Zeitschrift: Geographica Helvetica : schweizerische Zeitschrift für Geographie = Swiss journal of geography = revue suisse de géographie = rivista svizzera di geografia

Herausgeber: Verband Geographie Schweiz ; Geographisch-Ethnographische Gesellschaft Zürich

Band: 15 (1960)

Heft: 4

Artikel: Miscellanea geographica

Autor: Boesch, Hans / Carol, Hans / Brunnschweiler, Dieter

DOI: https://doi.org/10.5169/seals-42867

Im folgenden werden ausnahmsweise einige englischsprachige Referate publiziert, da ihre Veröffentlichung am ursprünglich geplanten Ort in Frage gestellt zu sein scheint. Der Charakter der Geographica Helvetica als schweizerische Zeitschrift bleibt indessen durchaus gewahrt. Red.

MISCELLANEA GEOGRAPHICA

On the occasion of the 18th International Geographical Congress in Rio de Janeiro the undersigned reported in four separate papers the recent work done in the Department of Geography, University of Zurich. These reports were intended to be published in the congress acta; this publication, however, has been so greatly delayed that they appear now in GEOGRAPHICA HELVETICA. More than four years have elapsed since the reports were written by the authors; still, after reperusing them, it was decided to publish them without any major changes.

HANS BOESCH

Principles of the Concept «Landscape»

by

HANS BOESCH and HANS CAROL

Every science has a definite object, and necessarily, definite methods of research. The often repeated saying that «geography is what geographers do» may be quite useful for an after-dinner speech, but as a definition it has no scientific value. Neither do we agree to the frequently pronounced opinion that methodological discussions are of no significant value, and that it would be much better, instead of discussing such problems, to go ahead and do some good and solid field work. On the contrary, we believe that the ever increasing interest in methodological problems, which is demonstrated by an ever increasing amount of methodological publications, will be of great importance to geographers and for the standing of geography among other sciences if, and as long as, the validity of the results obtained is always checked with respect to its practical and philosophical soundness.

This paper summarizes some of the results obtained in connection with the work carried out in the Department of Geography, University of Zurich (Switzerland) within the last fifteen years. In some points the results of our investigations essentially differ from those reached by geographers in the neighbouring Germany, where these questions were studied more intensively than anywhere else. The following is, therefore, to a large degree a critical and comparative discussion.

The German-speaking geographers use the word «Landschaft» or landscape to designate the object of geography. As in French, English and other languages, this word is used in the common language and also in several other fields to stand for different concepts with very definite meanings. It has been suggested that, in speaking of the geographer's landscape, the concept «geographic landscape» should be used.

HETTNER, possibly the most prominent of the German geographers, placed the concept of «landscape» in the following sequence, «parts of the world, countries, landscapes and localities», to indicate spatial unit of a specific character. Today, most German-speaking geographers mean by landscape a definite homogeneous area, generally a natural region. According to their view, it is possible to divide the surface of the earth into individual landscapes each of which possesses the qualities of a geographic whole and represents the real object of scientific geography. The landscape, *i. e.,* the geographic landscape, is here defined as a spatial unit with the definite character of a real entity which cannot be subdivided any further without losing its properties.

For HETTNER the landscapes were, however, but one group of spatial units and in no way the object of geography. According to him, the latter was defined as the complex of «the ground or lithosphere, the waters or hydrosphere, the air or atmosphere, the world of the plants and animals, men and his works . . .» He states that «in reality the surface of the earth is a three-dimensional figure of a considerable vertical extent,

made up of solid, fluid and gaseous parts and sheltering life». The five spheres mentioned (the lithosphere, hydrosphere, atmosphere, biosphere and anthroposphere) constitute what HETTNER termed the «Erdhülle» (others, more loosely, the «Erdoberfläche», the surface of the earth) and what has more recently been called by the Russian geographers the geographic substance. We prefer instead the internationally understood concept of «*geosphere*» which is self-explanatory, can easily be translated into most other languages and is not claimed by other sciences.

Two of the inorganic parts of the geosphere (the rocks and the air) envelope the earth continuously, while the hydrosphere, the plant and animal life as well as man are discontinuously represented. All the five spheres are within themselves highly differentiated into patterns of more or less homogeneous spatial units. However, these various patterns are not congruent because the factors responsible for areal differentiation are not working exclusively in a vertical sense and, consequently, in all the spheres in an identical way. While the geosphere in its totality possesses the character of a whole, it will be impossible to organize the geosphere into a single system of spatial entities or organisms. This has been recognized by many geographers; it may suffice to quote HARTSHORNE wo in *The Nature of Geography* asserts: «...we not only have not yet discovered and established regions as real entities, but we have no reason ever to expect to do so ...» This is a view which we strongly support and which is the basis of our conception. It follows that in principle any criterium can be used for a division of the geosphere, and that any such part of the geosphere is «geographic substance» or «landscape». It is suggested that the word «geomer» be used to designate such parts (Greek: ge = earth; meros = part of a whole). A geomeric division of the earth refers always to a geospheric whole, namely, to all the spheres which are represented within that area or at that particular point. In German usage the word landscape in the sense of geographic landscape may be synonimously used, and we may speak of the landscape of the continents, of Switzerland, of the mid-latitudes, or of New York. It also makes no difference whether the landscape does or did actually exist or not; frequently geographers study the natural landscape, not as it was before the arrival of man, but as it would be today if man had not interfered.

If we consider the possible degrees of integration within a geomer, we come to the following system:

	Natural Landscape		Cultural Landscape
	Inorganic Landscape	Organic Landscape	
Spheres represented	—	—	Anthroposphere
	—	Biosphere	Biosphere
	Atmosphere	Atmosphere	Atmosphere
	Hydrosphere	Hydrosphere	Hydrosphere
	Lithosphere	Lithosphere	Lithosphere
Laws governing the interrelationship	Inorganic	Inorganic and organic	Inorganic and organic and anthropic
Examples	salt desert ice desert	tundra primeval forests	urban and rural landscapes

Between these various principal degrees of integration, transitional types develop. The intensity of correlation between the different spheres and the landscape elements varies a great deal within any geomeric complex. BOBEK and SCHMITHÜSEN expressed this (1949) in the following words: «The landscape, in this way, represents an integration of the highest order, but of small intensity». The spatial dimensions of a geomer range horizontally anywhere from a single point to the whole of the geosphere, while vertically only a careful analysis of the geomeric complex will show us how far the correlation and, consequently, the extension of the complex really exist. For an understanding of the landscape the dimension of time is of equal importance as the

spatial dimensions. Here again, only scientific research is able to show in each case how far back our studies will have to be extended for an interpretation of the present-day landscape, while from another point of view landscape studies may be extended indefinitely into the past as well as into the future. The latter studies are important for geographic planning.

According to these views, the geosphere as such or parts of it are the object of the science of geography. They have to be studied in terms of the four dimensions of space and time and are characterized by a specific correlation among the different spheres mentioned above. We call any such correlation complex a landscape or geomer, irrespective of its horizontal extent, provided that it is vertically complete. Only if the object of our study has these geomeric properties, we are entitled to speak of geography and geographic research. If, however, our study includes only one sphere, or a combination of spheres, which do not form a geomeric whole, we are concerned — from the point of view of geography — with an elemental science such as geology, geomorphology, botany, etc., or with an elemental study. For the areal divisions which are not geomeric by nature, the expression geomer or landscape is not correct. We mention this specifically since in German usage expressions like «Sprachlandschaften» are currently used; the word «Sprachgebiet» or region would be more appropriate.

This definition of the object of geography gives us a very clear answer to the question of «what is geography». Furthermore, it leads directly to definite methods of scientific research, which may briefly be described in the following paragraph.

The scientific examination of such a complex object as represented by the geosphere must proceed by way of analysis, followed by synthesis. In correspondence with the possibilities mentioned above, a primary analysis distinguishes different *systems of approach* (Betrachtungssysteme) under which we view our object and, accordingly, the inorganic, the organic and the cultural geography. A secondary analysis involves a further organization of these systems of approach according to the following *directions of approach* (Betrachtungsrichtungen): the formal study is directed toward the form or morphology, the functional study toward the organization of the landscape. We prefer the expressions «form» and «function» to morphology and physiology since the latter two have already found in the biological field the very specific definitions which are not directly applicable to geography. In either direction our analysis will lead us to a recognition of a structural arrangement of the geomeric elements and their combinations, and hence we speak of the formal and functional structure of the landscape. For obvious reasons the two structures are practically never congruent; the hinterland of a harbor or the marketing area of a city, which lies within the category of the functional structures, seldom finds its counterpart in the formal structure. To both directions of approach the principle of genetic examination must be applied. Such a genetic examination will show us that the speed with which functional structures change is far greater than in the case of formal structures. It all leads back to the general statement made in the beginning that real entities in the sense claimed by many geographers simply cannot and do not exist. It is, therefore, obviously futile to look for a single system of regional or landscape divisions. It is also obvious that such a thing as a spatial unit of the smallest size which cannot be subdivided any further without losing its wholistic character (as in the case of organisms and organs) does not exist. As an architect or an engineer uses both the vertical and the horizontal plans to depict his object, so must the geographer use the different analytical methods. In both cases the synthesis will essentially consist in viewing together the different representations and in this way lead to a full understanding of the complex nature of the object.

LITERATURE

Boesch, H.: Amerikanische Landschaft. Neujahrsblatt Naturforschende Gesellschaft Zürich, 1955.
Carol, H.: Zur Diskussion um Landschaft und Geographie. Geographica Helvetica, 1956.

Seasonal Changes of the Agricultural Landscape Interpreted from Aerial Photographs *

by

HANS BOESCH and DIETER BRUNNSCHWEILER

Introduction

Aerial photographs have been used by geographers engaged in land utilization surveys mainly as base maps on which details could be recorded with greater accuracy than on topographic maps of the same area. While the agricultural area is left blank on ordinary topographic maps of most countries, the same is manifested on air photos with a striking completeness. The pattern of the agricultural landscape as seen from the air has not only its beauty, but it provides the geographer with a unique opportunity to see into the character of an area from a vantage point he has never reached during his field work.

Little systematic research has been done by geographers — nor, in fact, by anybody else — with respect to utilizing aerial photographs in agricultural geography. What we urgently need is an air photo legend, based on quantitative and qualitative criteria. Instead of only looking at them, we will then begin to read and really interpret aerial photographs.

To such a changeable complex as the agricultural scene, it is not possible to apply a single system of photo keys by which individual land-use types or crops should be recognized at any time of the year. But in any locality there must be periods during the growing season when we observe maximum color contrast which should subsequently be recorded on panchromatic film as distinctly contrasting shades of gray. By such tonal contrasts or differences and with the aid of textural (arrangement) and structural (height) characteristics, most crops might be identified at one time or another. Similar considerations have proved to be correct with respect to woodland (Lit. 1). It was with this working hypothesis in mind that the following study has been undertaken.

Organization and Location of Project

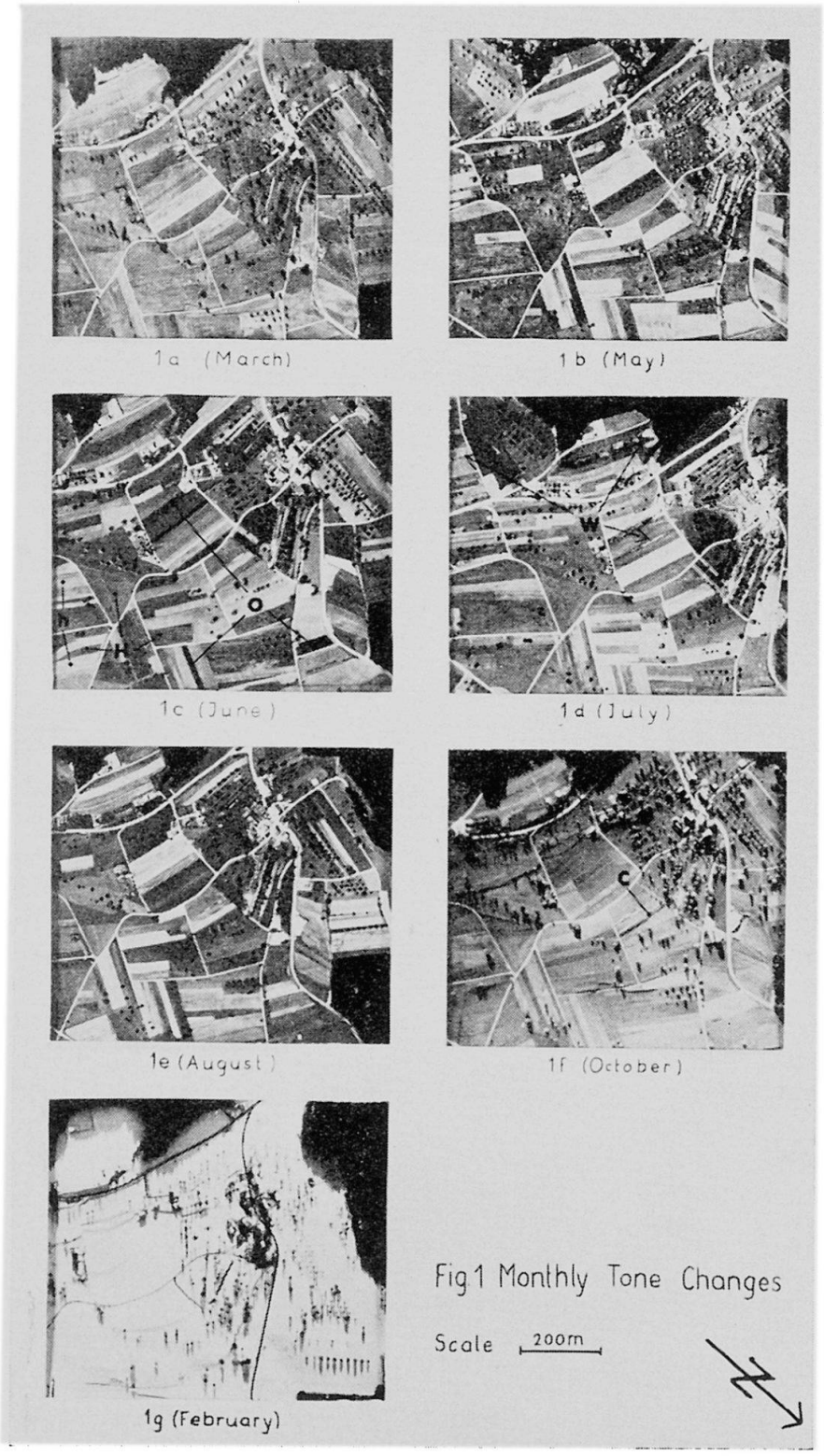
The aim of the study is to evaluate aerial photographs, as to their advantages and limitations in respect to crop identification and general land-use interpretation at different times of the year [1]. The area chosen for the project is located in the vicinity of the city of Zurich in northeastern Switzerland. Within this area a test strip was photographed seven times during 1952, the flight dates selected to represent distinct phases in the annual cycle of agricultural activities [2]. On flight days detailed surveys of the test strip were made whereby the conditions in all fields were carefully recorded with particular reference to those characteristics which might be considered essential to black-and-white photography (e. g., shade, intensity, and color of crops; sowing, cultivating and harvesting pattern; height of plants; color of surface soil; drainage conditions). The comparatively large scale of 1 : 13 000 of the contact prints made it possible to analyse the photographic characteristics of individual fields which ranged in size for the most part from one to three acres.

* Only figures 1 and 3 are reproduced here.

[1] A more detailed analysis of the same problem will be published in a forthcoming issue (published in March, 1957-HB) of the journal «Photogrammetric Engineering», Washington, D. C., under the title «Seasonal Changes of the Agricultural Pattern: a Study in Comparative Airphoto Interpretation» (BRUNNSCHWEILER, D.).

[2] The writers herewith expresse their gratitude to the Direction of Military Airports, Dübendorf (Switzerland), for the execution of flights and the processing of the film material.

The area itself is representative of the hilly country of northeastern Switzerland. The relative relief within one photograph is approximately 500 feet, with the terrain sloping slightly eastward. (See Fig. 1a-1g. Southwest is to the top of the pictures.) The bedrock, unexposed throughout the area, consists of horizontal sedimentary beds. There is a mantle of till with the thickness of a few feet. The soils are predominantly loamy with considerable stoniness, but without boulders. Drainage is adequate and soil erosion practically non-existent. The growing season normally lasts from April 15 to November 1. Dairying is the main agricultural enterprise in the area. Fields of grain



and grass for feed, pastures, small vegetable plots, orchards and well-kept mixed forests surround the hamlet from which all fields are operated. The hamlet is linked with Zurich, its major market, by a macadam highway.

Variations of Image Elements During the Year

An experienced interpreter will readily recognize major land-use units such as cropped land, pastures, orchards, or forests. On large-scale photos (1 : 20 000 and larger) it becomes possible to make much finer differentiations, because the unit area (fields) will exhibit distinct tonal, textural and stereoscopic characteristics by which the identity of individual crops can be established.

In order to demonstrate the dependence of these image elements upon the time of the year, the series has been classified into four categories each of which may offer optimum characteristics for specific interpretations.

The exposures made in March and October (Fig. 1a and Fig. 1f) contain little tonal and textural contrast. Homogeneity might in itself be of advantage for photogrammetric purpose while certain early or late crops (e. g., corn, or see C in Fig. 1f) will be best recognized at this time of the year.

The June and July exposures (Fig. 1c and Fig. 1d) have tonal contrasts still within a comparatively narrow range so that the overall pattern is one of a light-gray/dark-gray mosaic. Here again, some crops exhibit unique image characteristics by which they can be unmistakably identified. The best example of a tonal clue is given by fields of oats appearing the darkest of all the units in early June (see C in Fig. 1c). On the same photo the evidence of haying in progress is easily seen (H for uncut hay, and h for cut hay). Identification of individual crops becomes increasingly difficult with the advance of summer toward the harvest of small grains. Wind-laid patches are typical of grain fields and provide interesting microclimatological phenomena as well as clues for identifying oats (W in Fig. 1d) even at this time of the year.

The May and August exposures (Fig. 1b and Fig. 1e) contain maximum tonal contrasts effected by plowed fields against grassland in May, and by fields of mature grain or stubble against grassland in August. A black-and-white mosaic effect is the result in both cases. Permanent pasture land (P in Fig. 1e) stands out best at this time. Different harvesting methods produce a variety of field textures in August and stereo-effects are obtained. Neither of these two characteristics appears in May. This month, however, reveals soil and drainage conditions better than any other month.

Finally the February exposure represents a fourth category (Fig. 1g). Even the air photo of a snow-covered landscape might reveal some phenomena hitherto unnoticed; shadows disclose the finest details of surface configuration such as terraces less than two feet in height. Shadows of trees cast onto the snow can be discerned with remarkable clarity and the determination of tree heights by the shadow method is possible with a high degree of accuracy if due consideration is given to the thickness of the snow cover and to slope angles. The tonal uniformity and the absence of field textures induce the reader to focus his attention on individual objects rather than on areas.

By means of tone diagrams the average tonal values of six land-use units during the growing season have been worked out. «Average» is to be understood as the mean tonal value of all the fields of a particular unit at a certain flight date [3]. Through superposition of curves, the period during which individual crops are best recognized is readily seen to fall before, and not at the time of grain maturity.

Unlike tonal characteristics, it is difficult to give a quantitative summary of textural characteristics. The smallness of fields and the minuteness of textural details prevent a satisfactory reproduction of pictorial keys. This, however, does not mean that texture is given only a superficial treatment. On the contrary, it should be empha-

[3] A Kodak gray scale was used with white = 1 and black = 10.

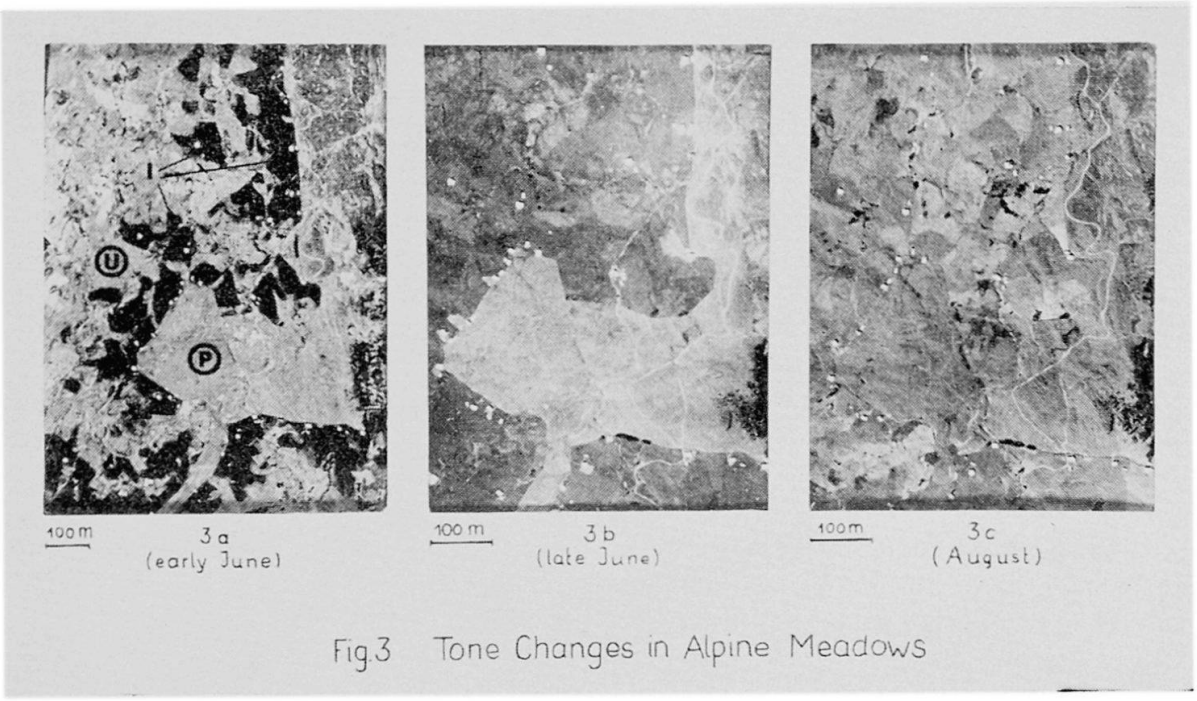


Fig.3 Tone Changes in Alpine Meadows

sized that a careful textural analysis is often the only successful technique to differentiate those crops which, in tone and stero-effect, look alike.

Besides tonal and textural techniques, stereoscopic work is of equal importance. Investigations with the parallax bar (Type Wild) have proved that the height of crop «canopies» being as small as three feet above the surrounding ground is measurable. A «carpet» effect is obtained with a common pocket stereoscope even from grain fields.

Application of the Seasonality Factor in Alpine Areas

If the value of serial photographs has been established in intensively cultivated areas with their marked seasonal changes, they proved to be even more useful in alpine terrain. Besides grazing land, hay meadoys and their quality often play a decisive role in the economy of the mountain peasant. A good part of the meadows surrounding the stables is regulary manured and there grows the grass in lush green (improved meadows, «Fettwiesen»), whereas the remaining hay land appears in dull brown (unimproved meadows, «Magerwiesen»). The difference between these two types of meadows on the airphotos is striking (Fig. 3a: I and U for improved and unimproved meadows respectively, and P for pasture).

With the march of time, however, this contrast quickly disappears and only a month later meadows look quite homogeneous and may, as a whole, be easily differentiated from the pasture land in June (Fig. 3b). The pattern is again reversed in late summer after hay has been cut: pastures now appear to be the darkest and blending with manured meadows (Fig. 3a), while the rest of the meadows gives lighter tonal values. Many other details such as swampiness, stoniness, erosion or the type of natural vegetation are to be seen in varying exactness during the year. Air photos, if correctly used, can be of utmost value in the alpine area for the difficult task of the consolidation of plots, which is often proceeding at a slow pace on account of the insufficient cartographic basis. They are also unique in tracing the past human occupance. In a particular area (Lit. 2) abandoned systems of terraces and irrigation, hardly visible on the ground, and old boundary lines, have been found by the use of air photos.

Conclusion

Distinct tonal, textural and structural (three-dimensional) patterns are exhibited by aerial photographs in the course of a year. Most crops and undoubtedly all the land-

use types have specific pictorial characteristics which are a function of time rather than of place as similar studies in other mid-latitude areas seem to confirm (Lit. 3).

By now many areas of the world have been repeatedly photographed from the air. To choose the set of air photos best suited to bring out a particular crop or land-use problem means saving hours of field work and often a higher degree of accuracy and completeness than would otherwise be attainable.

LITERATURE

HESSELMANN, H.: «A Map of Sweden's Beech Forest Based on Aerial Reconnaissance, «*Geografiske Annaler,* Vol. 21, 1939, pp. 77-87. Much information on the alpine areas has been taken from: STEINER, D. *The Application of Air Photos to Problems of Alpine Economy* (M.A. Thesis), University of Zürich, 1956. For the northeastern United States see: GOODFELLOW, J. *Seasonality as a Factor in the Use of Aerial Photographs* (M. A. Thesis), Clark University, Worcester, Mass., 1955.

The Decline of the «Three-Zelgen System» in Northeastern Switzerland

by

HANS BOESCH and MAX BRONHOFER

This paper illustrates the importance of the human factor in its relation to the changing pattern of an agricultural landscape. In the so-called new countries such changes occur as a rule with a speed which simply bewilders people living in the old countries where through centuries the inhabitants have been accustomed to a certain type of living and thus created very definite formal and functional landscape patterns.

Northeastern Switzerland is, in this respect, an old country. Through centuries from the early Middle Ages until about 1800, essentially the same patterns dominated the agricultural landscape. Before the great social revolution brought about a change in the basic laws and social structure toward the end of the eighteenth century, a thorough change of that system would have been impossible despite the fact that an increasing population pressure made it inconvenient and uneconomic. To alter the laws was finally possible within a relatively short time, but to change the mode of life was quite a different matter which required much more time to be accomplished. The problem confronting us is the study of the lag between these two phases since only the second phase has apparently a direct influence upon the landscape pattern. From the point of view of a historian the old system came to an end at a certain definite date at the beginning of the nineteenth century for the entire area of identical jurisdiction. From the geographer's point of view, however, its termination occurred much later. It is also to be expected that the time of termination may differ from one part to another within an area of identical jurisdiction. In the course of field investigations conducted around 1950, we happened to come across a case — the village of Merishausen in the extreme north of Switzerland near the German border — where the old system had been persisting for a hundred and fifty years following its legal abolition. A very detailled field survey was carried out by Dr. BRONHOFER and a short report published by another member of the field party (F. BACHMANN, Lit. 1 and 2). In the following years Dr. BRONHOFER expanded the study over a larger area, following up the problem which has been presented above. This report will be published in the near future (Lit. 3). While our departmental interests in these studies are primarily concerned with factual details, it is the broader aspect of the problem, as outlined at the outset of this paper, which justifies its presentation before an international congress.

In northeastern Switzerland the typical land-use and settlement pattern was, and still is, the nucleated village with open field, permanent pasture and woodland. In former

times permanent pasture and woodland were generally identical, and the main function of the open field was to provide the bread grains. Today, howewer, the open field is used for the production of grains, potatoes, root crops and fodder crops, while pasturing is no more allowed within the woodlands. The old nucleated village, on the other hand, did not change appreciably, at least as far as agriculture is concerned. Non-agricultural buildings have been spread among the farm houses within the last hundred fifty years, but dispersed farm-settlements are still an exception. The old rotation cycle was exclusively a three-year as well as a three-field scheme. It started with a winter crop which was followed by a summer crop, while the land lay fallow and was used as general pasture during the third year. Before 1800 this primitive rotation system had already been improved by using part of the fallow for the production of roots, forage crops, etc., a rotation system which is usually referred to as the «improved three-field system». The date when this improved technique was introduced can be determined quite accurately as it coincides with the abolition of the right of general pasturing, which is registered in the village records. Prior to 1800 all the members of an agricultural community, namely, all the villagers had to follow the same three-year cycle; later developments made it possible for each farmer to work out his own rotation scheme. Consequently some farmers today follow a three-year cycle while others practice a four-year or still another scheme. Such a term as «three-field system» applies only to a specific type of crop rotation and does not refer to the village organization which is quite another matter. The crop rotation cycle was developed in close response to the physical characteristics of the area as well as to the stage of technical development in agriculture. The political and social situation were responsible for the way in which agricultural production and hence the mode of life in a village were organized. Before and around the year 1000 the growing influence of nonagricultural landlords, secular as well as ecclesiastical, and their dependence upon the farming communities led to a rigid system of production, the main function of which was to provide the necessities of life (grains, wine, etc.) for the landlords who collected the taxes in kind, generally one tenth of the annual produce. The landlords were, therefore, immensely interested to maintain the producing area in accordance with their needs. The supply of bread grains was of primary importance and in consequence the open field was strictly reserved for its production. Since all the farmers were under the same rules and obligations, the most logical thing to do was to organize their work accordingly. It was especially the case after most of the land available for farming had been taken up, and shortage of land made it necessary to organize farming on the community level. The whole of the open field was henceforth divided into three equal parts, whether contiguous or not, each of which in turn was reserved for the winter or summer crop, or had to lie fallow, according to the year. Furthermore, since the various farm operations were to be carried out by all the villagers at the same time, only very few farm roads were needed even if individual properties were widely dispersed. On the other hand, the two thirds under cultivation had to be fenced in each year to keep out the cattle grazing on the fallow and wild animals from the adjoining forests. In northeastern Switzerland the local expression «zelgen» is still used occasionally for «fencing in». Such an open field consisting of the three equal parts was called «the three Zelgen». The «Three-Zelgen System» thus refers to a special form of organziation in agricultural production, while the «Three-Field System» is a specific type of crop rotation. For centuries the two systems were in close association.

We would like to point out that the formal pattern of the agricultural landscape under these conditions was quite different from that of today. The individual properties were not visible as the whole of each Zelge had the same appearance, be it fallow or under cultivation. We should also realize that by adhering to this system for many hundreds of years, the village community grew into a very tightly knit society where every member carefully followed a well-established path of life. During the eighteenth

century many landlords tried to improve the production techniques, but they took care to avoid any change which might have affected the basic relationship between the landlord and the farmers and, consequently, the Three-Zelgen System.

The French Revolution also brought about a fundamental change in the political and social structure of Switzerland. In this connection, laws passed by the federal authorities in the years after 1798 and later followed by the similar laws in the different cantons of Switzerland, are of paramount importance. For they gave the villages the possibility to terminate the century-old dependence on the landlords by substituting a rigidly specified rent in kind (tithe) for a rent in cash. By so doing, the farmers thereafter were, at least de iure, in a position to select the crops, the techniques, etc., individually and independently. De facto, however, this transaction did not mean that the Three-Zelgen System came to an abrupt end. Everything within the village had been geared to a well-established system, and a change could not be expected from one day to another. In the beginning few of the farmers broke away from the old rules and took advantage of the new freedom to plant what they chose on their own land. Absence or scarcity of roads made it almost impossible for them to reach their fields without somewhat damaging the neighboring fields. It was recorded in village registers with increasing frequency that such and such a person was fined for trespassing over the fields of his neighbor. These registers also tell us about the crop that was damaged, and the time of the year when such an event took place. By going through all the records since 1800 — wherever they were available — it was possible to reconstruct the process of the gradual decline of the Three-Zelgen System with its uniform crop pattern and the emergence of the individually controlled, variegated pattern. One of the most important steps toward the adoption of the individualized production was the construction of a satisfactory system of field roads to give direct access to all the fields. While the traditional, widely dispersed, elongated and narrow fields did not inconvenience agricultural production under the old system, the new system demanded an urgent rearrangement of fields. The basis of such a redistribution of property was a cadastral survey and careful assessment which meant new added expenses and an ultimate increase in the cost of agricultural production in general. From the geographer's point of view it should be noted that the landscape changed gradually both with respect to its form and its functional structure. The sweeping uniformity of the Zelgen area gave place to a mosaic of narrow and long lots with diversified crops. The rigid functional structure of former times which had united the producer and the consumer, gave way to an intricate marketing system.

Within the area of our studies (the canton of Schaffhausen) the de facto abandonment of the Zelgen System was in most cases accomplished before the turn of the century. Three villages gave up the old system during the first half of the nineteenth century, and one village (Merishausen) — at least in part of its producing area — still persists on the age-old system. By examining the reasons for these different behaviors, we found that beliefs and traditional thinking were of some importance in many instances. In most cases, however, the technical difficulties and the high costs involved in rearranging the cultural landscape induced the village community for a long time to refrain from a change or to operate at least part of the area in the traditional way as far as the Zelgen System is concerned.

From a broad point of view, this paper shows that in studying the history of a cultural landscape the dynamics, or the speed with which the landscape changes, has to be carefully examined. In addition to form and function, the direction and the speed of structural changes offer an additional characteristic in comparative areal studies.

LITERATURE

BACHMANN, F.: Vergangenheit in der Gegenwart. Leben und Umwelt, No. 6, 1954. BRONHOFER, M.: Untersuchung der rezenten Dreizelgenwirtschaft von Merishausen (Manuskript), Universität Zürich, 1955. — Das Ende der Dreizelgenwirtschaft in der Nordostschweiz, Diss. Universität Zürich, 1956.

Les sols polygonaux dans les Alpes suisses

par

HANS BOESCH et GERHARD FURRER

Depuis quelques années nous étudions en Suisse les formes récentes subnivales et périglaciaires des Alpes. Les résultats essentiels ont été publiés dans «Résultats des recherches scientifiques entreprises au Parc national suisse» (Tome 24, DOMARADZKI et 29, FURRER), «Les Alpes» (1/1951, BOESCH et 6/1955, FURRER) et «Geographica Helvetica» (1946, Streiff-Becker et 1/1955, FURRER).

Les enquêtes dans la région de nos Alpes démontrent que, là également, nous pouvons distinguer entre deux formes extrêmes de sols polygonaux sur des terrains sans végétation et couverts de matériel meuble: les macro-formes (diamètres de 0,3-1,5 m) et les formes en miniatures (∅ de 5-25 cm). Ces structures ont comme origine l'effet d'une gelée périodique. La durée et la manière de ce gel sont décisives pour la forme naissante: généralement les petites formes étant causées par des regels fréquents, mais de courte durée. Dans ce cas le triage du matériel n'est jamais très profond (4-6 cm).

A l'aide de profils creusés dans le sol, nous pouvons étudier la structure intérieure de ces formes. Jusqu'à présent, nous étions en mesure de constater un certain nombre de structures caractéristiques: le résultat essentiel consiste en la distinction de plusieurs types morphologiques et, de ce fait, de formations convergentes. Travaillant sur place, on peut souvent observer la genèse de quelques formes. Il est même possible d'évaluer toute une série d'états génétiques distincts qui se suivent dans le développement d'une structure.

Parmi les problèmes qui se sont posés pendant nos recherches, nous avons choisi les trois points suivants pour cet exposé.

1. «Pipkrake» (fines aiguilles de glace) comme facteur morphologique

On nomme «pipkrake» une certaine structure de glace en cristaux allongés semblable à des aiguilles et disposée en forme de brosse. Cette sorte de glace agit avant tout par force mécanique. L'effet de son action est le plus intense lorsque la glace se forme pendant plusieurs nuits consécutives. Selon l'attitude, ces périodes de regel quotidien varient. Les aiguilles sont toujours disposées verticalement par rapport à leur base poreuse et non glacée. Au sommet, elles portent superficiellement des particules de terre ou même des pierres qui peuvent atteindre jusqu'à 2 kg. Ce procès de regel est la base des mouvements de solifluxion en miniature au moment du dégel et du renversement des aiguilles de glace. La dimension du mouvement dépend de la longueur des cristaux et de l'angle d'inclinaison de la pente. Dans des conditions favorables, l'accroissement des cristaux peut atteindre chez nous en l'espace d'une nuit 4 à 6 cm. Si, pendant les nuits suivantes, les circonstances restent les mêmes, les aiguilles peuvent grandir jusqu'à 15 cm.

Pour étudier l'action d'une brosse de «pipkrake» sur une base horizontale et plane, on y place des pierres marquées ou de petits morceaux de bois, mesurés auparavant; on peut ainsi se rendre compte de l'allure et de la dimension du mouvement. Généralement on obtient le résultat suivant: les particules sont transportées du centre de la brosse vers la périphérie en lignes radiales de 2 cm. En cas de répétition de ces mouvements, des cercles pierreux peuvent se former. Dans la région subnivale des Alpes, ces structures sont très fréquentes sur un terrain poreux et de grains fins, couvert d'une couche mince de pierre de la grandeur d'un petit pois ou même de celle d'un poing. On trouve les représentants de ce type de structure au delà de la limite de végétation.

La formation de ces cercles pierreux peut être suivie en prenant en considération les différents états mentionnés ci-dessous:

a) A certains points, on peut observer sur des terrains couverts d'une couche superficielle de pierres que le rayon des débris grandit: les particules les plus petits s'amassant autour du centre et, en grandissant, s'éloignent de celui-ci. La distance radiale entre le centre et les pierres les plus grandes est de 5 à 7 cm.

b) Un certain état de développement est atteint dans les cas où la terre peut être aperçue entre les débris du centre. Elle perce la couche de pierres en forme de bourgeons. Souvent ces boutons de terre sont plus hauts que les pierres qui les entourent. Un filet de glace est observé à l'intérieur des bourgeons. Parfois, les pierres schisteuses sont disposées en ligne tangentiale et sont alors souvent renversées sur leurs arrêtes.

c) A la fin de la formation tout le matériel pierreux est poussé vers la périphérie. Le diamètre de terre fine mesure environ 6 à 10 cm.

Il arrive aussi que les cercles de pierres voisins se touchent. Dans ce cas, on parle d'un sol de résaux de pierres; les débris les plus grands se trouvent généralement au milieu des cadres qui sont alors assez larges.

Les brosses de glace grandissent sur leur base de grain fin en soulevant les particules quelques centimètres. La solifluxion au moment du renversement et du dégel pousse les pierres emportées vers la périphérie de l'ancienne brosse.

Même si l'angle d'inclinaison du terrain n'est que petit, les bourgeons aux centres des cercles pierreux ne forment plus de réseaux réguliers, mais se disposent en files courtes dans le sens de la plus grande inclinaison de la pente. Plus près de la base, on observe que les cercles se transforment en bandes fermées de terre fine, séparant les remparts de débris. Si la couche de particules meubles ne devient pas trop épaisse, les communications entre les remparts pierreux disparaissent de plus en plus vers la base de la pente. La largeur des bandes pierreuses et de terre fine mesure 5 cm.

La solifluxion inclinée est la cause de l'orientation des bourgeons de «pipkrake». Les débris superficiels sont poussés vers les deux limites latérales des bandes de terre fine. Autour de grands obstacles — îlots de végétation ou grandes pierres — les bandes coulent en forme de lignes aérodynamiques.

2. Les formes de grande taille au-dessus du «permafrost»

Allix (1923) décrit les sols polygonaux avec permafrost se trouvant dans les Alpes françaises à une latitude de 3052 m. Selon Troll (1944), il n'existe dans nos Alpes pas assez de preuves positives de la présence du permafrost ou d'un rapport entre celui-ci et les sols polygonaux. Cependant les études les plus récentes ont montré que le permafrost est beaucoup plus répandu qu'on ne l'avait généralement admis.

Le 10/11 août 1955 M. Furrer a observé à 2608 m, dans la région de Schuls (basse Engadine) des structures sous lesquelles on pouvait distinguer nettement le permafrost. Celui-ci consistait en plaques minces de glace tout à fait transparentes, d'une épaisseur de 3 à 5 mm et placées parallèlement à la surface. Des couches de terre fine glacée les séparaient. Les premières traces du permafrost se montraient dans une profondeur de 35 cm, et la glace pouvait être enlevée jusqu'à 65 cm sans que, pour cela, on arrive à sa base. La terre couvrant la glace ne contenait que peu de pierres et était imbibée d'eau ce qui causait une solifluxion très vive.

Comparés avec les formes en miniature, les sols polygonaux au-dessus du permafrost sont caractérisés par un triage plus distinct de leur matériel et également par leurs dimensions plus grandes des formes structurales. Rarement ils sont recouverts de plantes. Celles-ci ne poussent que sur les remparts de pierres; une preuve de la mobilité du centre.

3. Apparition et durée de la formation

Les macroformes sont fréquentes à proximité des langues de glaciers, sur les hautes plaines, les cols ou dans les vallons où la neige ne fond que très tard. On les trouve surtout

à des altitudes de 2200 à 2700 m et dans la partie basse de région subnivale. Cependant ces formes se présentent également à des altitudes beaucoup plus basses, sur des terrains où les glaciers ne se sont retirés que récemment: glacier de Morteratsch, 1950 m et Steingletscher, 1960 m.

Les formes en miniature, dues au regel et à la microsolifluxion, sont répandues à 2500 m, parceque dans la partie supérieure de la région subnivale la période essentielle du regel étant celle où il n'y a pas de neige.

Probablement les petites structures se forment au cours de quelques semaines, tandis que les grandes nécessitent quelques étés. Ces dernières dérivent d'un rythme de regel plus lent et se distinguent par un triage profond du matériel.

M. Furrer a pu observer près du Steingletscher (1960 m) des polygones de pierres nettement dessinés sur un terrain que la glace n'avait découvert qu'il y a 12 ans, tandis qu'au glacier de Ferpècle, 4 ans après le recul du glacier, on n'avait noté que des traces de polygones assez vagues.

LITTÉRATURE

FURRER, G: Solifluktionsformen im schweizerischen Nationalpark. Diss. Universität Zurich, 1954. — Die Strukturbodenformen der Alpen. Geographica Helvetica, 1955.

GEOGRAPHIE UND KARTOGRAPHIE AN DER 140. JAHRESVERSAMMLUNG DER SCHWEIZERISCHEN NATURFORSCHENDEN GESELLSCHAFT

EDUARD GERBER und ERNST WINKLER

Vom 23. bis 25. September 1960 fand traditionsgemäß die Jahresversammlung der SNG statt, die diesmal der aargauischen Tochtergesellschaft anvertraut war. Sie wurde in Aarau, Zofingen und Lenzburg abgehalten. Wie gewohnt beteiligte sich auch der Verband der schweiz. geographischen Gesellschaften unter dem neuen Präsidenten Prof. Dr. H. GUTERSOHN an ihr.

Der Jahresvorstand der SNG hatte zum Thema der Hauptvorträge das der Geographie besonders nahe Problem «Mensch und Umwelt» gewählt. Eine Reihe prominenter Autoren äusserten sich zu diesem ebenso komplexen wie aktuellen Fragenkreise, so der Jahrespräsident Dr. K. BAESCHLIN, Aarau, über dessen historische Entwicklung und Problemstellung, der Astronom Dr. M. WALDMEIER, Zürich, über «die Beziehung Mensch-Weltall», der Geobotaniker Prof. Dr. L. EMBERGER, Montpellier, über «la relation homme-nature», der Zoologe Prof. Dr. O. KOEHLER, Freiburg i. B., über «die Beziehung Mensch-Tier» und der Mediziner Prof. Dr. W. LÖFFLER, Zürich, über «die Beziehung Mensch-Mensch». Sie versuchten namentlich zu zeigen, mit welchen Mitteln der Mensch seine Umwelt zu erfassen und — wie naturgemäß besonders der Astronom darzulegen vermochte — zu erweitern verstand. Da die Geographie an diesem Tour d'Horzion nicht beteiligt worden war, obwohl sie Wesentliches dazu beizusteuern gehabt hätte, organisierte der VSGG unter Leitung von Dr. E. GERBER unter dem Motto «Mensch und dörfliche Umwelt» als Beitrag eine Exkursion nach Schinznach-Dorf. Sie war ebenso wie die geographisch-historische Führung durch die Tagungsstadt Aarau durch Prof. Dr. O. WERNLI und P. ERISMANN erfreulich gut besucht.

Die wissenschaftliche Sitzung der Geographen fand Samstag, den 24. September in der Aarauer Kantonsschule statt. Es sprachen 11 Referenten, deren Ausführungen teils lebhaft diskutiert wurden. Leider fiel der Vortrag «Die Rodung als kulturlandschaftsgeschichtliches Problem» infolge Erkrankung Prof. Dr. W. U. GUYANS, Schaffhausen, aus; doch ist zu hoffen, daß seine Ergebnisse noch veröffentlicht werden.

In der ebenfalls am 24. September abgehaltenen Delegiertenversammlung des VSGG, die der Präsident wie die Tagung selbst in gewohnter souveräner und straffer Weise leitete, wurde auf das 75. Jubiläum der Neuenburger Schwestergesellschaft am 15. und 16. Oktober hin-