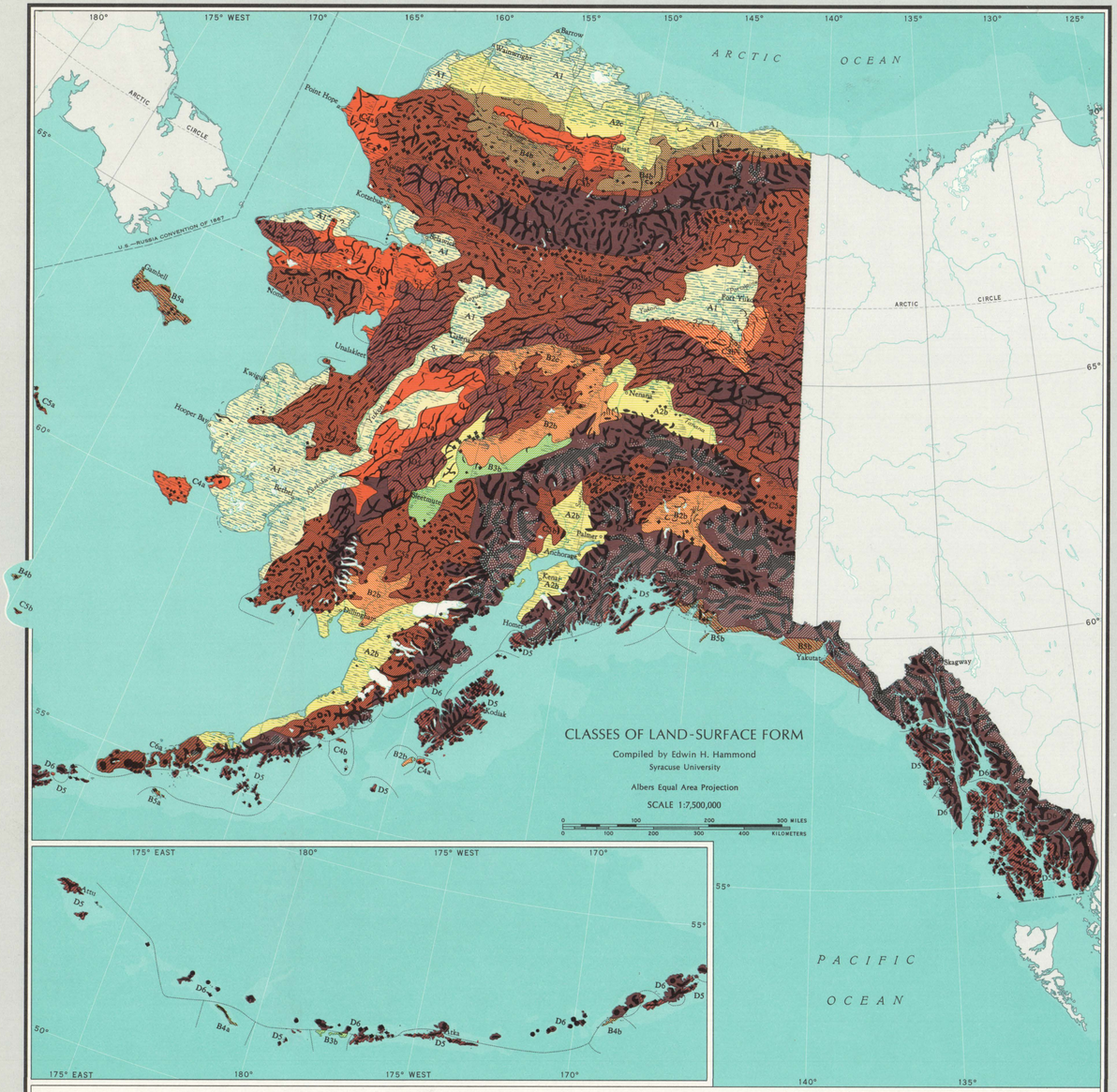


CLASSES OF LAND-SURFACE FORM

PLAINS

- A1 Flat plains
- A2 Smooth plains
- B2 Irregular plains

PLAINS WITH HILLS OR MOUNTAINS

- B3b Plains with hills
- B4a,b Plains with high hills
- B5a,b Plains with low mountains

OPEN HILLS AND MOUNTAINS

- C3 Open hills
- C4 Open high hills
- C5 Open low mountains
- C6 Open high mountains

MOUNTAINS

- D5 Low Mountains
- D6 High mountains

OTHER CLASSES

- 10-50% of area covered by standing water
- More than 50% of area covered by standing water
- 10-50% of area covered by glaciers
- More than 50% of area covered by glaciers
- Irregular peaks and regular cones
- Crests
- Escarpments and valley sides

In the last three symbols, width of line is directly proportional to height of feature above its base

SCHEME OF CLASSIFICATION

SLOPE (Capital letter)

- A More than 80% of area gently sloping
- B 50-80% of area gently sloping
- C 20-50% of area gently sloping
- D Less than 20% of area gently sloping

LOCAL RELIEF (Numeral)

1. 0-100 feet
2. 100-300 feet
3. 300-500 feet
4. 500-1000 feet
5. 1000-3000 feet
6. Over 3000 feet

PROFILE TYPE (Lower case letter)

- a More than 75% of gentle slope is in lowland
- b 50-75% of gentle slope is in lowland
- c 50-75% of gentle slope is on upland
- d More than 75% of gentle slope is on upland

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CLASSES OF LAND-SURFACE FORM IN THE UNITED STATES

In contrast to the traditional systems of physiographic regions based upon genetic factors, maps of land-surface form in the United States have been developed by Edwin H. Hammond from an empirical analysis of the land surface. The basic maps of this group are those on pages 62-64, which show the occurrence of landform types defined in terms of a selected group of surface characteristics. The regional map (below) is a more generalized representation, roughly comparable in degree of detail to the regionalizations of Powell and Fenneman. On it the country has been partitioned into ten major divisions, six for the conterminous States and Hawaii, and four for Alaska. The conterminous area is further subdivided into 35 provinces.

Since no specific hierarchy of regional boundaries is established on the larger scale maps, there is no unequivocal basis for combining the small areas into landform regions of larger size. The attempt has been made to reach a compromise between strict adherence to a systematic hierarchical scheme and a mere equalization of subdivision size. Most of the boundaries between provinces on the regional map are also boundaries between surface form classes on the more detailed maps, though a few exceptions occur, chiefly in zones of gradual transition. The user of so generalized a map should keep in mind that the subdivisions vary markedly in homogeneity. Certain of the provinces, such as the High Plains and the Gulf-Atlantic Coastal Flats, contain only minor internal variations, whereas others, such as the Appalachian Highlands, the Middle Rocky Mountains, and the Columbia Basin, are internally quite heterogeneous. Throughout, surface character has been given greater weight than similarity in geologic structure or other specific factors of landform genesis.

The chief aim of the larger scale maps (pages 62-64) is to enable the user to compare and contrast the surface form of different parts of the country in specific terms. To accomplish this aim a small group of surface characteristics was selected to serve as a basis for a meaningful, specific, and cartographically practicable system of landform characterization. Criteria for the selection of characteristics were that they should: 1) be especially effective in conveying a visual image of the surface form; 2) be broadly suggestive of possible relationships to other phenomena of geographical interest, especially potential land use; 3) be capable of being determined readily for broad areas from available map data, and 4) be capable of simple expression.

In accordance with these principles, five properties of land-surface form were selected for use on the maps. These are: 1) percentage of area occupied by surfaces of gentle inclination (less than 8% or 4°35'); 2) local relief, that is, maximum difference in elevation within a limited area; 3) percentage of gently inclined surface that lies in the lower half of the local relief; 4) percentage of area occupied by sand, ice, and standing water; and 5) pattern of major crests, peaks, and escarpments. The first three characteristics are used as the basis for a simple classification (shown in the map legend on page 63), from which each class of land-surface form is designated by a 3-item code, such as B3a. In this example, the "B" indicates that 50 to 80% of the area is occupied by gentle slopes; the "3" signifies that the maximum local difference in elevation is 300-500 feet; and the "a" means that more than 80% of the gently sloping land lies in the lower half of the elevation range. In areas of very little gentle slope (D) or very low relief and great smoothness (A1), the third designator is omitted. The coded classification for each separate area is shown directly on the map. In addition, different landform classes are distinguished by color to heighten visual perception, colors becoming darker or more intense as roughness increases. For the sake of simplicity, classes that differ only in terms of the position of the gently sloping land in the profile are distinguished by color differences only if the amount of gentle slope is large (A or B) and the local relief is considerable (3 to 6).

Character of surface material and pattern of major features, the fourth and fifth items in the list of properties, are omitted from the classification in order to control the number of classes. However, these properties are shown on the map by overprinted symbols. The occurrence of significant amounts of sand, ice, or standing water is indicated by conventional patterns in blue or black. Major crest lines, peaks, and escarpments are shown by various black symbols indicated in the legend. For each feature shown, the thickness of the symbol is directly proportional to the height of the crest of the feature above its base. No feature that rises less than 300 feet above its base is represented on the map.

Although gentle slope is here defined as an inclination less than 8%, that is not strictly a critical value for land utilization. It does, however, fall in the range within which the difficulty of machine cultivation increases rapidly, erosion of cultivated fields becomes troublesome, easy movement of vehicles becomes impeded, and in general one becomes highly conscious that he is dealing with a sloping surface.

Since local relief is defined as maximum difference in elevation within a local area, it is necessary to specify a fixed size for that local area. Experimentation led to the selection of a unit square six miles across. A unit of this size is neither small enough to cut individual slopes in two nor large enough to embrace areas of excessive diversity, nor to distort local relief figures by adding in long regional slopes.

The class boundary values chosen throughout the classification are essentially arbitrary and have no critical significance. Those for percentage of area in gentle slope and for vertical position of gentle slope afford a conveniently small number of classes with roughly equal class intervals. For local relief the class interval is broadened as the relief increases, following the idea that for most purposes there is progressively less concern with small absolute differences in relief as the relief becomes greater. For surface materials the 10% figure is a reasonable threshold value at which the presence of sand, ice, or water becomes distinctly noteworthy, whereas the 50% value marks the lower limit of predominance of these significant materials.

In delineating the crest, peak and escarpment patterns, considerable generalization has been necessary. Nearly all isolated features with more than 300 feet of local relief appear on the map, but in areas where high features are closely spaced, only selected ones can be shown. In such areas, features have been selected that display the essential character of the pattern as clearly as possible. The degree of generalization is keyed to the scale and to the requirements for reasonable visual clarity. The smallest region delimited by boundaries and given a coded classification has an area of about 800 square miles. Smaller areas are omitted or absorbed into the adjacent region that they most resemble.

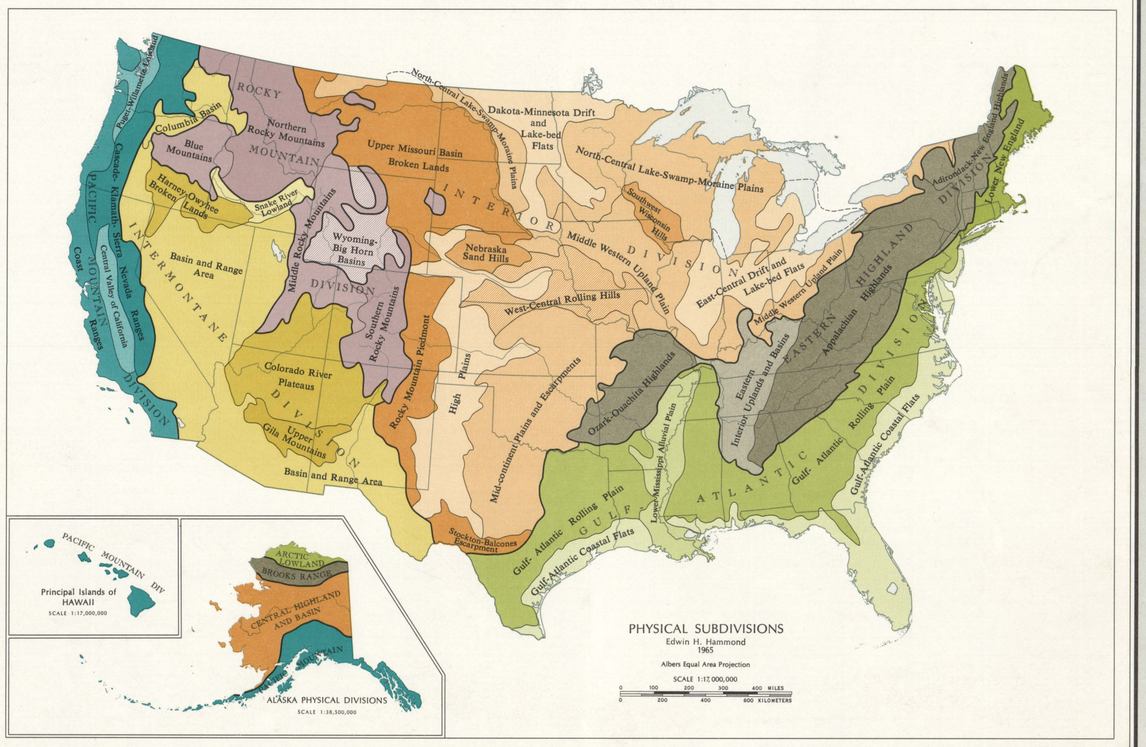
The finished map is believed to be unique in representing the pattern of land-surface variation in the United States as an array of clearly defined types that can occur repetitively and that can be compared and contrasted in terms of specific attributes. Because the scale is rather small and the classification simple, the map is necessarily a highly abstract version of reality, revealing no more than five selected bits of information about any area. As in all maps of natural phenomena based upon systematic classifications, some of the boundaries between areas fall in the midst of zones of gradual transition rather than at points of discontinuity or abrupt gradient.

The shift of emphasis from structure and developmental history to character of the surface form produces significant departure from the earlier maps. By way of example, the Fall Line, which separates the Appalachian Piedmont from the Atlantic Coastal Plain on the Powell and Fenneman maps appears here as a boundary in only a few short segments. Although it represents a major break in geologic structure, it forms a much less fundamental dividing line for surface configuration. The narrower valley floors, more rolling divides, and somewhat higher elevations which distinguish the Piedmont surface from that of much of the inner Coastal Plain are only in places distinctive enough to warrant being set apart by a class boundary. Much the same is true for the southern boundary of Fenneman's Superior Upland, where an important geologic boundary is effectively masked by a cover of glacial drift that imparts a similar configuration to the surface on both sides of the lithologic line.

Conversely, the Classes of Land-Surface Form maps emphasize certain other distinctions that the Fenneman and Powell maps do not. Examples may be seen in the separation of the flat, marshy, outer Coastal Plain from the more rolling, better drained inner sections; the recognition of a great variety of relief and roughness in the Appalachian Plateaus area, and the sharp distinctions among different parts of the Central Lowlands. To some degree those represent a finer subdivision made possible by the larger scale, but they also reflect a basic difference of emphasis in the criteria of differentiation.

Although the map is designed to show visually and functionally significant aspects of the terrain and not to indicate genetic factors in surface development, it is not without significance to geomorphologists, because each of the regional differences in surface properties poses a problem of origin. Certain of those problems, especially those of differences in slope and slope profile characteristics, are unusually knotty and have as yet received relatively little attention in systematic regional studies.

A more comprehensive treatment of the subject appears in Edwin H. Hammond's "Analysis of Properties in Land Form Geography: An Application to Broad-Scale Land Form Mapping," *Annals of the Association of American Geographers*, Vol. 54, 1964, pp. 11-23. The author's map of the conterminous States at 1:5,000,000 which accompanied the above-referenced article was adapted to National Atlas scale with the author's assistance, and was extended by him to include Alaska and Hawaii (pp. 60-62).



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