MISCELLANEA GEOGRAPHICA

WARSZAWA 1986

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PHOTOMORPHIC REGIONALIZATION OF POLAND

Advance in geographical environmental research, a better knowledge of the laws that govern the functioning of the environment, its rate of growth in particular, largely depend on the remote-sensing techniques. Remote sensing has nowadays come to be the source of a great deal of useful information on various geographical components, their accurate location and spatial differentiation as well as time-related variability.

Data that reach us through satellite imagery render it possible to survey geographical environment components from the cognitive point of view and facilitate the taking of decisions in the planning and economic domains. They help more properly manage and protect natural habitat and appear as an irreplaceable anthropopressure monitoring instrument.

As a result of the satellite-performed missions a great number of photographic and scanner images could have been made available in various electromagnetic-spectrum bands. However, as results from literature, the use of such data in natural research is highly inadequate.

Accordingly, technological advance in the supply of the data is much faster than their actual use in the geographical research.

Problems encountered in benefiting, in full, from the remote sensing information data, in the research of various geographical disciplines result from a number of reasons, often closely linked with each other.

First of all, remote sensing of geographical environment is a relatively new line of research. It is interdisciplinary since it comprises elements of physics, technology — chiefly elctronics and computer science, with several domains of natural sciences. From materials published so far it is however evident that technical aspects of the remote sensing owerweigh its character of natural science. It would be therefore necessary to establish a state of equilibrium between the data acquisition and processing procedures and potential of the applicability and effective use of such data in natural research, in that straightforward methods could be introduced to allow a quick and possibly all-round utili-

zation of the remote sensing data, by imparting them geographical contents and form.

Secondly, no electronic equipment to scan the images is mede available in the research and didactic institutions.

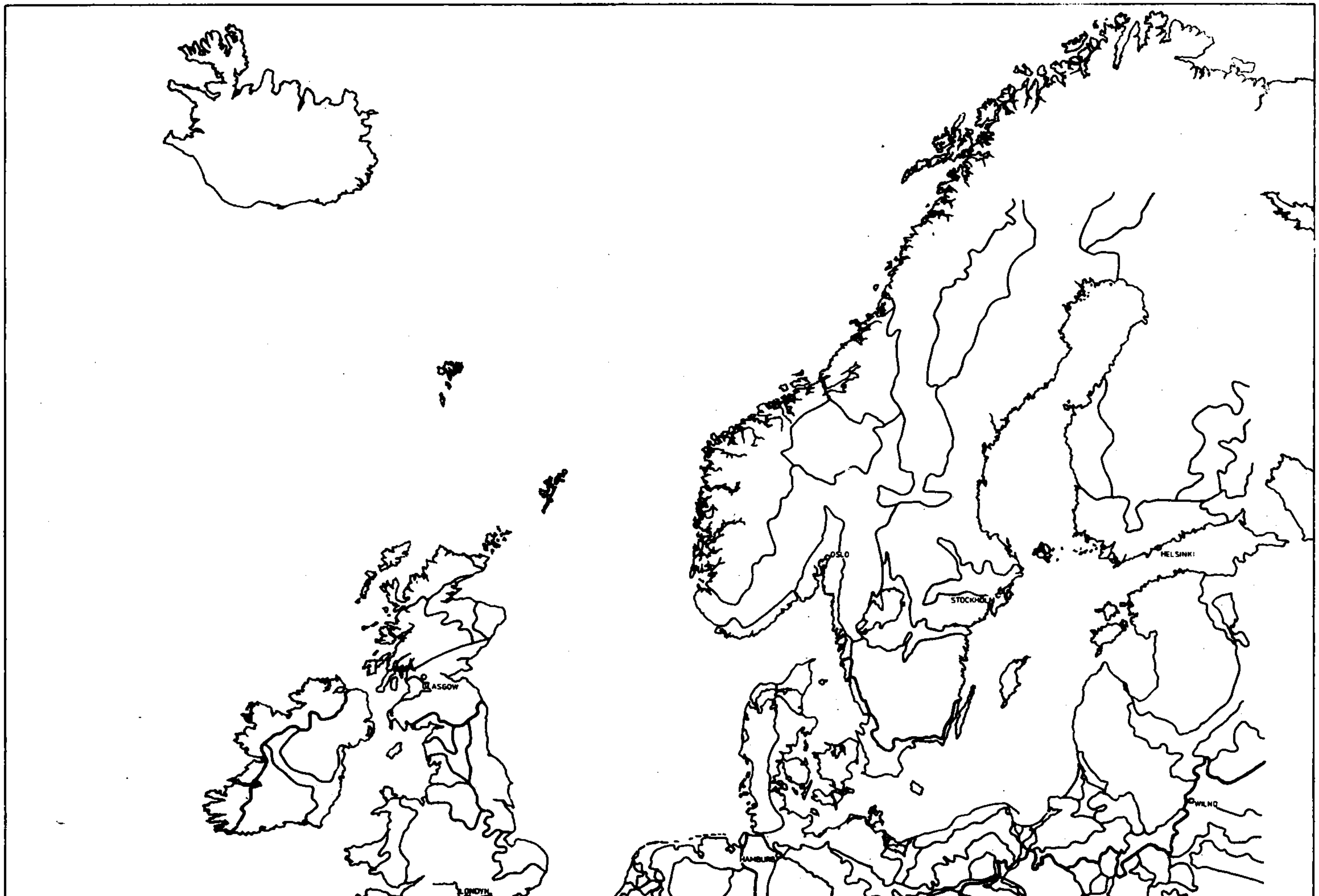
Thirdly, there are no publications on remote-sensing and natural sciences to show us that even within the well-known European areas there are situations in which the remote sensing technique is likely to be found highly beneficial.

Fourthly, there are not many publications which assess the extent of reliability of the material based on the remote sensing information. This indicates the necessity to carry out certain studies on extrapolating data for the relatively small research (training) areas to larger areas, with the right amount of credibility preserved for the extrapolated data. In other words, it is indispensable to identify boundaries of the territorial units in which the investigation (training) area data would preserve their reliable and uniform character of the truly representative data. This problem is tackled in the further part of this paper.

THE NOTION OF A PHOTOMORPHIC UNIT

In the interpretation of satellite images there are two different approaches to solving research problems, each of them based on a specified characteristic method of scientific research. They are made dependent on the research objective. One is an inductive approach. Starting from the analysis of facts identified on images we come on this basis to conclusions concerning individual environmental components, generalized in continued deliberations. The other approach is based on the deduction method in which starting from more general premises we eventually arrive at lengthy conclusions and diverse semantic divisions. In the latter case, a remote-sensing image is approached to as a set of the singly representable facts applying to a variety of components of the geographical environment. In such an image as if the layers of data applying to particular components of the environment are superimposed upon each other. Condensation of data applying to only one component of the environment brings to the fore one element or a set of elements characteristic of such a component, thus contributing to the fact that a satellite image for the given area carries with it more information of the component chosen than of others which become less visible on it, or are often identifiable only through indirect conclusions.

Bearing this in mind, it may be said that even when preliminarily viewing the remote-sensing images, both aerial and the satellite ones, we can see that such images to a certain extent tend to reflect diversifi-



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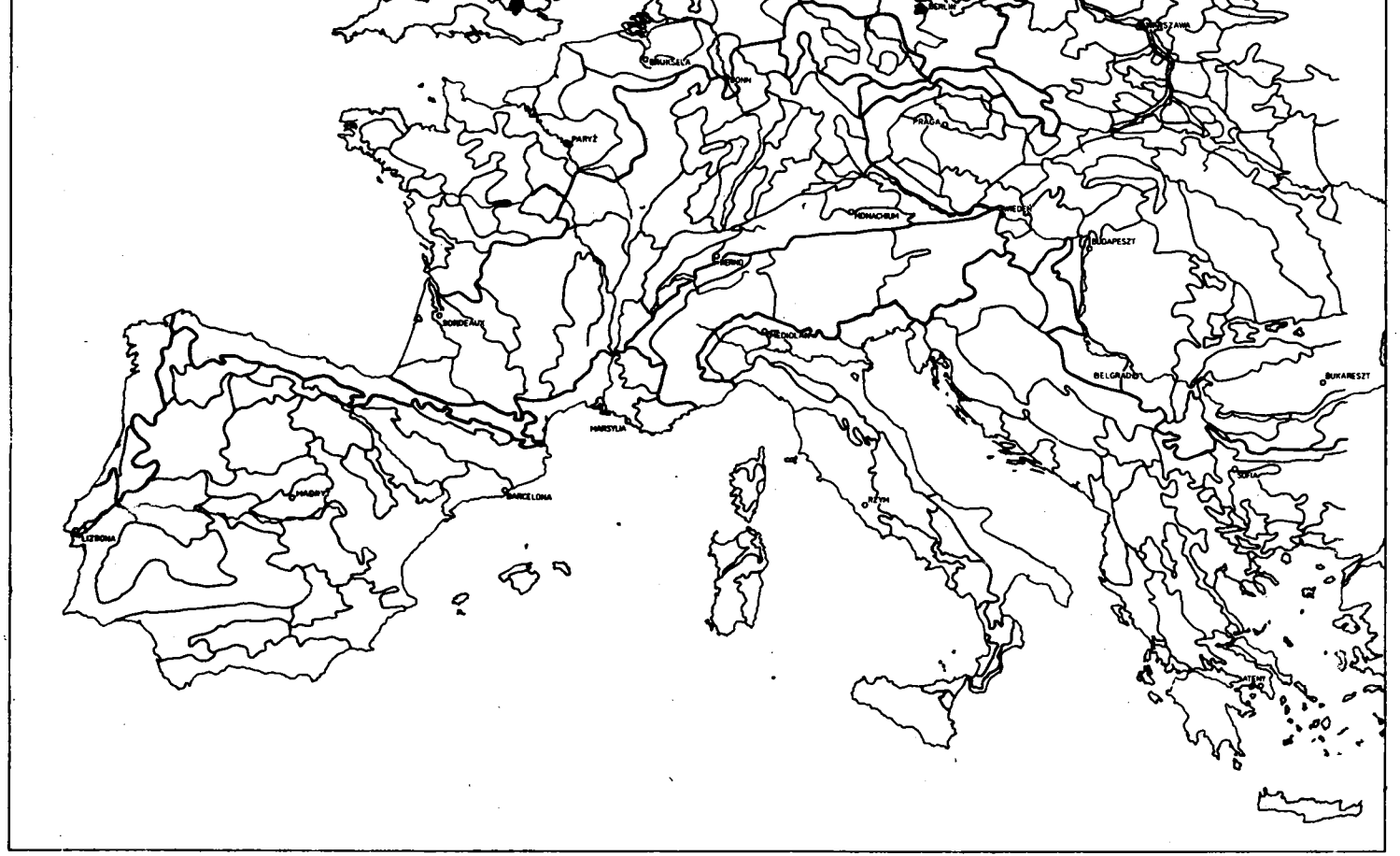


Fig. 1. Europe — Delineation of photomorphic units according to the NOAA satellite imagery data.

cation of the geographical environment. The image is divided into areas differing in size and in their character, as against the background of the neighbouring areas. This results from the fact that the image of the particular fragments of the land is an outcome of the resultant prominence the particular components of geographical environment reflect in the image. The most important, leading, component, represented by the greatest number of identification features, forms external appearance of the territorial unit under review, and makes its physiognomy. Once it will be the relief, at some other time water relations prevailing in the area, diversification of flora, land usage or even social and economic relations as well as political past of the territory. Each of these components of the geographical environment has its specified share in the process of making such and no other image of the given area.

The remote-sensing images of the earth surface must be regarded not only as a statistical set of part-images of the geographical environment components. They are dynamic in their nature, showing relationships and mutual dependencies among the particular components. The art of reading such connections requires thorough knowledge of the laws governing the natural environment.

The whole geographical-environment-information record in an aerial photography, or satellite image, is formed by three elements of every image, being at the same time its identification features: phototone, photostructure and phototexture (pattern). Combinations of these three features on the surface of each photograph or photosketch form various tonal and structural configurations limited to a strictly confined area. Such territorial units analysed under a photographic record will be referred to as **territorial photomorphic units.** They are characterized by a certain amount of image homogeneity making reference to specified relationships existing between the most important geographical environment components.

The analysis of the 1 : 3 500 000 satellite image of Europe, cumulated from the NOAA-7 meteo-satellite images through editing, has been carried out by the Remote Sensing Division, Royal Aircraft Establishment, England, on May 20th, 1985.

A number of territorial units with a specific image structure have been obtained in this manner (Fig. 1).

Photomorphic units marked out in continental scale make reference to the predetermined natural structures. This induces us to tackle this problem more carefully on national scale, particularly with reference to Poland. A comparative analysis of the 1 : 250 000 LANDSAT satellite images has been thus carried out for some chosen parts of Poland taken against the geological, geomorphological, and soil-identification maps

worked out in comparable scales to assess the degree in which the satellite image reflects or depends on the above-mentioned components of geographical environments. Special attention has been given to the Tatra Mountains, the Small Beskid and the Silesian Beskid Heights, the Proszowice Plateau, the Drohiczyn and Siemiatycze Uplands, and the South-Masurian Forest and Lake Zone (Fig. 2). When analysing their geographical environment, use has been made of cartographic materials the list of which is provided in the bibliography.

THE PHOTOMORPHIC UNITS MAP OF POLAND

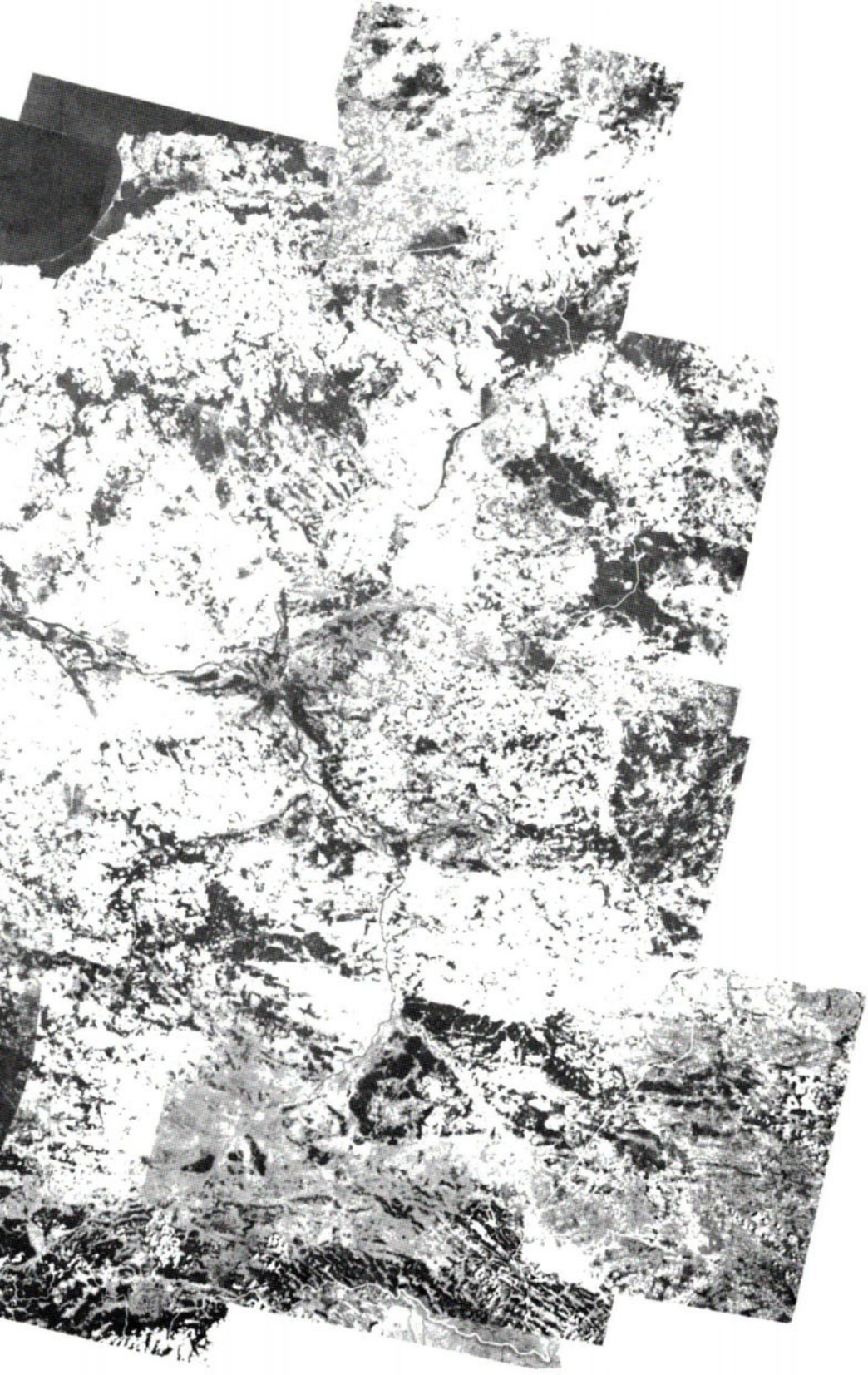
From the analysis of the territories chosen it is evident that photomorphity of the satellite images largely depends on the geographical environment components. The significance of these components in making up an image varies according to the part of Poland handled. In the Carpathian units zone it is tectonics that plays the most important part and imparts that area a well-defined phototextural style. In the upland units this will be the method of land use that will impress its character in connection with a greater tectonic and lithological homogeneity. In the Central Poland's lowlands, these will be soil types making reference to the Quaternary formation lithology that seem to be a leading component. In the early glacial areas, characteristic features of the image are connected with the lithology, hydrography and land usage.

The analysis of the chosen areas also indicates that units distinguished against the photointerpretation criteria often correspond to the existing geosystems.

On the basis of the photomorphic survey conclusions for the chosen parts of Poland and on the previously presented theoretical preassumptions, all satellite images available in Poland and deriving from the LANDSAT series satellites and covering Poland's territory have been analysed from this point of view. The number of these images is forty and they come from the years 1973 to 1979. They represent colour compositions in themselves, in conventional tones, produced by the synthesis of the channel 4, 5, 7 black-and-white MSS images. The analysis has been made on the 1 : 250 000 photographic paper copies. It was based on such photointerpretation criteria, as the phototone, photostructure and phototexture. Figure 3 shows the black-and-white version of the colour images that have been reproduced and then re-edited as a photomosaic on one display panel. It brings out photomorphic variability of the satellite image on the all-country's scale.

No sooner than the indispensable reproduction steps have been

Fig. 3. The satellite image of
-and-white reproduction of LANDS.



Poland. Photomosaic prepared from the black-
AT MSS false colour images.

Fig. 2. Poland — Identification of the analysed photomorphic units:
1 — Tatra Mountains, 2 — The Small Beskid, 3 — The Silesian Beskid, 4 — The Pro
South-Masurian Forest and Lake Zone.

szowice Plateau, 5 — The Drohiczyn Upland, 6 — The Siemiatycze Upland, 7 — The

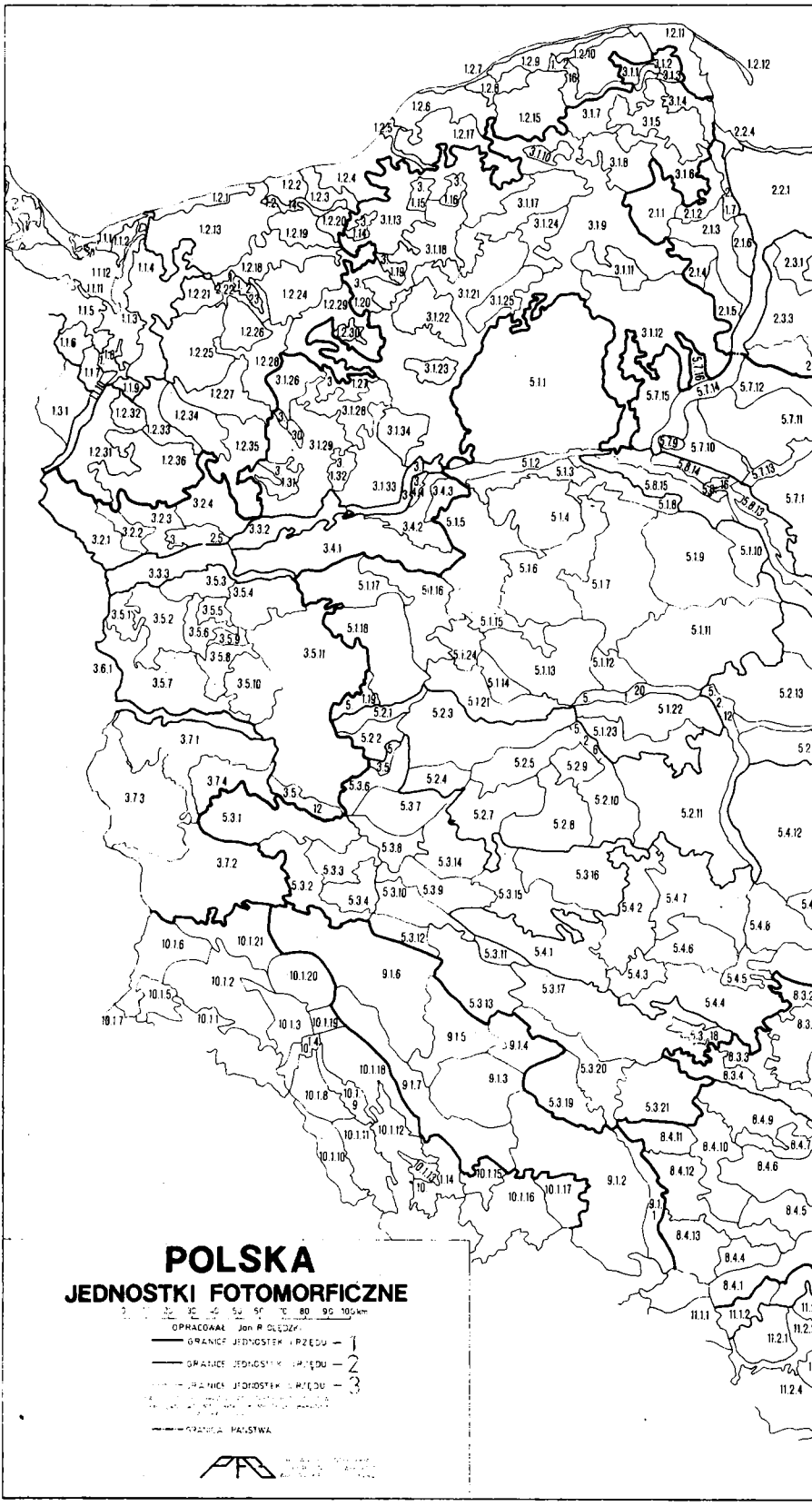
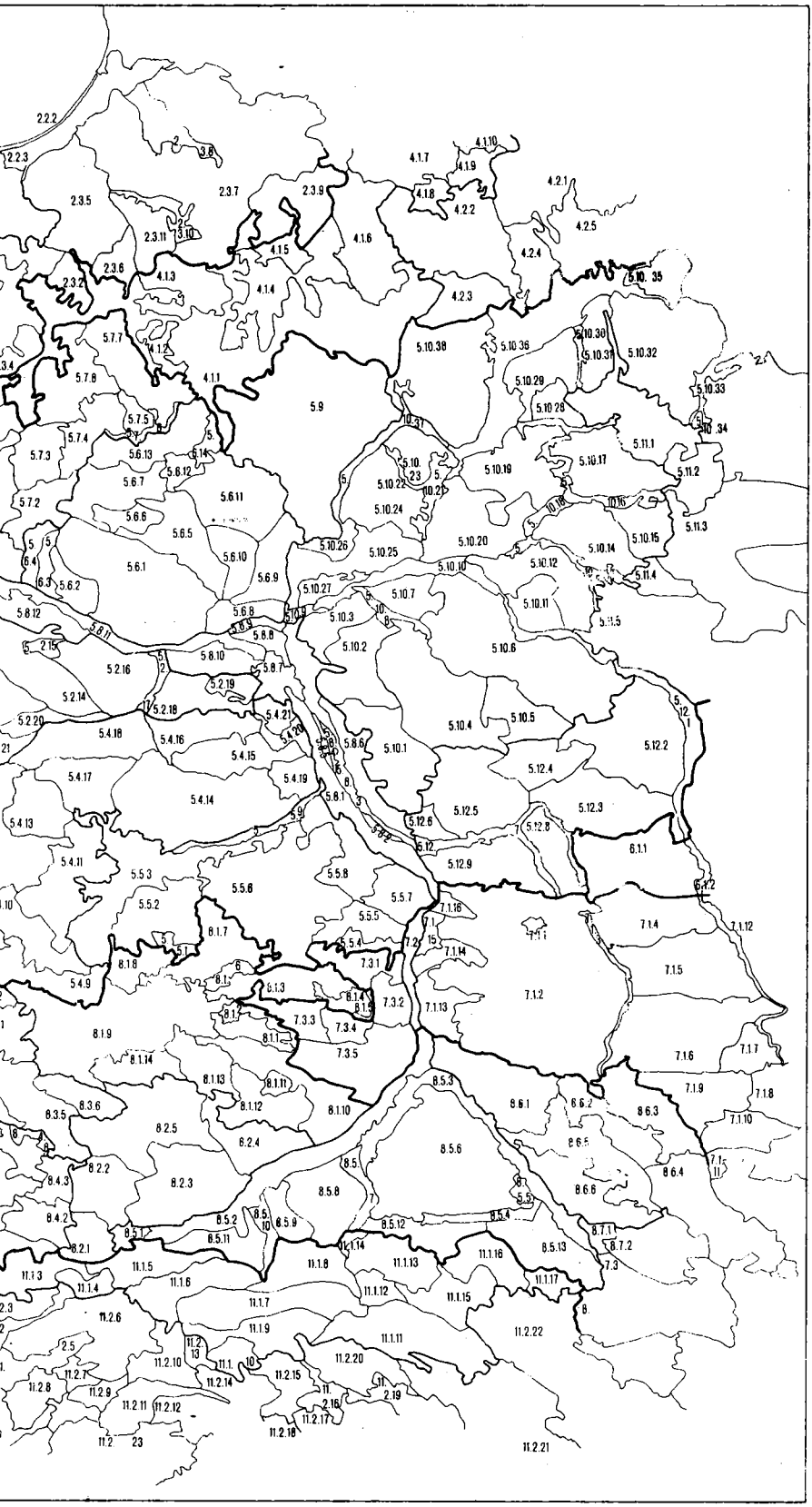


Fig. 4. Division of Poland into photomorphic units according to the LA
1 — boundaries of the 1-st order units, 2 — boundaries of the 2-nd order units, 3
false colour satellite images (LANDSAT series satellites).



ANDSAT imagery data.

— boundaries of the 3-rd order units. Prepared from a composition of the MSS

completed, outlines of the photomorphic unit contours marked on the 1 : 250 000 images were presented as a map of photomorphic units of Poland (Fig. 4). Units marked out proceed in three generalization levels. Accordingly, there are 11 photomorphic units of the 1st order, 42 photomorphic units of the 2nd order and 494 photomorphic units of the 3rd order.

Boundaries of these units are mostly univocal in their character. Yet, there are also zones the boundaries of which prove to be pretty unstable and so they should be seen rather as certain zones. This is linked with the unstable appearance of the geographical environment, with its dynamics depending on the season of the year. Of certain importance is also technical non-uniformity of images analysed.

The map of photomorphic units of Poland reflects a rather complex approach to both natural features of the geographical environment as well as symptoms of economic activity exercised within its confines. Units discriminated are largely linked with the natural components of the environment, thus showing the extent to which the economy (anthropogenic features of the environment) is adapted to the natural environment. There are only a few units which are completely anthropogenic in their character. This applies in particular to Upper Silesia and to the big urban agglomerations which represent technically typical geosystems.

The map of photomorphic units provokes a question: what is the relation in which units discriminated remain towards spatial divisions existing in this country? The answer to this question will be possible only after the comparative analysis of the identified photomorphic units and their spatial layout has been completed against the background of maps showing spatial position of the chosen, most physiogenic components of geographical environment. This analysis will permit an answer what is the geographical sense of the photomorphic units distinguished on air photographs.

Nonetheless, in a statistical sense at least, a comparison can be made between Poland divided into photomorphic units and Poland divided into physicogeographical regions (J. Kondracki, 1981). This comparison shows that the distinguished photomorphic units of the 1st order correspond to subprovinces in the physico-geographical regionalization of Poland, units of the 2nd order correspond to macroregions, and those of the 3rd order to the mesoregions. It is felt, at the same time, that the higher-rank photomorphic units seem to integrate — to some extent — corresponding units deriving from the physico-geographical division (subprovinces and macroregions). In the first case, 18 subprovinces are indentified with 11 units of the 1st order, und the 56 macrore-

gions with 42 units of the 2nd order. At the lowest-rank units level, on the other hand, the number of photomorphic units increases, thus accounting for 494 units as against 318 mesoregions.

In addition to the cognitive aspect, i.e. the assessment of the relation between the remote-sensing image and its natural and economic contents, the importance of a photomorphic analysis may also lie in the chance of upgrading remote-sensing studies into geographical environment and its monitoring.

Through their contours, the photomorphic units mark out boundaries within which it is possible to extrapolate results of studies based on the remote-sensing data obtained from the key (training) areas treated as representative ones. Contours of the photomorphic units delineate, at the same time, the geographical space within which data derived on the basis of statistical probability are likely to have an identical reliability.

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