

CONSTRUCTION OF LANDFORM KEYS*

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ABSTRACT

Landform keys range in scope from an elementary land classification to an elaborate guide for specialized research into some aspect of terrain. The purpose of the key will indicate its level. At each key level there is a minimum requirement of photographs, maps and information. Landform patterns are functions of seven factors: bedrock gradational processes, soil-forming processes, water and ice, vegetation, human enterprise, and time. The landform approach is essentially an extrapolation of ground studies by means of airphotos.

INTRODUCTION

A LANDFORM may be defined as a unit of land surface of which its origin and history, together with the nature and distribution of its materials, can be deduced from its shape, position, pattern, and general appearance. So defined, the landform can be used as an index to the terrain characteristics and problems associated with similar landforms wherever they may occur.

A landform key may be defined as a combination of textual and pictorial material so arranged that it will aid in the rapid identification of landforms. Such keys are needed in reporting on natural terrain.

In the study of landforms and the preparation of landform keys, aerial photographs are indispensable. The objectives of landform photo-studies range from delineation of a few land types in highway reconnaissance mapping to comprehensive description and appraisal of all landform varieties in terms of civil engineering, oil exploration, mining, forestry, military, and similar enterprises.

Work with landforms requires special training, skill, and experience which many interested people do not have, due to the pressure of limited time, funds, and other employment. For these people, landform keys are valuable "working tools." The keys make three specific contributions:

1. *They summarize the experience* of landform specialists, and *eliminate* the need for a *long training course* or extensive background data.

2. *They teach a systematic procedure* in the photo-examination of landforms, and they *standardize the product* at a pre-selected level of requirements.

3. *They permit the advanced specialist to concentrate his efforts* in those landform areas which initial work with the key has shown requires further study.

ORGANIZATION

Construction of a landform key involves three general considerations:

1. purpose and level of the key.
2. choice of key to be used.
3. analysis of the available background material.

A brief discussion of these considerations may clarify the approach to landform key construction.

1. *The purpose* for which the key is to be used will indicate the level of the key. Its use may range from grouping landforms into a few elementary types for those without special education or experience to the guiding of the research specialist in an investigation of some aspect of landforms. The specialist's key may "key out" numerous sub-types and variants, and is termed a high-level, or technical key.

2. *The choice of key* to be used will depend on the use level, the region to be covered by the key, and the availability of materials for the key. The two general groups of keys are selective and elimination. Elimination keys may be constructed for regions in which the landforms are

* This is a part of the Panel on Photo Interpretation held on March 8, 1955 during the Society's Annual Meeting. At the end of the paper, Mr. Ireland displayed a large number of aerial photos on the screen and discussed them with the assembled members of the Society. Space prohibits their reproduction here.

clearly distinguishable from one another at the working level of the key, and in which the data and materials at hand are adequate. Selective keys may be used where the landforms are not always clearly distinguishable at the key level, or the materials are inadequate for an elimination key, or both.

3. *Background material* required in the construction of landform keys consists of textual material, photographs, and maps. There is a minimum of such material required in building a key at any level, even the simple, elementary key.

PROBLEMS

Problems encountered in preparing landform keys are discussed in three general groups: 1—Kind of key to be constructed, 2—Presentation, and 3—Patterns on aerial photos.

1. KIND OF KEY TO BE CONSTRUCTED

When the purpose has been established,



FIG. 1. A drumlin field, one of the glacial relief patterns. Drumlins are long, narrow, streamlined hills of till, oriented parallel to the direction of ice advance. Here they are from 40 to 80 feet high. (Courtesy Commodity Stabilization Service, U.S.D.A.)

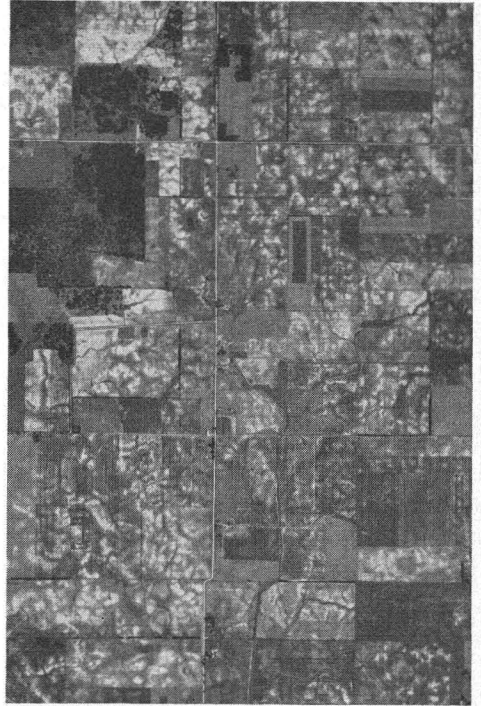


FIG. 2. A mottled, light-and-dark pattern of soil differentiation found on till plains and moraines of the latest glacial period. Dark-toned depressions have fine-grained or marsh soils. (Courtesy Commodity Stabilization Service, U.S.D.A.)

the form of key that must be selected is that which will yield the desired results. The choice is governed by the adequacy of available background material, from the standpoint of both quality and quantity. Adequate materials for landform key construction should permit illustration of each selected type with photographs of good quality, textual material, and maps.

The ideal photographic presentation of a landform pattern includes:

a. *Small-scale vertical photograph* of the pattern showing its setting and general appearance, its boundary characteristics, drainage, vegetation, and culture. Photo preferably should be within a scale range of from 1:15,000 to 1:45,000.

b. *Large-scale vertical photographs*, partly in stereo, illustrating the elements which identify the pattern. Photos preferably should be within a scale range of from 1:5,000 to 1:15,000.

c. *Oblique photograph* to relate aspect of vertical photos to the more familiar hori-



FIG. 3. The karst or sink-hole pattern of some limestone terrain. Sink-holes are funnel-shaped or bowl-shaped. Many of them contain ponds or fill of washed-in or slumped material. (Courtesy Commodity Stabilization Service, U.S.D.A.)

zontal view of ground photos or ground observation.

d. One or more *ground photographs* of the recognition features illustrated by vertical photos.

Background textual material consists of two classes, general information on a broad regional basis, and detailed information at photographic locations. For the region, general descriptions of landforms, soils, and geology are helpful. Engineering and hydrological reports and investigations are also useful as guides to the range, relationship, and significance of landforms within the region. For the photo location, a detailed description of the terrain is necessary to support or verify the photo-identification of a landform or its pattern.

Small-scale maps are useful in showing the distribution of landforms and their relationship to cultural and other features. Such maps may be of various kinds, such as soil, geologic, or landform. Large-scale maps are frequently used with photographs

in the body of the key. Choice in either small or large-scale maps is usually limited, and a selection must be made that best suits the requirements of the key.

It is readily understandable that the collection, analysis, and selection of background material is one of the most important and time-consuming phases of key construction.

2. PRESENTATION

Although assembly of and selection of material may be the largest time-consuming part of key construction, the arrangement and presentation of the selected material are quite critical. The purpose of the key is to quickly and systematically identify a landform type, sub-type, or variation of a type. Use of the key will indicate the degree of breakdown *desired*, but adequacy of material is usually the limiting factor. Logical sequence of presentation and clear-cut terminology are essentials in either a selective or an elimi-



FIG. 4. Hills of Lower Mississippi Valley Loess near Vicksburg, Mississippi. These hills are 75 to 200 feet high, with a maze of deep, steep-sided gullies whose small tributaries enter them at right-angles. (Courtesy Commodity Stabilization Service, U.S.D.A.)

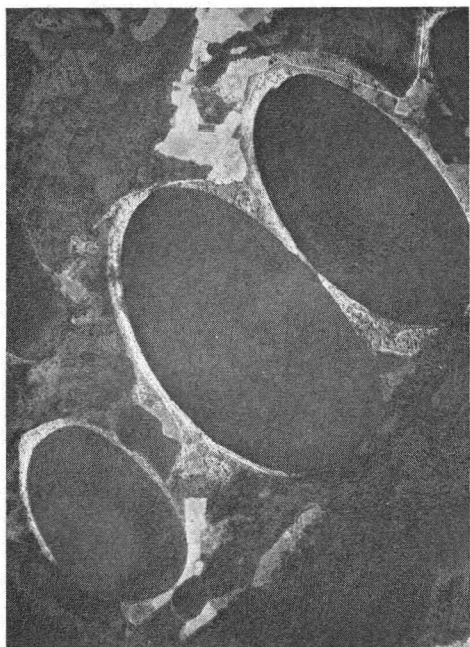


FIG. 5. Carolina Bays, a pattern of elliptical sand beach ridges enclosing wet marshes. The ellipses are oriented parallel to one another and across the ancient beach ridges of the coastal plain. (Courtesy Commodity Stabilization Service, U.S.D.A.)

nation key. In many cases the end product is obtained by deduction or association. Even in these instances, terminology should be such that there will be little doubt as to the indicated nature of the photo image. General terms such as large, small, light, dark, steep, rounded, etc., are usually not specific enough for use in keys. Additional qualifying adjectives and assigned numerical limitations are often necessary for good results.

3. PATTERNS ON AERIAL PHOTOGRAPHS

A number of factors in various combinations create the elements of the patterns

seen on aerial photos. The principal factors are (1) *relief*, (2) *bedrock*, (3) *weathering and erosion*, (4) *soil and rock surfaces*, (5) *water and ice (surface and ground)*, (6) *vegetation*, (7) *human enterprise*, and (8) *time*. The first four (relief, bedrock, weathering and erosion, and soil and rock surfaces) are the dominant factors; the others may contribute to patterns, or may conceal them.

Some patterns may identify landforms at once, such as relief patterns of particular rock strata, dunes, or end moraines. Other patterns require canvassing the pattern elements in a logical sequence before the landforms can be determined. In a level plain, such pattern elements as gullies, bluffs, drainage, tone, and texture may all have to be considered along with patterns of vegetation and of human enterprise. Figures 1 through 5 show typical landform patterns.

CONCLUSIONS

1. Landform keys are becoming more and more important in the study and analysis of natural terrain features.
2. Adequate photographs, information, and maps are indispensable in the construction of good landform keys.
3. Much work remains to be done on the problems of patterns and recognition features. Patterns which indicate a specific landform in one study area may not be valid for a similar landform in another area.
4. Many of the problems of landform key construction cannot be anticipated prior to actual preparation of the key.
5. Material for a landform key must be drawn from information covering several specialized fields of work. Therefore it is logical to assume that no individual can match the work of a team of specialists in preparing landform keys.