

# AN INVENTORY OF FRENCH LITTORAL

Jean-Philippe GRELOT;

Institut Géographique National, France

2 Avenue Pasteur  
94160 SAINT MANDE - FRANCE

## ABSTRACT

The production of inventory mapping requires the collection of a considerable amount of data. Digitizing those data and using powerful computer procedures opens new perspectives for using thematic cartography.

The Institut Géographique National-France, has developed a cartographic processing chain whose major assets are the constitution of files and the use of an automatic plotter. That chain was constructed, in particular, for producing an inventory of the littoral showing both land use and land legal status. Hand-drawn documents are produced in the normal manner either by interpreting aerial photographs (land use) or based on data collected from local authorities (legal status).

The outlines of zones and administrative boundaries are digitized by scanning equipment and coding is carried out in an interactive manner.

The area symbols and screens are generated by automatic plotting in order to produce the films required for offset printing. Thematic files are crossed with administrative files in order to produce statistical data banks.

New products can be produced from such digital data, for example,

- (a) Synthesis derived maps
- (b) Maps produced crossing several themes,
- (c) Statistical calculations.

As the programme will be repeated every five years it will be possible to up-date the files and automatically compile evolution maps.

## INTRODUCTION

Along the 5 000 km of the French littoral one encounters zones devoted to agricultural, tourist or industrial activities : wild rocky coasts, meadows, forests, long sandy beaches, marshy deltas and ports. This littoral is the object of important economic projects proposed by major companies and pressure groups.

The mapping of the littoral is destined to make that sensitive zone better known, to guide public authority policy and to facilitate negotiations between different groups.

In order that the inventory should not only be an historical record but, in addition, a real tool for regional development it was given a dynamic aspect by taking land use evolution into account and by displaying the differences between the theoretical use of that space as planned by legislation and the actual use that one observes on aerial photography.

The benefit that one expects from automatic cartography clearly appears here : by including the building-up of computer files in the map compilation procedure, the data are gathered in a form which ensures their perfect conservation and makes it possible to use them in the best conditions. The techniques used must be sufficiently effective for processing this type of mapping, both as regards graphic quality as well as costs and delivery times.

## THE DATA

Limited to a coastal strip about 5 km wide, the inventory mapping has two major aspects :

- (a) land use as currently observable (147 large format sheets at 1:25 000),
- (b) legal status of the land (23 sheets at 1:100 000) destined to orient the present and future use of the space.

### Land use

The use of the land sector is obtained by medium-scale photo-interpretation carried out by the Institut Geographique National (I.G.N.-F). The main divisions of the resulting map legend differentiate between the urban, agricultural, natural and coastline spaces. Information on the maritime sector is collected from local authorities and concerns marine breeding and natural resources zones which are being exploited or have to be protected.

## Legal status

The legal status of the land is also established using data supplied by local authorities. It has two components :

- (a) Legal status of the ground as obtained from town planning documents, forestry regulations, national parks, nature reserves, wild sites, historic monuments and maritime law.
- (b) Ownership of public authorities.

## CARTOGRAPHIC COMPILATION

### Digitization

Data digitization is carried out in two stages. The outline overlays obtained by scribing are oriented in accordance with the Lambert system, and analyzed automatically by a scanner. The grid file so obtained is processed in order to skeletonize the outlines and correct imperfections, then to attribute a common code to all the points of the same unit. One thus obtains a computer file which is termed "geographic".

One then proceeds to the coding of the thematic information ; one establishes a correspondence between each unit and the thematic code supplied by the overlay, then transcribes the result on to the computer support, obtaining the "statistical" file. That coding is carried out interactively, by means of a digitizing table, by levelling inside each land parcel : double coding makes it possible to eliminate errors.

The entire group of information forms the littoral data bank.

### Legend

The development of the legend, in its graphical representation, was carried out taking two constraints into account :

- (a) Automation of the largest number of production stages so as to reduce the manual interventions, and so the prices and delivery times,
- (b) Production of very high quality mapping whilst using only four colours, again for economic reasons.

The area symbols were drawn using an interactive colour display and building up a library : the typography common to all the maps in the series (titles and subtitles) was digitized using a scanner in order to complete a file carrying the legend.

### Offset film output

The output of offset film from the four-colour procedure is carried out by simultaneously processing the "geographic" and "statistical" files, then placing the area symbols from the library using a programme and finally adding the legend file. The area symbols and the screens are

generated on films by an automatic laser-plotting machine in order to produce the black, cyan, magenta and yellow master printing plates which are completed manually when necessary. Then follows the addition of the point symbols and the legend elements appropriate to each map, and finally the integration of the planimetric-relief-hydrographic base map. A proof is produced by the Cromalin process for inspection prior to four-colour printing.

## BASIC PRODUCTS

The results of this procedure are displayed in two forms : a series of maps accompanied by tables of statistical data.

### Maps

The basic tools are the land use maps with legends which immediately reveal two reading levels. At a first glance, the reader differentiates between the urban zones (bright colours with gradation, geometric area symbols), agricultural zones (cool colours, slack area symbols), natural zones (dull colours), coastlines (black area symbols), aquatic zones (on the hydrographic blue colour, figurative area symbols in cyan for the breeding zones and in magenta for the natural resources to be protected). Inside each of these groups, a more detailed examination (second reading level) makes it possible to find each legend item. At the technical level, the only elements added manually to that map are point symbols in magenta (discharges, isolated buildings), embankments, the sheet title and commune names and boundaries on the black printing plate ; it is planned to digitize these items in order to plot them automatically. The outlines of the photo-interpretation zones, the legend lettering as well as the kilometric ticks are generated automatically on the same plate as the black area symbols.

The maps showing land status are, in certain ways, more complex because numerous themes are superposed.

The base is a legal map which includes town planning documents translated by colours recalling the land use (spaces allocated to urbanization, agriculture, natural zones), a forestry theme in magenta area symbols (land clearing forbidden, protected forest, forest perimeter fire-break), protected sites in black area symbols (parks, reserves, historic or other sites), maritime status in magenta or cyan area symbols.

It is completed by a monochrome land ownership map using screens and area symbols ; point symbols are added manually for the linear zones and small properties.

In order to obtain a first comparison between the legal texts and the actual use of the land, a summary land use map is also produced. The reduction of the scale from 1:25 000 to 1:100 000, the regrouping of the land use themes into seven classes (urban, agricultural, and natural zones, wooded country, marshy zones, marine breeding and natural resources) and the assembly from 3 to 8 sheets at 1:25 000

for each sheet at 1:100 000 takes place automatically with a group of programmes, so that the thematic plate of monochrome area symbols is produced directly without photo-engraving operations.

### Statistics

The second type of document produced systematically is a list of communal statistics. To the population and housing data collected during the 1968 and 1975 national censuses are added the total areas of the themes for each commune by distinguishing between three different types of geographic zone :

(a) the actual littoral zone extending from the coast inland for a depth of 2 km, (b) a less sensitive zone from 2 to 5 km and (c) the hinterland beyond 5 km. These results are obtained by computer crossing of the digitized outline plates and the communal boundary files. The areas are printed in hectares.

### DERIVED PRODUCTS

The advantages of the above procedure stem directly from file constitution and, in particular, from the raster-mode files. In addition to the fact that the acquired data are stored in perfect condition, all the information shown on a printed map is immediately usable for producing either a new thematic map or statistical results. In addition, the technical resources used enable one to have, whilst keeping to the four-colour process, a very wide range of colours and symbols whilst obtaining a graphic quality which exceeds the best traditional products. Finally, the printing scale can be selected as required and contiguous maps can be assembled very rapidly.

### Cartographic products

A certain number of trial uses of the files have now been carried out.

For instance, it has been possible to select a theme or a group of themes by associating it with the assembling of several sheets and with a change of scale : this makes it possible to display a particular phenomenon or to present a synthesis of the space over a vast zone covering several sheets of the initial sheet line system.

By crossing themes obtained from maps printed at the same or different scales, one of the themes acting as a selective mask with respect to the other, one can display the interactions between different phenomena, such as legal provisions and the actual state of affairs. Thus it has been possible to study the degree of protection of natural spaces with respect to the diffuse urbanization due to tourist developments.

## Statistical products

Another class of products is constituted by purely statistical outputs. These can be the equivalent, in the statistical field, of the cartographic documents described above but one can add :

- (a) ratio calculations for determining a typology of communes or natural regions in accordance with a group of criteria (tourist, agricultural, or industrial vocation, etc.),
- (b) integration of data taken from other French national files e.g. national censuses of population or agriculture, inventory of communal services and equipment, the construction file, business concerns and factories file, etc.

One thus constructs a communal statistics data base whose different components mutually enrich one another and unite to provide a better knowledge of the littoral and lead to an improved follow up of its evolution.

## REVISION

The Inventory is planned on a five-year cycle. This decision led to the early inclusion of the revision aspect in the design of the production chain used for the reference operations based on 1977 aerial photography.

For the second generation, the photo-interpreters will have the reference map and the summer 1982 aerial photography at their disposal. The photo-interpretation overlay will be produced on a base map showing the topography and the outlines of the initial zones ; only those zones which have been modified between the two aerial surveys, either in their geometric definition or their thematic contents, will be redrawn. The compilation will thus be considerably reduced. That overlay will be digitized in the same way as in the initial procedure and the revision will be carried out by an entirely computerized procedure. Two land use files will then be available, one for the reference date the other corresponding to the current state. One will then be able to produce an up-to-date map and evolution maps.

The large number of themes involved excludes the representation of all the evolutions on a single map : some of them by their very nature are impossible to display or are of little significance. However, a major advantage of the digital production-line associated with raster mode mapping is the possibility of being able to automatically produce those evolution maps without undertaking a new interpretation by comparison of two the states and a new compilation for each type of evolution map ; the time gained and the money saved are appreciable.

In addition, all the statistical calculations can be carried out either in global percentages or more precisely by calculating the evolution matrix. These results, completely impossible to obtain with normal manual cartography, can

guide the selection of the evolution maps to be produced.

### CONCLUSION

The major project constituted by the Littoral Inventory forms part of a decisive stage in thematic cartography. The printed maps cover two basic functions (a) a function of synthesis, i.e. collection of data corresponding to a given moment, which particularly interests technicians and (b) a teaching function of information transmission by images to a larger public including those persons responsible for making decisions and formulating policy, regional development authorities, teachers and all persons concerned by the development of the littoral zone.

However, the cartographer is no longer the exclusive author and producer of a given map ; henceforth a map will result from the particular use of file or group of files via software and the cartographer must become a computer expert in order to design and develop those files and software so that he can make the best use of the mass of recorded data.

If the reference document, the one which contains all the data, is no longer a map but a digital file, the power of computers and automatic equipment will become available to the cartographer who can then rapidly produce many varied forms of output using representation modes which are as detailed as he requires.