

National atlases and development

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ABSTRACT

Discussions are taking place in many countries on whether or not a (new) national atlas should be published, and in what form. This article provides general information on the function, content, requirements, structure and format of national atlases, and also on their role in national development. Examples are drawn from the production of the national atlas of The Netherlands.

A national atlas has been defined by Salishchev as a basic multi-subject geographic atlas of a single country, which contains a summary representation of contemporary scientific knowledge of the country in the fields of physical, economic and political geography [3]. It is usually an official or at least state-sponsored publication of all relevant spatial information available for a state's territory. As in all atlases, national atlas editors try to present the contents systematically; the consecutive maps relate to each other and together show the structure of the country.

The national atlas concept presupposes a relatively large scale, to show a relatively large degree of detail including the smallest administrative units for which social and economic data are collected. Physical maps should show a detailed synthesis of earth science aspects. The material, usually collected from different sources, must be edited and redrawn to be presented at a similar level of generalization and hierarchical classification—to allow comparison. It is the systematic and similar treatment of the data which enables national atlas users to profit maximally from the concept. Comparison of different themes for the same region and comparison of different regions for the same theme should yield useful conclusions. To these should be added comparisons in time.

The development of the national atlas concept was a logical consequence of the information explosion of the 19th century. The general advancement in the natural sciences was coupled with the phenomenal development of statistical data collection, especially in centralized states. Atlases made it possible to view all these spatial data together—to enable a partial or total synthesis to be made. The traditional national atlas can therefore be conceived as a non-computerized geo-

graphic information system in its own right: it was the first medium which enabled users to compare, overlay or otherwise combine data, for the first time presented at similar scales at a similar degree of generalization.

The national atlas concept first materialized in the atlas of Finland, published in 1899, followed by Canada in 1906. Both countries have remained trend-setters in updating their national atlases (second edition in Finland in 1910, Canada in 1915; fifth editions in both countries in the 1980s) and in establishing standing national atlas organizations for revision and research. The national atlas of Switzerland, published as 96 separate sheets from 1965 to 1978, established new cartographic design standards.

In 1956, the International Geographical Union (IGU) established a commission on national atlases to aid in their production and to help bring about standardization. In 1960, this commission produced, under the guidance of Professor K A Salishchev, a survey of their history, an analysis and a guide for their improvement [3]. In 1976, the successful IGU national atlases commission was disbanded and succeeded by the joint ICA (International Cartographic Association)/IGU working group on environmental atlases. To gain some idea of the efforts of the commission in encouraging national atlas production, Figures 1 and 2 compare the world situation in 1960 with that of 1978. Until 1960, only 12 countries had published national atlases, while between 1960 and 1978 a further 42 countries published them. What was the success formula of the national atlas concept that it was followed by so many countries?

FUNCTIONS OF NATIONAL ATLASES

Since World War II, approximately 50 percent of the production of new national atlases has been in the developing countries. The rise of national atlas production in these countries is related to their striving for political and economic independence and a realization of the role a national atlas can play in social, economic and natural resource development. The justifications for producing such an atlas may be categorized under the headings of planning and decision making, research, education and reference, wherever spatial information is necessary.

Maps in national atlases are not usually planning maps in the direct sense but they may be very useful in the early inventory stages of planning and decision

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making, as information sources for politicians, legislators, administrators and planners. During the production of the atlas, the editors may see the need for more research to fill gaps in the data, and the atlas itself as a scientific repository of spatial information will form a starting point and framework for further research. In education, a national atlas can be very useful at all

levels from secondary schools upward as a comprehensive single reference source of spatial information. Particularly in developing countries, this information may be otherwise difficult to obtain and the atlas may also be useful in stimulating an appreciation of national identity. In addition to these functions, a national atlas is often regarded as a kind of cultural

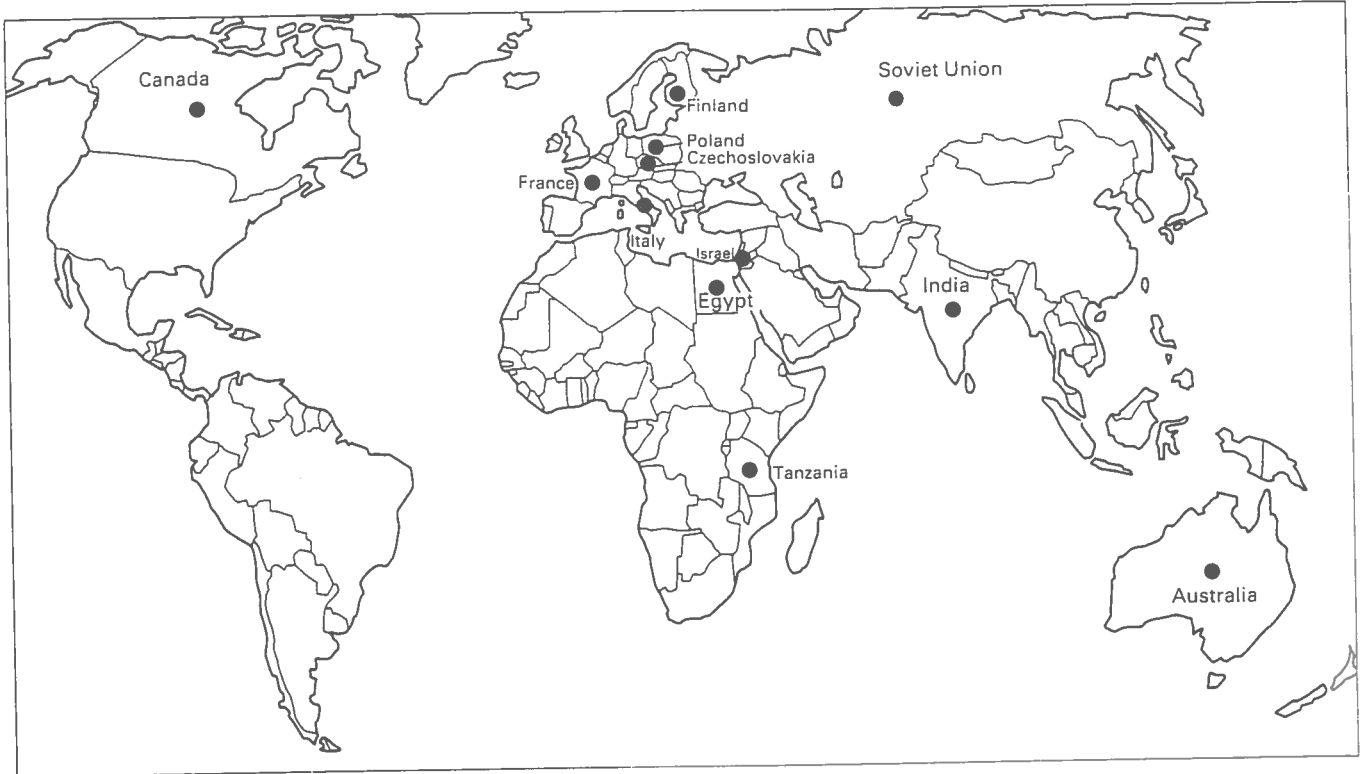


FIGURE 1 National atlases published before 1960 (from [3])

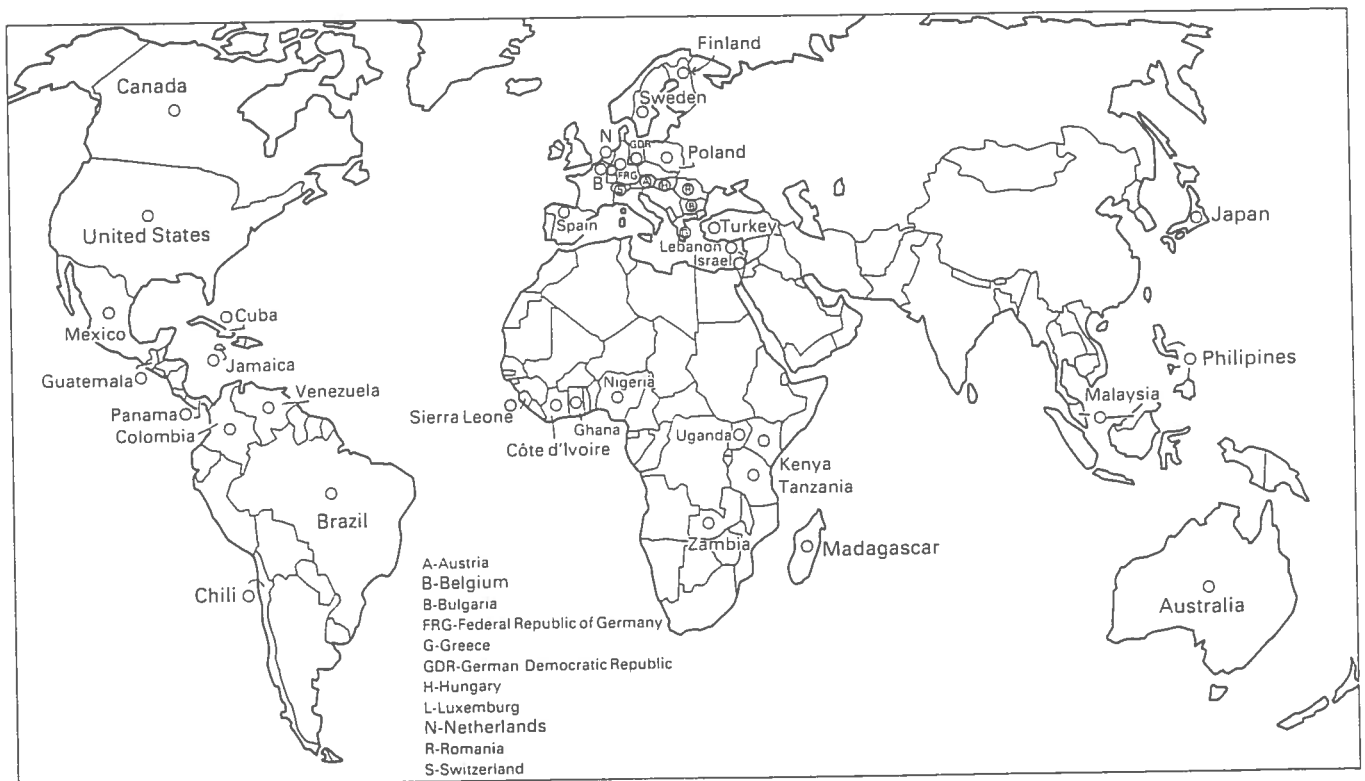


FIGURE 2 National atlases published between 1960 and 1978 (from [9])

ambassador, or for public relations [7]. Finally, seen internationally, national atlases help to fill the gaps in our knowledge of the world we live in.

Although the functions of a national atlas are known in general, there have seldom been any systematic user investigations, either before or after publication. Although expectations regarding the outcome should not be too high, such investigations may be desirable so that as many user needs as possible are met [2], or to justify the production of a new edition. In Canada, an investigation was made into the use of the maps of the 4th edition of the national atlas, and even an attempt was made to derive a cost-benefit ratio [4]. As well as confirming the functions already described, these investigations brought to light some interesting uses of the atlas, including demonstrating the viability of a pipeline route, some pre-investment studies, illustration of regional economic potential and the preparation of tourist literature, other specialized atlases and geography textbooks.

National atlases have many users and cannot hope to satisfy all of them completely. In this respect, they are similar to topographic maps in that diverse users may have more specific needs but no feasible economic alternative. National atlases of different countries and even successive editions of one atlas may differ considerably in content and character according to which functions are considered to be the most important. Particularly in the more industrialized countries, there is also some tendency for atlases to become more problem-oriented, the atlas of the Netherlands being a case in point.

In addition to its primary functions, a national atlas may have several important additional benefits for society at large. The first of these secondary functions is the establishment of an organizational framework for bringing together all kinds of geographic data, often from unrelated sources, both well known and obscure. In some ways, in fact, the atlas itself can be regarded as an index to all the sources used. The experts from many different fields, the scientific institutions, national and other organizations who work together on the atlas preparation form a network which will have to coordinate data and make them compatible. This function of creating a source network is realized to the full and becomes profitable only if the network is not disbanded after the atlas is published. It should be kept in existence not only to produce further editions of the atlas but also, perhaps even more important, to become a kind of standing clearing house for the efficient exchange of geographic data, available at any desired moment. In addition, unnecessary repetition of data collection by users will be prevented.

The second indirect contribution of a national atlas is related to the first one: the production of the atlas stimulates interdisciplinary cooperation to the benefit of all involved. The national atlas may first of all be considered as the pre-eminent meeting place of geographers and cartographers. The geographers who

work on the project will learn more about cartography and the possibilities and limitations of maps as useful tools in planning, education and research, while the cartographers will learn to appreciate better the nature of the data to be mapped and the needs of the users. More effective maps should be the consequence.

The development of cartographic skills, methods and techniques may also be singled out as an indirect benefit of national atlas production. For many countries, the production of the atlas will be the first experience of a scientific cartographic product of this scope. Apart from the heavy demands of accuracy, reliability and completeness, which will tax to the utmost the abilities of the cartographers, the national atlas project will enable the designers to experiment with various types of representation and methods of construction, so improving the quality and standards of local cartography.

A final secondary benefit, brought to light for example in Canada, is that commercial and government producers of geography textbooks and school atlases may use the national atlas as a major source of data, without which some publications would be economically impractical to produce [7].

REALIZATION OF A NATIONAL ATLAS

To bring a national atlas project to fruition, there are certain requirements in addition to the important one of a solid financial base [7]:

- mappable information
- scientific backing
- cartographic skills and technical facilities
- a good organizational structure.

The publication of a national atlas is not normally a commercial proposition; governments will therefore have to make available the funds needed for production and distribution. Money will be needed for fitting up and staffing a national atlas bureau, for data collection, materials and reproduction. Some government support may take the form of making available scientific and technical manpower already in government service, as well as technical facilities and equipment.

Because it is very difficult to establish a cost-benefit ratio for a national atlas project, it is often difficult to find financial support from the government. In the Canadian investigation [4], the time estimated to be saved by users of the 4th edition of the National Atlas of Canada was in a ratio of approximately 60 to 1 compared to the time needed to produce the atlas. Based on some very cautious assumptions (eg. the value of the users' time is only 10 percent of the value of the atlas producers' time), budget analysts in the Canadian Department of Energy, Mines and Resources calculated a benefit-cost ratio of better than 2:1. Of course these figures have an indicator value only and cannot immediately be applied to other countries, where circumstances may

be very different. Usually, the decision to go ahead with a national atlas project will be based largely on a critical evaluation of its purposes and as such may be considered as a policy decision, realizing that most users of national atlases are in government service.

An important requirement for national atlas production is that data must be available and/or collectable. Hence, national data collection organizations must participate in a national atlas project. Because map scales are small in such atlases, it is usually no problem to acquire data for the topographic base of atlas map sheets. In developing countries in particular, however, the acquisition of sufficient, reliable and detailed thematic information (social, economic and physical) may be a problem. For all countries, there may be problems in acquiring sufficiently up-to-date data. The various themes mapped in the atlas should, as much as possible, reflect the situation at the same, most recent moment, for maximum usefulness and in order to allow optimum comparison. It follows that national atlases should be published as soon as possible after the data have been collected. They may also include maps emphasizing the dynamic character of a topic, based on data collected at different times.

As noted above, a national atlas project may be a good occasion to try to fill in gaps in existing knowledge or in the data available. Modern techniques such as remote sensing from satellites may be used to this end. Data quality and availability are very variable in different countries, but a shortage of data should not be a reason not to start a national atlas project. To facilitate national development, the information that is available, even if incomplete or provisional, should be passed on as quickly and as effectively as possible to potential users.

National atlas production requires good scientific backing for collection of the appropriate data and further evaluation, interpretation and manipulation. Scientific experts in all relevant fields covered by the national atlas must become involved in the project. If the scientific expertise is not available, it may have to come from abroad by means of consulting and education, possibly through international organizations. Foreign technical assistance may also be required for the actual design and production of the atlas, since in many countries the cartographers have not yet developed sufficient expertise in the production of small-scale thematic maps and there may be a shortage of technical facilities and materials. For these reasons, the entire technical production stage may be contracted out to organizations such as the French ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer). If the production work is not contracted out, the attachment of the national atlas bureau to an existing national mapping organization seems to be the most profitable, as the best skills and facilities may be available there.

The bureau must be considered as the organizational pivot on which everything hinges, and it is responsible for the day-to-day execution of the

work. An editorial board, consisting of geographers, cartographers and other geo-scientists may be established to define policies, coordinate activities, maintain contact with the wide range of experts and data collection organizations involved and to keep a check on progress and on whether the original objectives have been met. Another possible organizational structure is a separate national atlas organization, such as the Indian National Atlas and Thematic Mapping Organization (NATMO) established in 1956.

Once all the basic requirements are fulfilled, many other initial problems must be solved before the actual data collection for the atlas and the production work can start. A very important early decision is on the atlas format and map scales. The physical dimensions of a national atlas are usually determined by its standard one-to-a-page map, positioned upright or sideways [3]. In deciding on scale, not only the page format should be considered, but first of all the uses. A larger scale allows more details, useful for the decision makers, while a small scale gives a better overview at national level, useful for educators. With these considerations in mind, Salishchev [3] recommended a series of metric scales for use in national atlases, based on the scales of 1:1 000 000 and, possibly, 1:1 250 000 and their multiples. This allows better comparison among maps within the same and in different national atlases. The choice of a single scale throughout an atlas is not advisable, not only because the data required for that scale may not always be available, but also because of differences in the nature, importance and complexity of the data to be mapped [3]. Comparisons between maps may be facilitated if the atlas is published in loose-leaf form. Advantages of this system are that each map can be made available as soon as it is ready, and can be revised separately, so that the atlas as a whole can be more up-to-date.

Other initial decisions in national atlas projects must be made with respect to, for example, the map projections used, the text and its language, marketing and distribution. The main decision, however, is on content. This should be related to the specific purposes and uses [2]. In addition, the well-known recommendations of Salishchev [3] may be taken into account to facilitate international comparisons. Salishchev's recommendations were, however, made in 1960, and since then there has been a definite tendency for national atlases to become less of an inventory and more problem-oriented, with more emphasis on social and economic topics and, especially in developing countries, applied maps [5].

THE ATLAS OF THE NETHERLANDS

The atlas of the Netherlands provides a useful example of a national atlas in production. In many ways, its functions, content, layout, design and production methods and the available data are specific to the Netherlands, but some characteristics will be similar in other countries. The second edition of the atlas is at a

half-way point, and an advisory committee has just started thinking about a possible third edition.

The origins of the atlas go back to 1932, when the Dutch section of the International Geographical Union appointed a committee to draw up a plan for

Delayed by the economic depression and the war, it was not until 1951 that the Ministry of Education and Science and the Royal Geographical Society jointly established a Foundation for the Scientific Atlas of the Netherlands, which initially received a small government grant for preparatory work. This subsidy was considerably increased in 1959, making it possible to begin the actual compilation and printing.

The atlas appeared in 13 issues (98 loose-leaf map sheets) between 1963 and 1977. A supplement of 16 updated or new map sheets was published between 1978 and 1981. Most map sheets carry an explanation, including an English translation, on the reverse side, with information about the data on which the map is based and pointing out and explaining certain distribution patterns. It was a traditional national atlas in that it was clearly an inventory and descriptive in nature. The number of subscribers—more than 8000—was much higher than expected and reflected the considerable public interest in the project.

The first concept of a second edition was formulated in the early 1970s, and new ideas about atlases emerged. The second edition was to be more problem-oriented [1, 8]. It will therefore not be a complete inventory, and for less dynamic geographic aspects (eg, climate, soils), users may be referred to the first edition. The new atlas is oriented towards major problems in society and planning and does not follow completely Salishchev's recommendations.

Human activities have a central place: housing, employment, welfare and recreation, in one of the most densely populated countries in the world (and also the consequences of these activities for landscape and environment) are displayed in maps. Emphasis is on the problems and developments of society, for example, demographic changes, care of environment, the constant battle against water, obtaining clean water, unemployment, and the conflict of interests in physical planning.

Regional differences and the dynamic aspects of geographically and cartographically interesting themes receive full attention. This often results in map series on a certain subject, with maps for different periods and forecasts of future developments. Moreover, the spatial distribution patterns of different themes are compared to define typical regions. The Netherlands is also placed in the wider geographic context of western Europe.

Physical themes are subordinated to social interests. For example, the economic importance of natural resources from each geologic period is prominent in the representation of geology.

In general, a national atlas is used by a relatively small group of professionals, usually in governmental, industrial or commercial organizations. It is hoped

that the second edition will arouse the interest of a larger public, particularly in secondary and tertiary levels of education—and also interested citizens—which is why the atlas has been popularized to a certain extent.

The format of the new atlas is quite different from the first edition. Instead of large loose-leaf map sheets, there will be 20 separate volumes (see Figure 3) that can be assembled in a special case. Each volume is in fact a small thematic atlas and geography textbook dealing with a particular subject. A sample page is shown in Figure 4. The subjects are classified into five main groups, as indicated below. Publication started in 1984 and will be completed in 1988.

Population and settlements

- (1) Population*
- (2) History of human occupation*
- (3) Towns and cities
- (4) Villages

Human welfare

- (5) Housing*
- (6) Services
- (7) Recreation*

Human resources

- (8) Labour
- (9) Industries
- (10) Agriculture
- (11) Gateway to Europe*
- (12) Infrastructure*

Natural resources and environment

- (13) Geology*
- (14) Soils*
- (15) Water*
- (16) Landscape*
- (17) Environment

Physical planning

- (18) Physical planning*
- (19) Urban planning
- (20) Rural planning*

(* = already published)

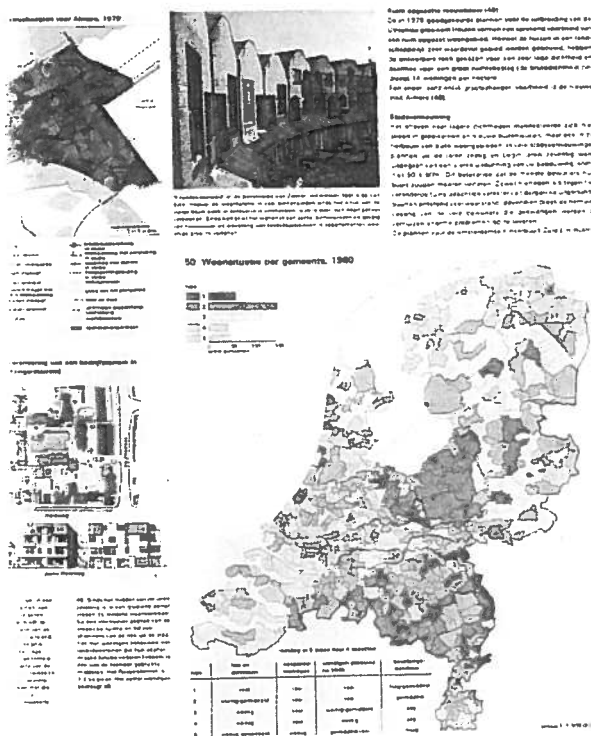
The first edition maps had bilingual legend text and explanation (Dutch and English). The new atlas is in Dutch only, but a concise English edition will probably be published in 1989 or 1990.

Each volume is compiled separately and can be bought and used separately. Nevertheless, the atlas forms a coherent whole. Each volume contains 24 pages, 30.6 x 36 cm. The size was determined by the size of a map of the Netherlands at scale 1:1000000. Other scales include 1:1500000; 1:2000000; 1:3000000; 1:4000000—and sometimes even smaller.

In addition to maps, diagrams, photographs and text, the last page of each volume is reserved for a glossary and references to data sources and useful literature on the relevant subject. On average, graphics—all printed in four colours—occupy 70 percent of



FIGURE 3 Each atlas volume has a distinctive cover—a colour photograph indicative of the volume's content



RE 4 Typical atlas page from volume 5, "Housing"

space (see Figures 5 and 6). The text provides inuity throughout each volume in a problem-orient-approach.

Not all maps show the country as a le. There are many large scale maps of regions settlements representing phenomena which could otherwise be shown in the detail required.

In the preparatory stages, many separations were vrn or scribed of rivers, lakes and coastlines, nation-provincial and municipal boundaries and other administrative and statistical units; roads and railways built-up areas. Negatives of the hydrography are ilable in varying densities of rivers and lakes for the ie scale. To achieve greater uniformity, base map nents were made available to map authors and data pliers, depending on the map subject.

The Foundation for the Scientific Atlas of The etherlands—directed by a board of trustees in which ous ministries, government institutions and scientif-organizations are represented—is responsible for ublishing the atlas, with the support of the Ministry Education and Science. The Foundation establish-an editorial committee, consisting of geographers cartographers, that is responsible for the content the atlas. Sub-committees are responsible for ups of volumes and another sub-committee is rensible for the cartographic design.

The graphics are produced in the Bureau of the us; staffed with four cartographic draftsmen and ded by a geographer-cartographer. The bureau is sed in the Topographic Service of the Netherlands, ich is well equipped with the necessary production ilities. Some 60 authors/specialists from various overnment institutions and universities collaborated in

the atlas compilation. These authors deliver the data for the maps and make text proposals. Compilation is supported by the editorial committee, which has the additional task of relating the volumes and improving the readability and usefulness for a large public. In some cases, a journalist-geographer edits the text.

Each author was given a comprehensive guide-book containing information about the purpose and use of the atlas, the contents of all volumes, maps and text compilation, available base maps and all kinds of practical arrangements. Moreover, a dummy contain-ing parts of different atlas volumes was distributed to the authors and potential buyers.

The atlas is published by the Government Print-ing and Publishing Office, which also handles market-ing and distribution. Its design department assists in design and layout and attends to the coloured photo-graphs used within and on the cover of each volume.

Atlas financing is rather complex. Parts of the production costs are borne by the Ministry of Educa-tion and Science; for six years, it provides a grant of Dfl 330000 per year, mainly for the expenses of the atlas bureau (salaries for staff and the costs of map production up to and including the final overlays, ready for mounting with the text and photographs).

From the final overlays, the Government Print-ing and Publishing Office publishes the atlas at its own risk. Only a small percentage of the revenue goes back to the Foundation.

Neither the members of the editorial committee nor the authors receive any payment for their work. In addition, their institutes and organizations lend free support, for example by preparing data or manuscript maps.

Nevertheless, the atlas is still rather expensive—almost Dfl 30 per volume and Dfl 550 for the whole atlas on subscription. At the moment there are ap-proximately 6500 subscribers in addition to the sale of some 800 to 1500 separate copies of each volume.

NATIONAL ATLASES AND THE FUTURE

The Atlas of The Netherlands, like other national atlases, aims at satisfying certain needs for spatial information. It is unlikely that there will be less interest in spatial information in the coming dec-ades. On the contrary, as long as our societies are becoming more and more complex, it is a safe assump-tion that reliance on spatial information and also its cartographic representation will increase. Although there may be some changes in detail or emphasis, the general functions of national atlases will remain to be fulfilled in the foreseeable future.

Because of rapid developments in the fields of digital technology and telecommunications, however, changes are very likely in the concept of a national atlas, *ie*, in the ways the apparent needs will be satis-fied [4, 6]. We have described the traditional nation-al atlas as a primitive geographic information system "avant-la-lettre". The computerization of this particu-

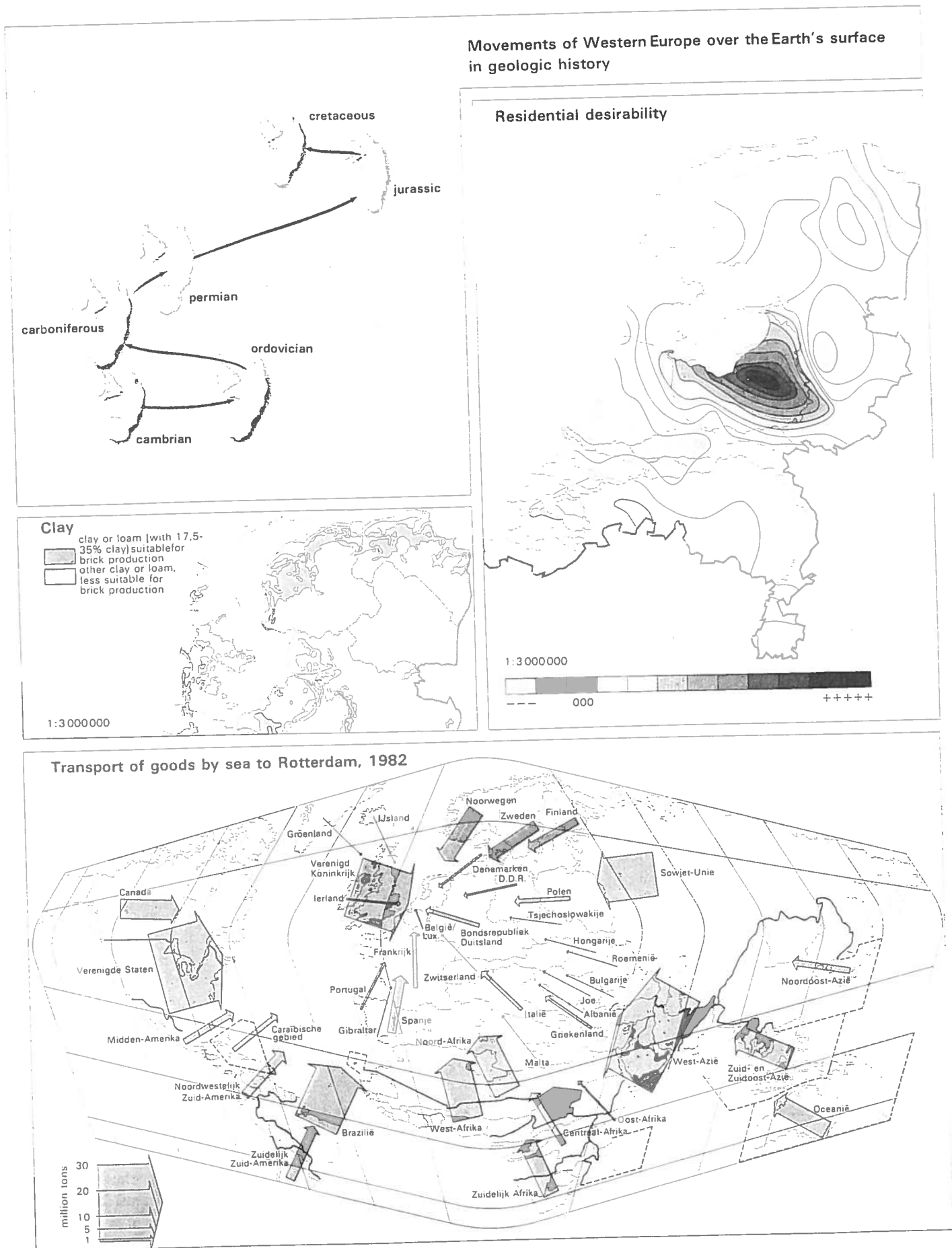
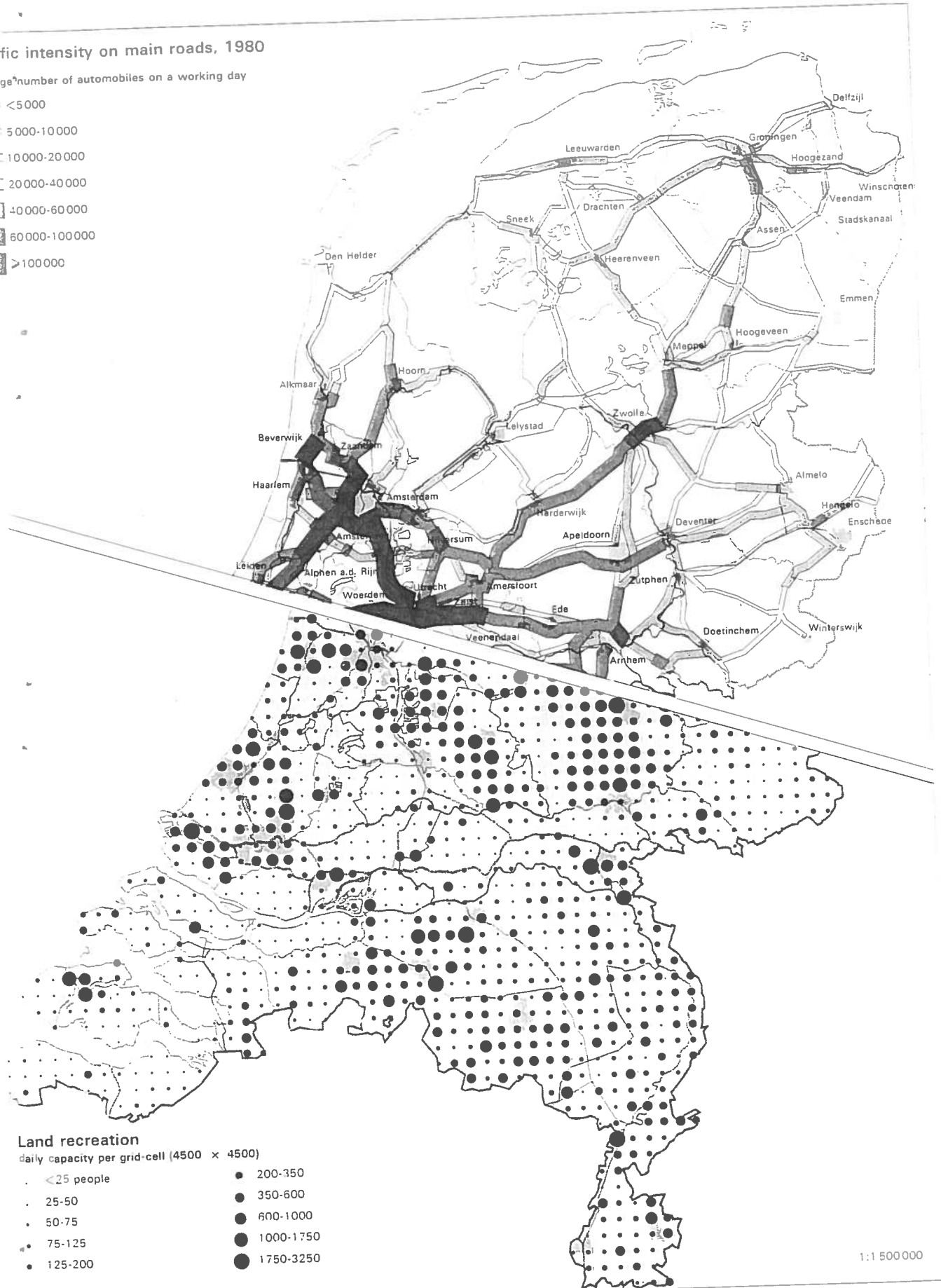


FIGURE 5 Examples of some methods of cartographic representation used in the atlas of The Netherlands (titles and legends translated)

Traffic intensity on main roads, 1980

Legend: number of automobiles on a working day

- < 5000
- 5000-10000
- 10000-20000
- 20000-40000
- 40000-60000
- 60000-100000
- > 100000



Land recreation

Legend: daily capacity per grid-cell (4500 x 4500)

- < 25 people
- 25-50
- 50-75
- 75-125
- 125-200
- 200-350
- 350-600
- 600-1000
- 1000-1750
- 1750-3250

1:1 500 000

FIGURE 6 Fragments of 1:1 500 000 maps from the atlas of The Netherlands (titles and legends translated)

lar geographic information system is now imminent in some countries. As a consequence, a new national atlas concept may emerge which will be less static and more dynamic in nature. In addition, because of modern technologic developments, the actual means of spatial information transmission will also change. In the future, the main goal of a national atlas project may no longer be the production of the traditional hard copy. Instead, emphasis may be put on the constant dissemination of the spatial information stored in the geographic data base, in either hard or soft copy map form or not in graphic form at all, to users on their demand. It is definitely no longer science fiction to think of users retrieving spatial information from the national atlas data base at home or in the office and displaying it in graphic or textual form on their video display screen on the desk.

As Monmonier ([6], p 136) stated: "The paper atlas most likely will become secondary to the digital cartographic data base from which it will be derived...." For the time being, it is difficult to think of a complete disappearance of the hard copy national atlas—especially in view of its educational and reference functions—but the electronic atlas is advancing.

The potential increasing applications of digital technology and modern telecommunication systems and the development of a computerized national atlas geographic information system are clear:

- The utility of the spatial data increases because of more efficient and flexible access. More specific needs of a variety of users can be satisfied by the generation of maps and digital spatial information from the same data base on demand.

- There are more possibilities for quick data analysis, processing and manipulation.

- Maps can be produced more rapidly, and more possibilities will be created for experimentation with map design, leading to more useful information.

- Last but not least, more up-to-date spatial information may become available.

Indeed, the replacement of a traditional national atlas bureau by a broadly oriented standing clearing house for the exchange of geographic data has many potential benefits. This will, of course, lead to substantial changes in the everyday organization of a national atlas project. Data base administration is not the same as atlas production coordination, and it is not unlikely that there will be increasing involvement of private companies as spatial data suppliers and users (eg. private companies engaged in the fields of car navigation systems or electronic educational devices). What will remain the same, in our opinion, is the need for experts and government institutions to keep participating in the network needed to provide and analyze the spatial information and the need for cartographers who structure and present the information, whether on a screen or not, to ensure that the information given is relevant and significant and also to ensure that the information received by the users of the national atlas system of the future will be comprehensi-

ble and intelligible.

It may still take quite a while before national atlas geographic information systems become fully operational. Many countries will not yet be in a position to implement such systems, for example because of lack of expertise, manpower, financial resources (high capital investments are needed) or because of technical and maintenance problems. Nevertheless, countries can already start building up the necessary network of experts and institutions. And if it is now possible, countries—developing countries in particular—should still seriously consider the production of a "traditional" (paper) national atlas. The needs for development (also of skill and expertise) are urgent in many places in the world, and national atlases may contribute to satisfying these needs.

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RESUME

Dans beaucoup de pays, des discussions se tiennent pour savoir si un atlas national doit être publié, et sous quelle forme. Le présent article donne des informations générales sur la fonction, le contenu, les exigences, la structure et le format des atlas nationaux, et aussi sur leur rôle dans le développement national. La production de l'atlas national des Pays-Bas sert d'exemple.

RESUMEN

Son muchos los países donde se están celebrando discusiones sobre si un nuevo atlas debe ser publicado, y en que forma. Este artículo proporciona información general sobre la función, contenido, requisitos, estructura y formato de los atlas nacionales, y también sobre su papel en el desarrollo nacional. Los ejemplos son extraídos de la producción del Atlas Nacional de Holanda.