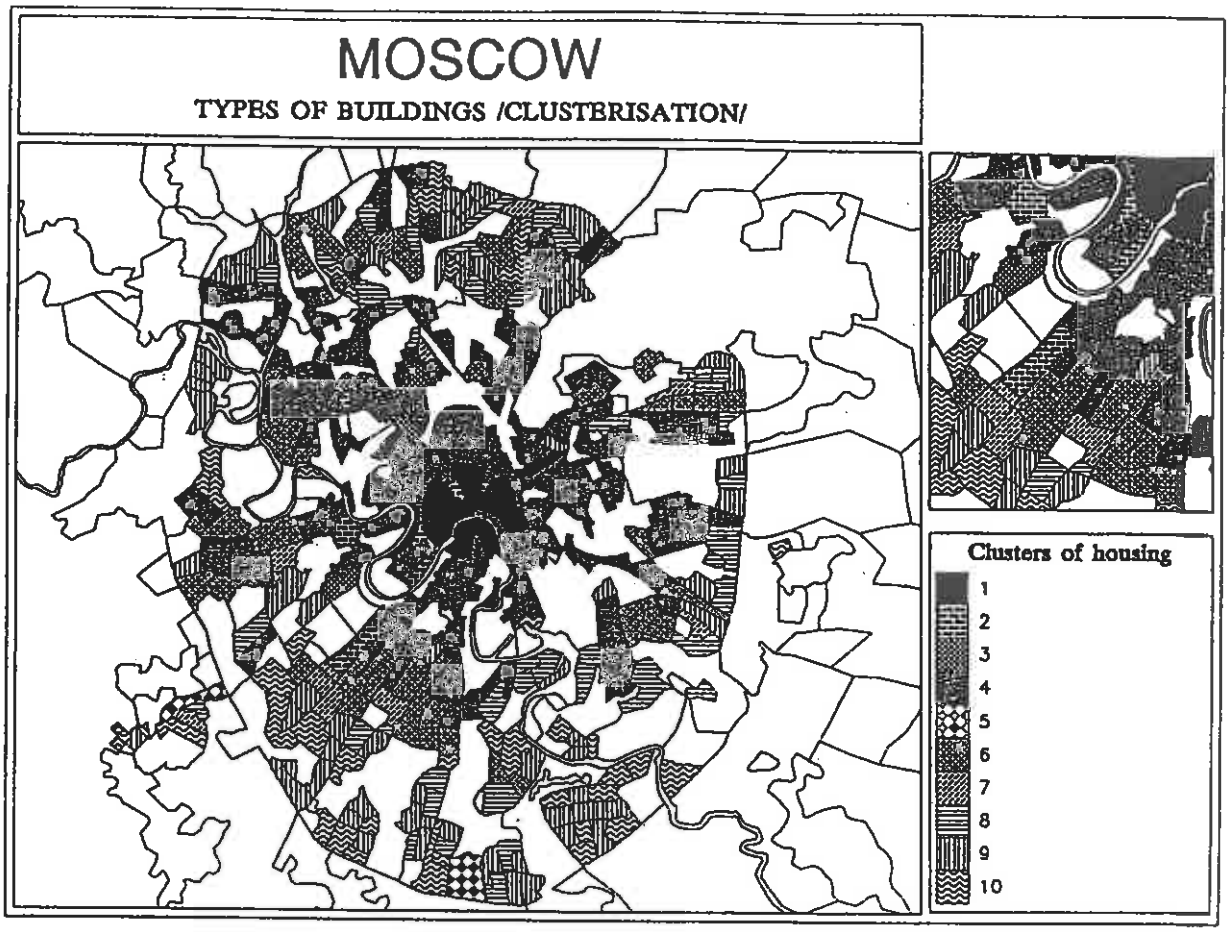


Figure 17.

Final cluster centers

| Cluster | G | H | I | L | K | M | J | Number of cases |
|---|---|---|---|---|---|---|---|---|
| 1 | **93.9** | 4.8 | **57.7** | 18 | 17.5 | 5.2 | 1.6 | 24 |
| 2 | **92** | 9.1 | 7 | **63.6** | 13.3 | 15.6 | 0.6 | 11 |
| 3 | **77.1** | **69.2** | 0 | **42** | **40.7** | 15.3 | 2 | 5 |
| 4 | **65.7** | **42.7** | 10.9 | 12.3 | **42.4** | **28.8** | 5.7 | 153 |
| 5 | **46.4** | **86.2** | **55.3** | 0.9 | **26.8** | 13.2 | 3.9 | 2 |
| 6 | 15.3 | **95** | 0.7 | 1.9 | **61.8** | **31.2** | 4.4 | 50 |
| 7 | 0.2 | 0 | 0.2 | 1.2 | **62.2** | **25.6** | 10.8 | 11 |
| 8 | 10 | **97.3** | 0.7 | 0.4 | 10.3 | **77.9** | 10.7 | 43 |
| 9 | 1.2 | 18.7 | 0.4 | 0.3 | 6.8 | **68.9** | **23.5** | 68 |
| 10 | 2.8 | **83.3** | 1.2 | 0 | 2.2 | **27** | **69.6** | 43 |

Table 4. Clusterisation of housing on types of buildings (G-M).

in communal flats; a climate of loneliness, want, dissatisfaction and inconstancy.

At the same time, however, there are still many families of native Muscovites (Muscovites of the second and third generation), to be found in this part of Moscow.

A second point is that, in the city centre, there is a lot of new housing, ministry-supplied, and constructed by house-building co-operatives.

This housing stock is of very high quality, as it was provided for the more privileged strata of the former soviet society, (communist party, government and military bureaucrats, and certain writers, artists and actors).

These neighbourhoods of communal flats and the more comfortable departmental and co-operative housing tend to be rather dangerous, in terms of the social stresses caused by the contrasts in adjacent living levels.

Another source of social stress is found in the relations between "limiters" and native Muscovites.
The "limiters" are recruited from social groups which do not immediately need many of the advantages of a large city. Their psychology and system of values often differs sharply from those of the native Muscovites. But the most important thing is that the "limiters", supported by the enterprises which recruited them, and having large families and low living space per capita, take up individual residence and leave communal flats more rapidly than native Muscovites, which frequently produces considerable discontent among the latter.

## 7.2. THE "STAR" OF STALIN'S HOUSING.

The period of housing construction between 1918 and 1959 may be called the period of "Stalin's Renaissance", because the main tendency in architecture was to build monumental pseudo-classical houses, often decorated with sculptures "to glorify the triumph of socialism".

Many houses for socialist elite were built in this style, mainly along the most important avenues and streets.

Housing for workers built in that period was usually more simple, and located near industrial plants and enterprises and at a later period, in open spaces near the external ring of Moscow, on the sites of former villages.

At the same time, within the present-day territory of Moscow, it is still possible "to find" the centres of ex-cities, which were adjacent to Moscow before it extended its boundaries in 1964; for instance, the cases of Babushkin (to the north-east) and Kuntsevo (to the west).

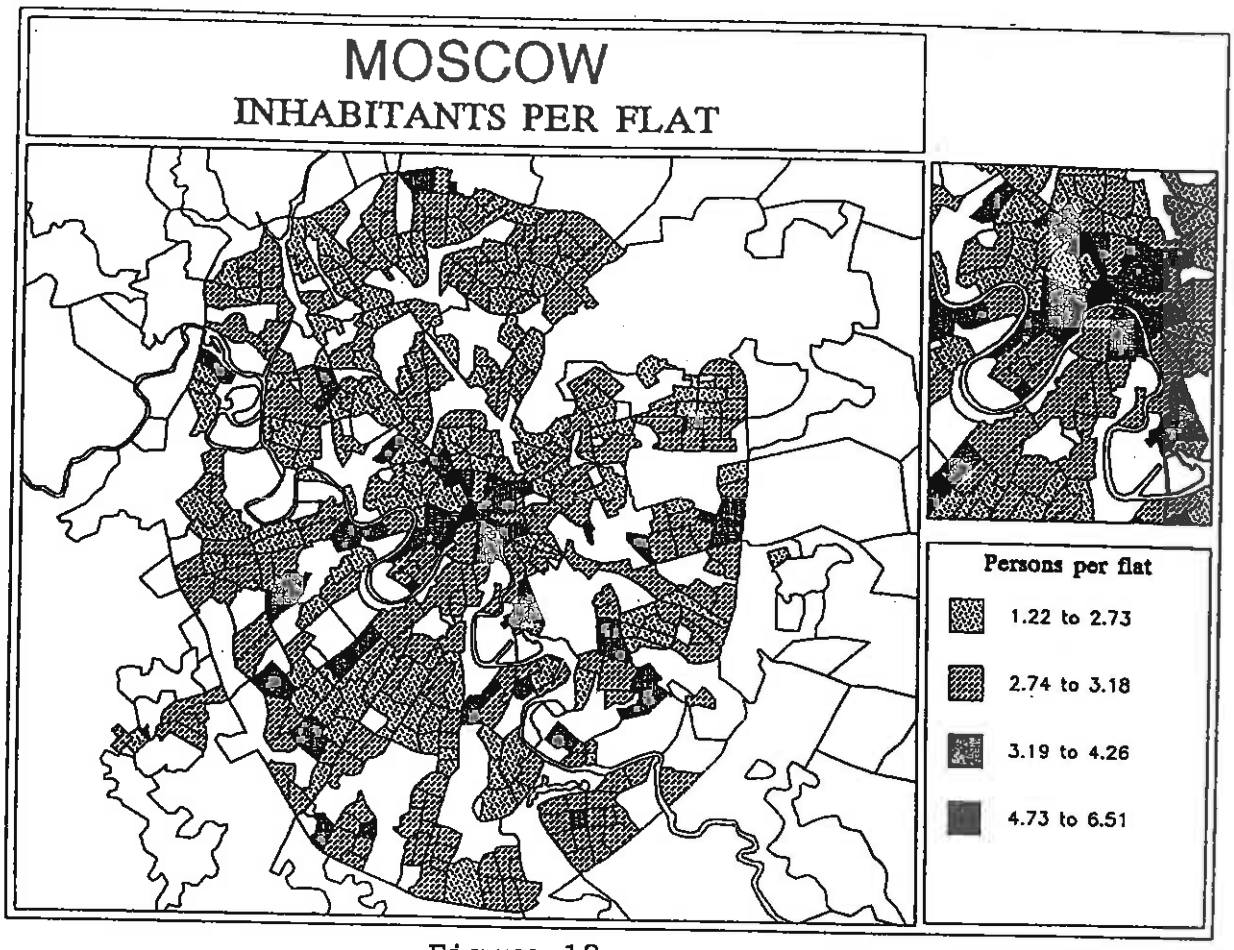


Figure 18.

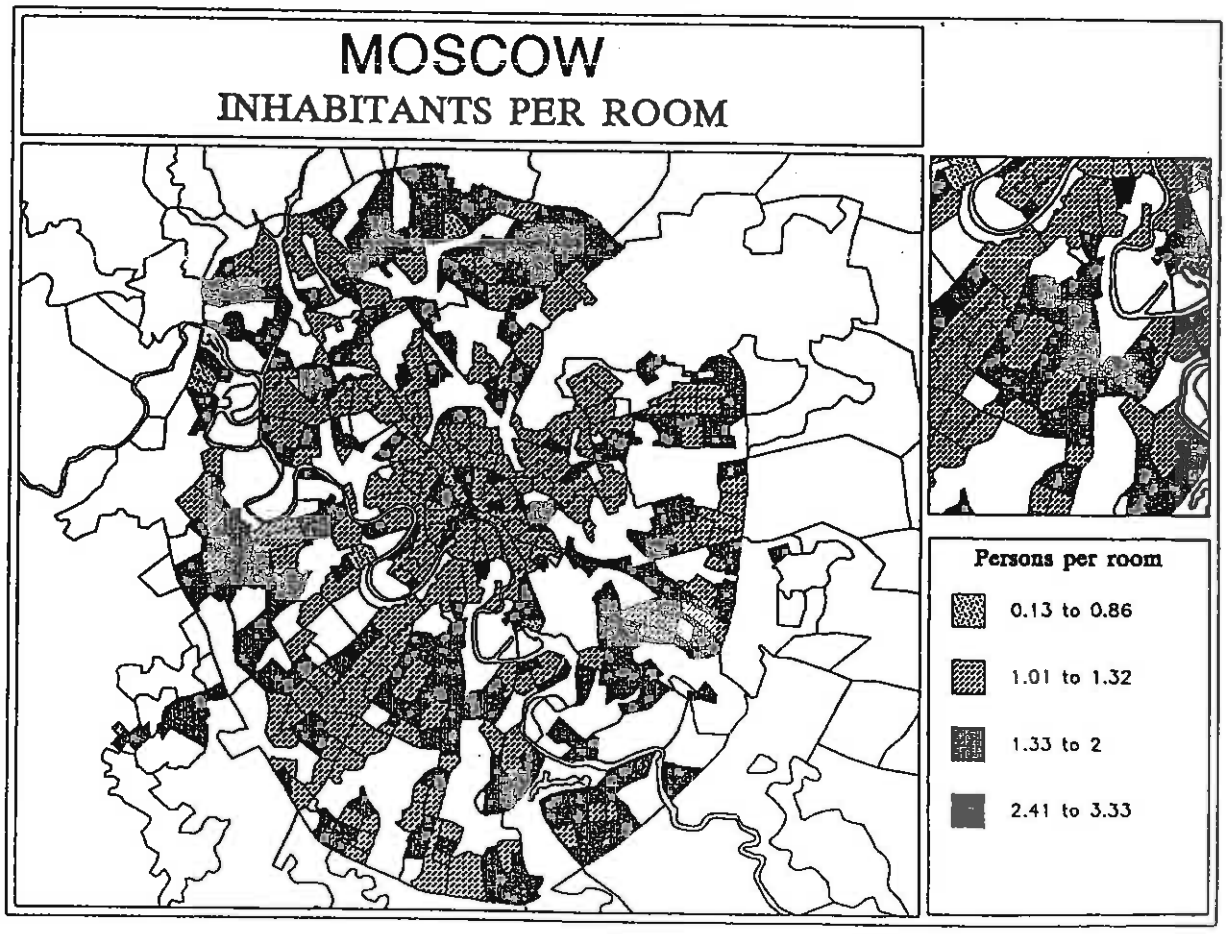


Figure 19.

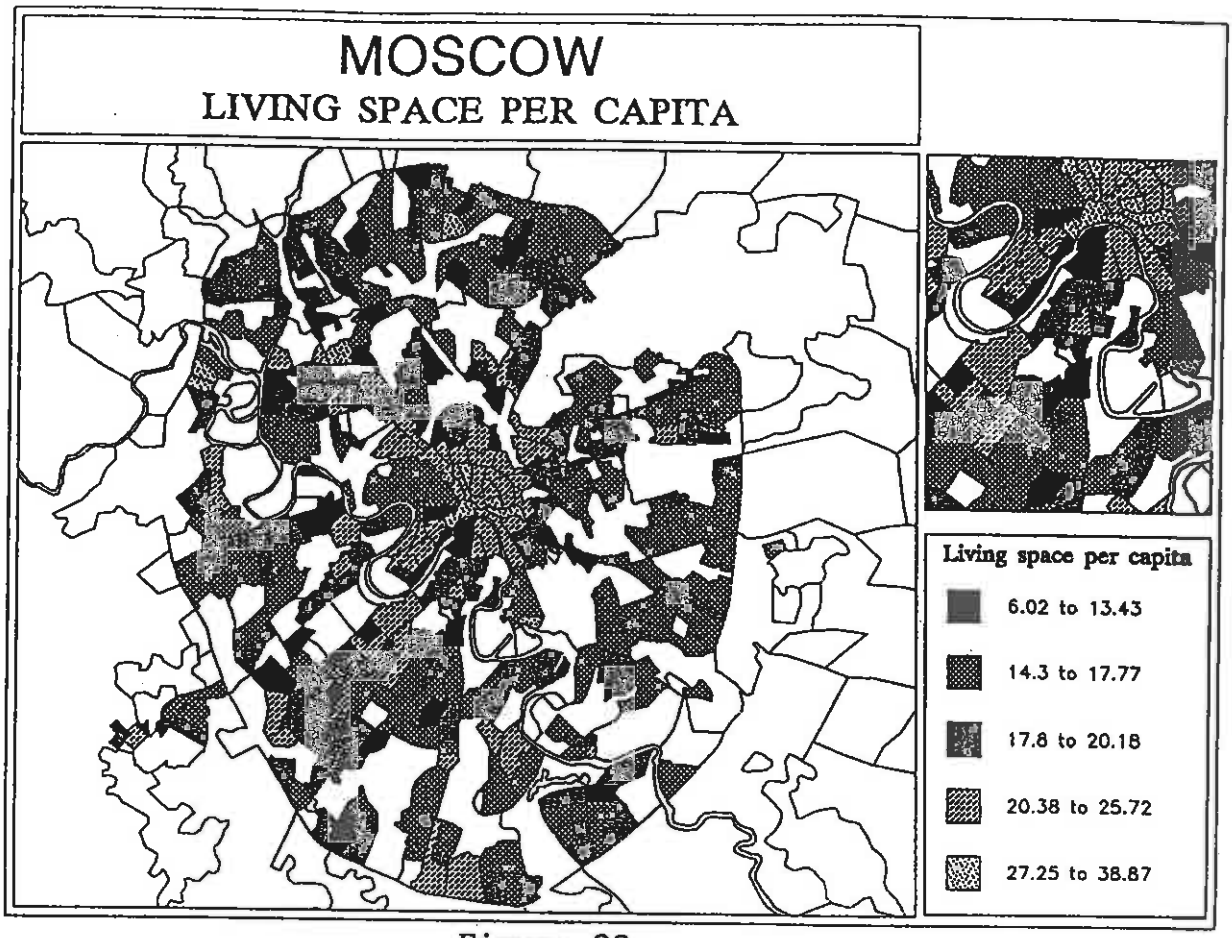


Figure 20.

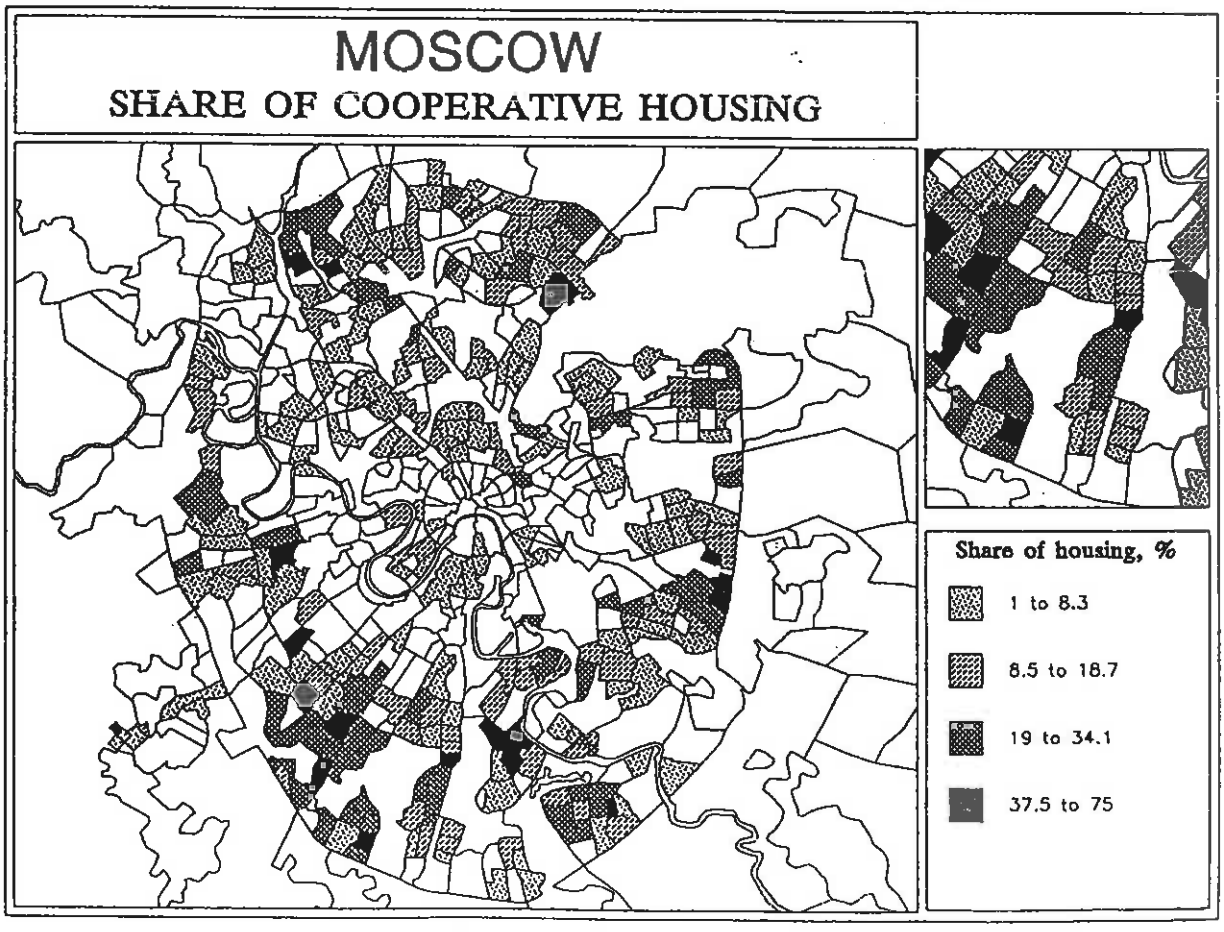


Figure 21.

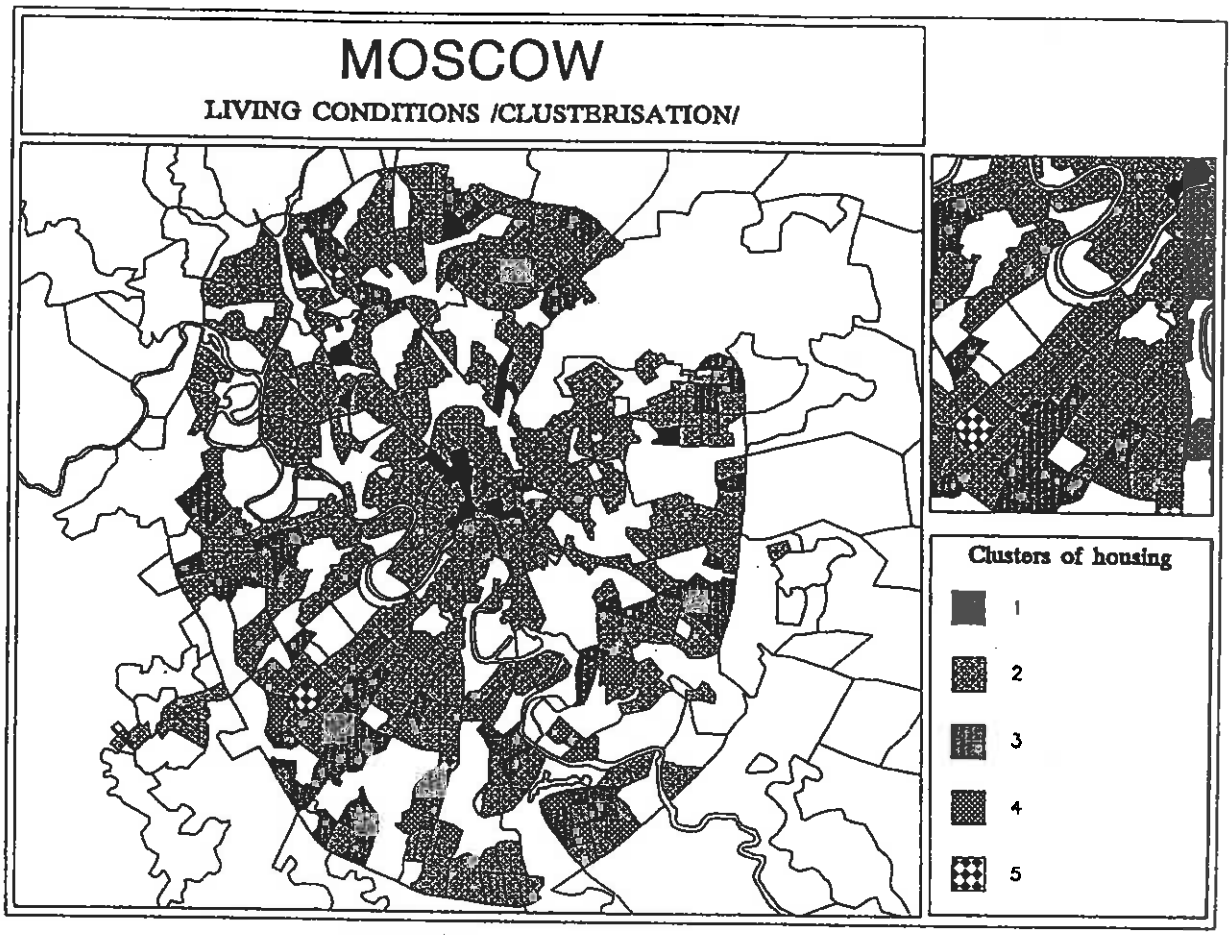


Figure 22.

Final cluster centers

| Cluster | N | O | P | Q | Number of cases |
|---|---|---|---|---|---|
| 1 | **3.8** | 1.22 | **28.1** | 2 | 14 |
| 2 | 2.9 | **1.35** | 17.3 | 3.3 | 293 |
| 3 | 2.8 | 1.29 | 17.3 | **28.7** | 60 |
| 4 | 2.7 | 1.28 | **19.1** | 16.9 | 39 |
| 5 | 2.6 | 1.2 | **20.4** | **61.1** | 4 |

Table 5. Clusterisation of housing on living conditions (N-Q).

During that period some "villages" were built which are to be found within the present-day territory of Moscow. Thus, for example, there is the settlement of writers, artists, etc. near Leningradsky Avenue (north-west), in which 50% of the houses are constructed from wood, and none of them are higher than 2-3-storeys.

The same type of village exists in "Serebryany Bor" ("Silver Pine Forest"), to the west of Moscow on a bend of the Moskva river.

Housing during the Stalin period was generally built from brick and was from 5 to 11 storeys. This housing was normally of very good quality with spacious, often many-roomed flats with all modern conveniences.

But construction activity was not very intensive in that period, with only 17.5% of Moscow housing being built at that time (a period of more than 40 years), therefore the housing crisis was increasing.

That period also produced the most varied spectrum of types of housing, in terms of numbers of floors and architectural decisions, before the period of "industrial" construction began.

With the passage of time, of course, the social structure of the inhabitants in the elite housing has altered. The older housing has become less and less identified with the elite strata, and more with workers and low income persons.

By contrast, the social structure of housing populated by workers families from the beginning has not altered very much.

## 7.3. KHRUSTCHEV'S HOUSING "NUCLEII".

During Stalin's construction period, experiments with industrial wainscot housing had begun, but it was only from 1960 that such types of construction became prevalent.

A considerable part (18.8%) of Moscow housing was built in the period of only 5 years, from 1960 till 1964. This was mainly 5-storey buildings, without elevator and rubbish chute, with very small normally 2-roomed flats, very small (about 5 sq. meters) kitchens and no separate bathroom and toilet.

These flats were populated by people from the communal flats of central Moscow, from communal workers flats from the Stalin belt housing, and by inhabitants of villages adjacent to districts of new construction.

Most of the housing built during this period was of low

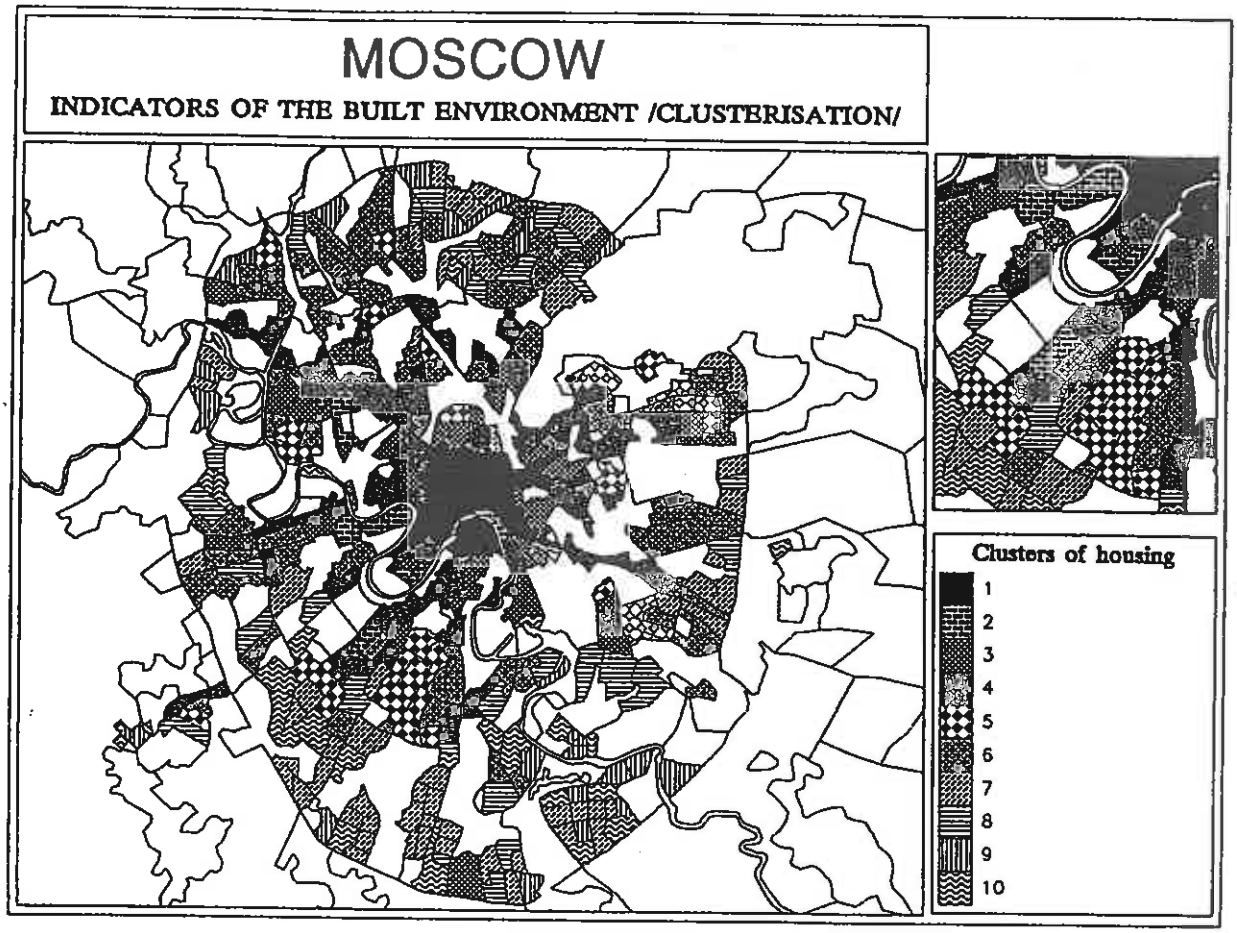
MOSCOW
INDICATORS OF THE BUILT ENVIRONMENT /CLUSTERISATION/
Clusters of housing
1
2
3
4
5
6
7
8
9
10

Figure 23.

Final Cluster Centers

| Cluster | A | B | C | D | E | F | Number of cases |
|---|---|---|---|---|---|---|---|
| 1 | **67.1** | 21 | 2.9 | 2.3 | 4.9 | 1.7 | 36 |
| 2 | 0.1 | **80.3** | 9 | 5.1 | 4.2 | 1.2 | 15 |
| 3 | 5.7 | **54.2** | 13.3 | 8.1 | 11 | 7.7 | 31 |
| 4 | 2.9 | **34.1** | **39** | 9.4 | 10.9 | 3.7 | 61 |
| 5 | 0.1 | 9.7 | **59.2** | 18.6 | 6.3 | 5.8 | 35 |
| 6 | 0.2 | 9.6 | **23.9** | **42.9** | 16.5 | 6.8 | 90 |
| 7 | 0.2 | 1.1 | 0.2 | 8.4 | **76.1** | 14.1 | 59 |
| 8 | 0 | 3.6 | 13.3 | 10.7 | **48** | **24.4** | 31 |
| 9 | 0.5 | 1.6 | 0.6 | 6.7 | 17.9 | **72.7** | 26 |
| 10 | 0.3 | 1.1 | 0.2 | 0.7 | 10.7 | **87.1** | 26 |

| Cluster | G | H | I | L | K | M | J | Number of cases |
|---|---|---|---|---|---|---|---|---|
| 1 | **94.2** | 7.1 | **44.7** | **23** | **22.2** | 8.2 | 1.8 | 36 |
| 2 | **88.6** | 15.9 | 2.4 | **52.9** | **21.8** | **20.2** | 2.7 | 15 |
| 3 | **73** | **24.4** | **24.1** | 11.6 | **37.2** | **20.7** | 6.4 | 31 |
| 4 | **69.8** | **52.4** | 6.6 | 17.5 | **49** | **23.6** | 3.2 | 61 |
| 5 | 13.7 | **36.4** | 1.5 | 1.8 | **65.7** | **25.4** | 5.6 | 35 |
| 6 | **31** | **73.5** | 3.2 | 2.5 | **42.3** | **46.3** | 5.7 | 90 |
| 7 | 1.7 | 1.4 | 0.6 | 0.3 | 2.6 | **73** | **23.6** | 59 |
| 8 | 15.9 | **87.5** | 4.4 | 0.5 | 13 | **57.1** | **25** | 31 |
| 9 | 1.9 | 1.6 | 2.4 | 0 | 4 | **60.6** | **33** | 26 |
| 10 | 1.4 | 0.2 | 0.3 | 0.2 | 1.8 | 17.4 | **80.3** | 26 |

| Cluster | N | O | P | Q | Number of cases |
|---|---|---|---|---|---|
| 1 | **3.6** | 1.23 | **22** | 2.1 | 36 |
| 2 | **3.4** | **1.38** | **18.3** | 1.8 | 15 |
| 3 | 2.9 | **1.37** | **18.1** | 3 | 31 |
| 4 | 2.8 | 1.32 | **18** | 2 | 61 |
| 5 | 2.7 | 1.33 | 16.8 | 6.3 | 35 |
| 6 | 2.8 | 1.33 | 16.7 | 8.1 | 90 |
| 7 | 2.9 | 1.33 | 17.2 | **20** | 59 |
| 8 | 2.9 | 1.35 | 17.3 | 12.7 | 31 |
| 9 | 2.9 | **1.37** | 17.9 | 10.2 | 26 |
| 10 | 2.8 | 1.32 | **18.5** | **20.4** | 26 |

Table 6. Clusterisation by all variables (A-Q).

quality. It is uncomfortable, cramped and is now very overcrowded. But in 1960's it was the solution to many of life's problems for a lot of Muscovites, as it enabled them to take up individual residence in this type of housing.

The main area of such types of construction is located to the south-west of Moscow, the area of "Cheremushki". There are also certain other "nucleii" of this type of building, which continue or surround "Stalin's" building zones, fill in inter-zonal spaces, or are sometimes located separately.

There was a period when the demolishing of 5-storey buildings was actively discussed to make space free for high-storey buildings, in order to conserve urban space, and to provide more comfortable apartments. But this idea was never brought to fruition because of lack of money, the continuing housing deficit, etc.

In fact, of course, 5-storey buildings are better than 16-storey ones from the point of view of social life - it is more controlled, more friendly, and "closer to the ground". There is only one case where 5-storey buildings can be pulled down, and that is to make room for 1-2-storey family housing, or for parks and gardens, in order to create more open urban space.

## 7.4. THE FRAMEWORK OF NEW HOUSING

After 1965, the majority of new housing has had more than 5 floors. Between 1965 and 1970, houses were usually 9-12-storey. After 1970, a considerable part of the housing constructed had 12-16 floors. After 1980, high-storey housing (16, 17, 22 floors) were the norm. The majority of this housing is constructed from wainscot blocks and only a minority is brick-built.

Construction at this time was intended to free up areas near earlier housing blocks, very often adjacent to the official boundary of Moscow - the Moscow Ring Motorway.

After 1980, new construction was localised not only at the periphery of Moscow, but it went back towards the city centre, filling in some of the open spaces which were previously thought not suitable or too expensive for construction, (eg. close to the Moskva river).

Specific strata of the population tend to live at the periphery of Moscow. Firstly, there are younger parents with small children. The average age of population at the periphery of the city is much younger than that in the centre.

At the same time, there is a certain number of elderly people who have come here from the reconstructed city centre.

There are also many hostels here, usually for "limiters".

Thus the "limiters" usually have the following cycle of residence: at first - a hostel at the periphery of Moscow; later - a room in the "communal" flats in the inner city; and lastly, when they have family - a private flat again at the periphery.

Native Muscovites very often leave the city centre for periphery private flats. But it has been very difficult for some of them to adapt to the new urban situation of the new high-rise district, which is very different to that which they left in the city centre.

Different sections of this new housing vary considerably in terms of quality, and of the social strata of the Muscovites who live there.

Thus the periphery of Moscow shows the main part of co-operative housing, where high income persons tend to live, including some concentrations of high quality departmental housing for the former socialist elite to the south-west and north-west of the city.

## 8. CONCLUSIONS

### 8.1. "GIS" CONCLUSIONS.

All the procedures described above - the formation of databases, the basic maps, the selection of software and the processes of mapping - are in line with the recent period of GIS development.

Further progress in the spheres of information, hardware and software will make all these stages more satisfactory and user-friendly.

But the role of the geographical researcher will continue to be the most important in realisation of appropriate GIS.

### 8.2. "CITY" CONCLUSIONS.

It is clear that the socio-architectural landscape of Moscow is very varied. It is not true to maintain that in the "socialist city", all social strata are mixed and there are no separate districts for the elite or for the workers, as there are in the case of Moscow.

The elite take the best and quietest places in the reconstructed inner-centre, or the high quality new housing at the periphery, leaving for others the older or lower quality less comfortable housing blocks near industrial plants, railways and motorways, or in the far periphery with few transport communications.

City life goes on, the architectural landscape is changing; housing becomes older, and new housing is built. The social landscape is also changing in accordance with that process. If in "the West" people with high incomes have an advantage in the choice of the place and quality level of their residences, in modern Russia people with political power have the same advantages.

Perhaps in the new political and economic situation this will change and the younger generation will never know where the "tsar villages" are situated in Moscow.

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