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Native Nutrient Status of Texas Soils

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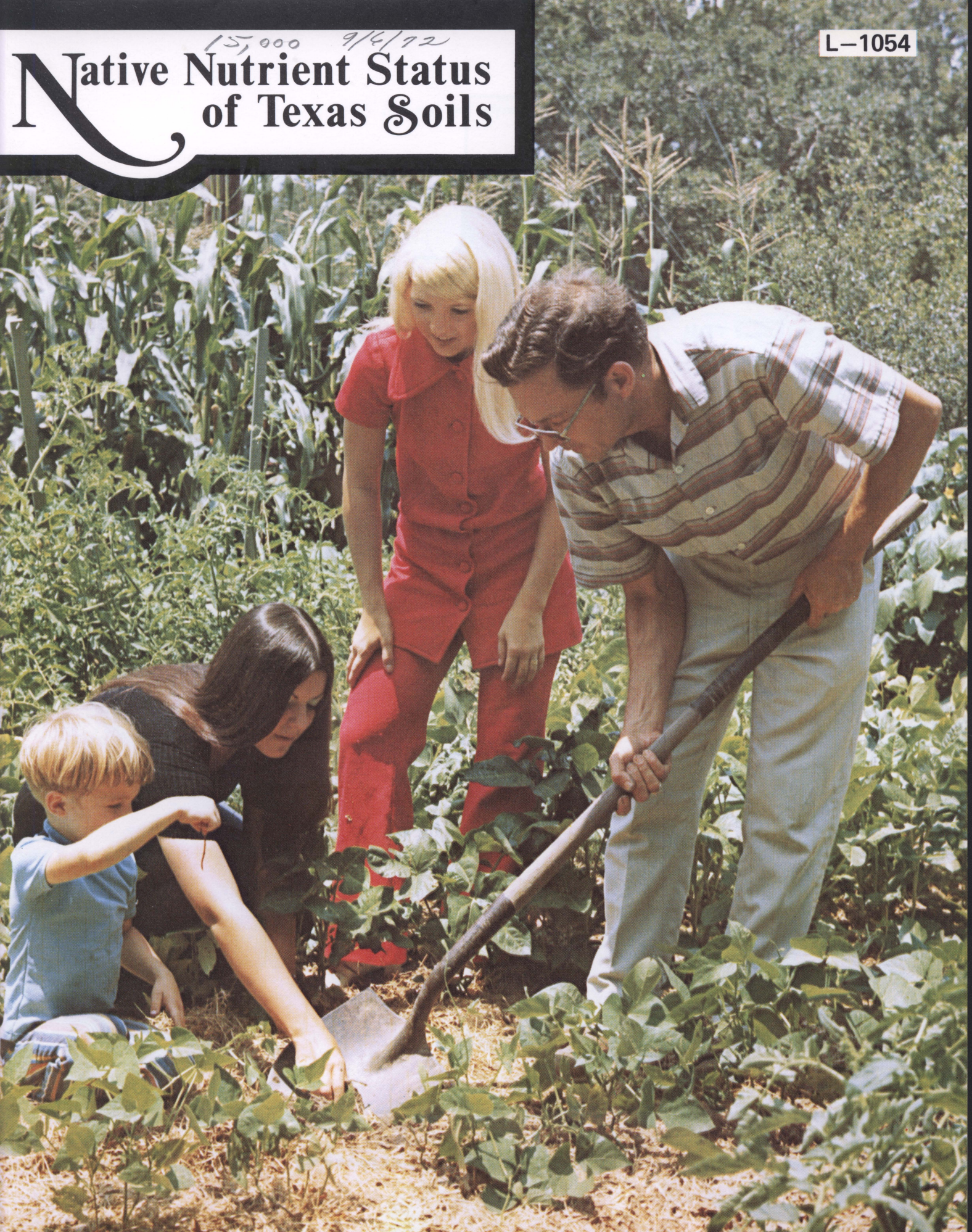

TEXAS A&M UNIVERSITY • TEXAS AGRICULTURAL EXTENSION SERVICE • J. E. HUTCHISON, DIRECTOR, COLLEGE STATION, TEXAS

Native Nutrient Status of Texas Soils

Flake L. Fisher*

The science of soil survey allows man to describe, characterize and map soils as they occur in nature. This enables him to use his knowledge of a specific soil and to make maximum or best use of that specific land area.

Soils result from the interaction of climate and organisms on geologic materials as conditioned by topography over a period of time. These soil-forming factors vary widely over Texas, producing many kinds of soils differing as to profile features and other properties (figure 1). Soils vary in the kind, number and degree of development of major horizons (natural occurring layers) and/or sub-horizons that may form. Very few soils have all the major and minor horizons, but all soils exhibit some of them. Therefore, we may define soil as a collection of natural layers occupying the outer portions of the earth's surface and capable of supporting plant growth. It develops specific properties due to the interaction of climate and living matter acting upon parent material as conditioned by relief over periods of time.

The specific properties (three-dimensional) that develop as the result of varying parent material, plants and climatic conditions afford a base to start classifying soils. The grouping of soils in the least specific group or class is known as the soil order. The soil orders that occur in Texas are shown in figure 1. A brief, generalized description of the soil orders follows:

Entisols — Soils lacking well developed horizons. Mostly young soils (ENT≅Recent), variable in texture, developed on recent geomorphic surfaces in a wide range of climates, but may occupy older surfaces if man has disturbed the soil so as to destroy the horizons, or if formed in parent sediments highly resistant to alteration such as quartz.

Remarks: Deep sandy soils of coastal terraces and off-shore barrier islands of the Gulf Coast.

Vertisols — Clayey soils that shrink and develop wide cracks during dry seasons followed by expansion or swelling on rewetting during moist seasons (VERT≅Invert). Intersecting slickensides develop. This characteristic movement can break plant roots, pipes, building foundations, and complicate the design, construction and maintenance of highways and streets. Vertisols have a high capacity for holding plant nutrients and water, but when moist they are slowly permeable to water and air. Commonly, they are dark colored from the surface down to as much as 3 to 6 feet (1 to 2 meters) with gradual changing wavy boundaries between horizons of little contrast, except in organic matter content and associated changes in soil color. Micromounds and microdepressions, called "gilgai" microrelief, develop on undisturbed surfaces.

Remarks: Dark clay soils of the nearly level and sloping uplands and stream terraces of the Blackland Prairies of Texas.

Alfisols — Soils usually light colored in the A horizon with B horizons more clayey and higher in bases than the A horizon. They are moderately leached in the upper horizons but usually become more basic with depth (ALF≅ Pedalfers). Layers high in carbonates or other salts may occur in lower horizons. Commonly, the A horizons are thin and loamy over B horizon very clayey and slowly permeable, making many Alfisols very drouthy for plants; and in some, the clayey B horizons are sources of trouble for engineers.

Remarks: Loamy soils with thin A horizons over clayey B horizons high in montmorillonite on nearly level and sloping uplands and stream terraces in the Claypan Area.

Inceptisols — Soils varying in color and texture which have undergone limited horizon development. (INCEPT≅Inception). They are losing materials from leaching each year throughout, but pronounced illuvial horizons have not developed. Some modification of weatherable minerals in the profile is apparent. Equilibrium between erosion and weathering may be a major factor controlling their features of morphology.

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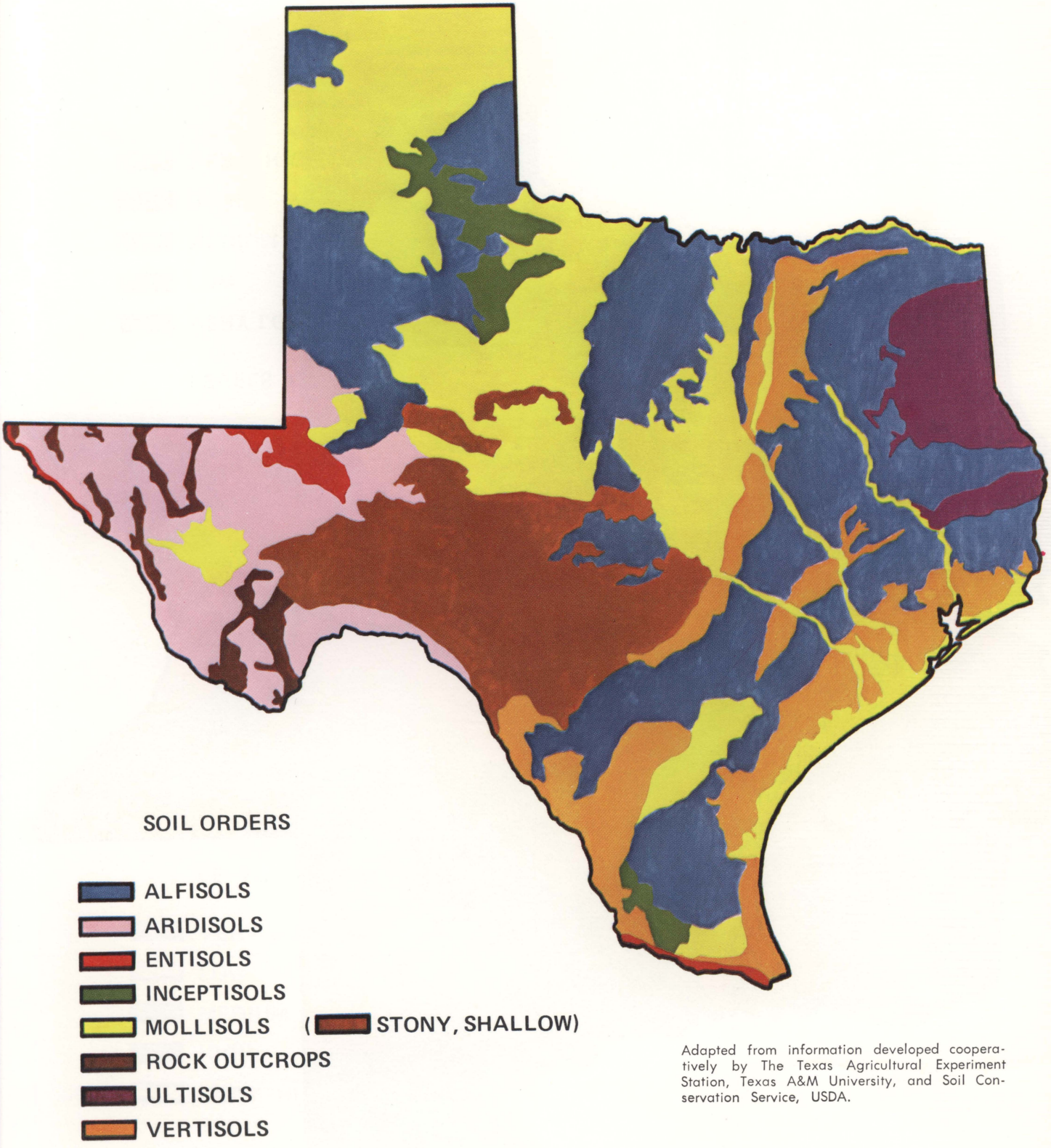

Fig. 1. Dominant soil orders in Texas.

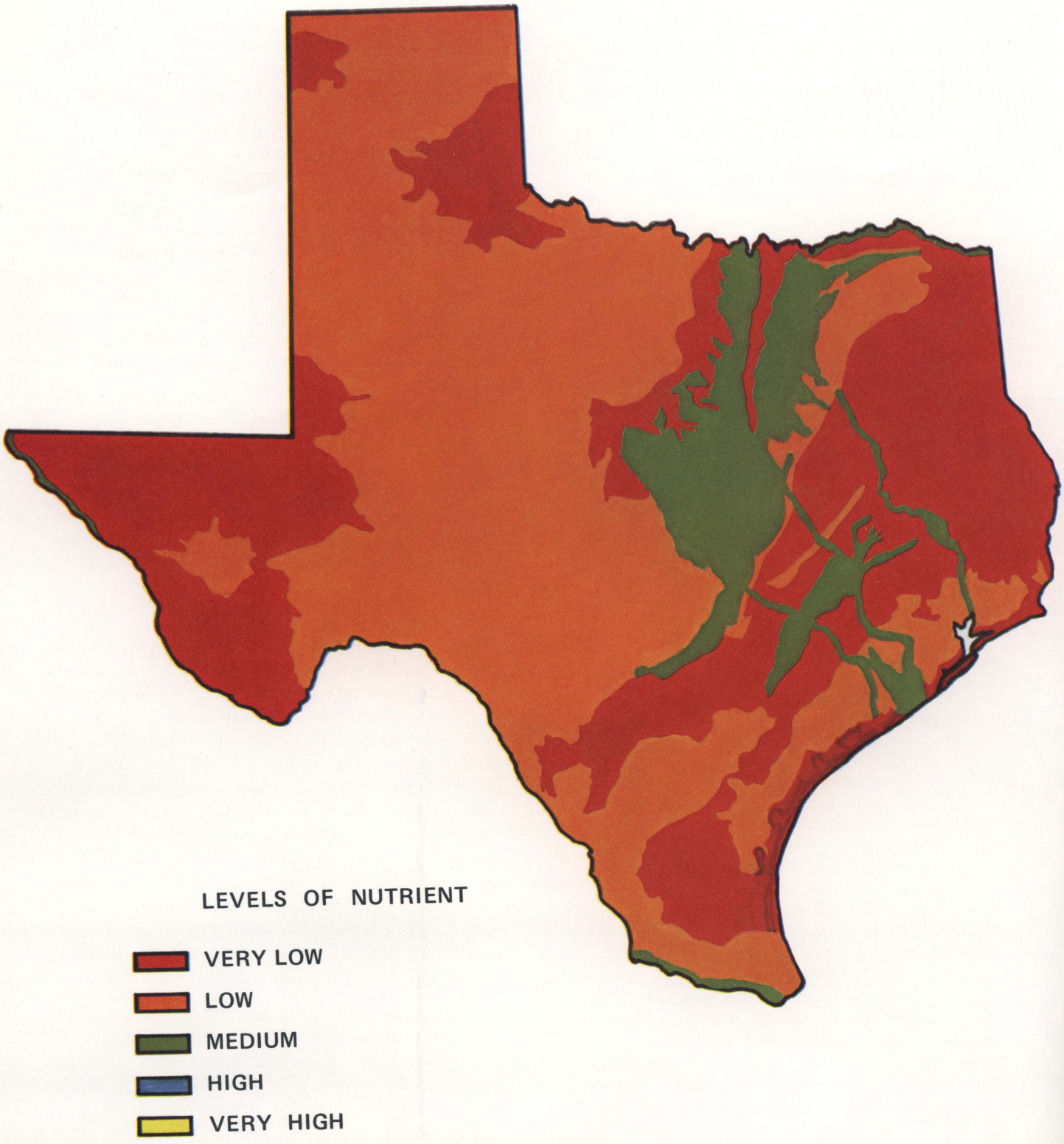

Fig. 2. Native soil levels of nitrogen.

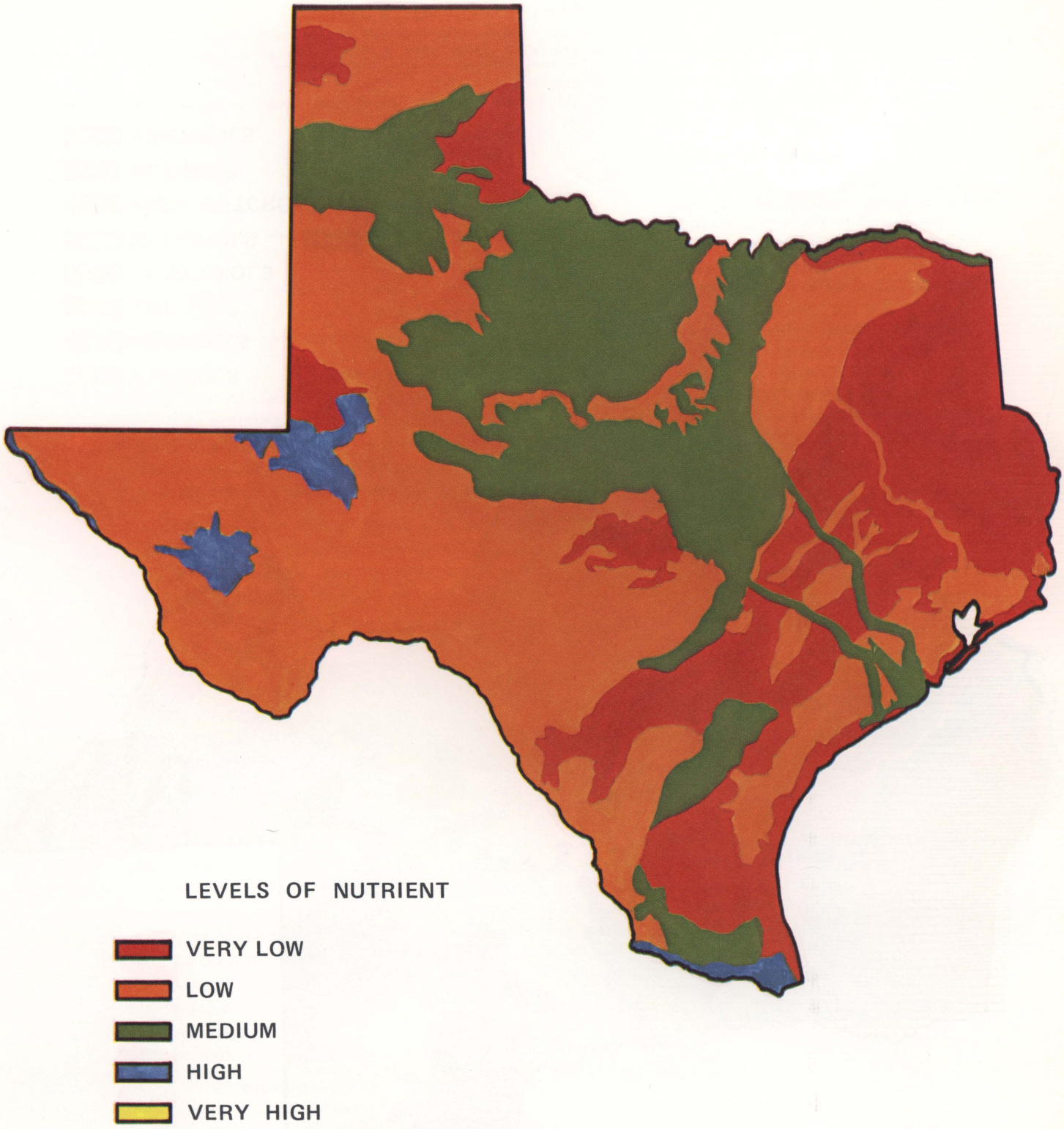

Fig. 3. Native soil levels of phosphorus.

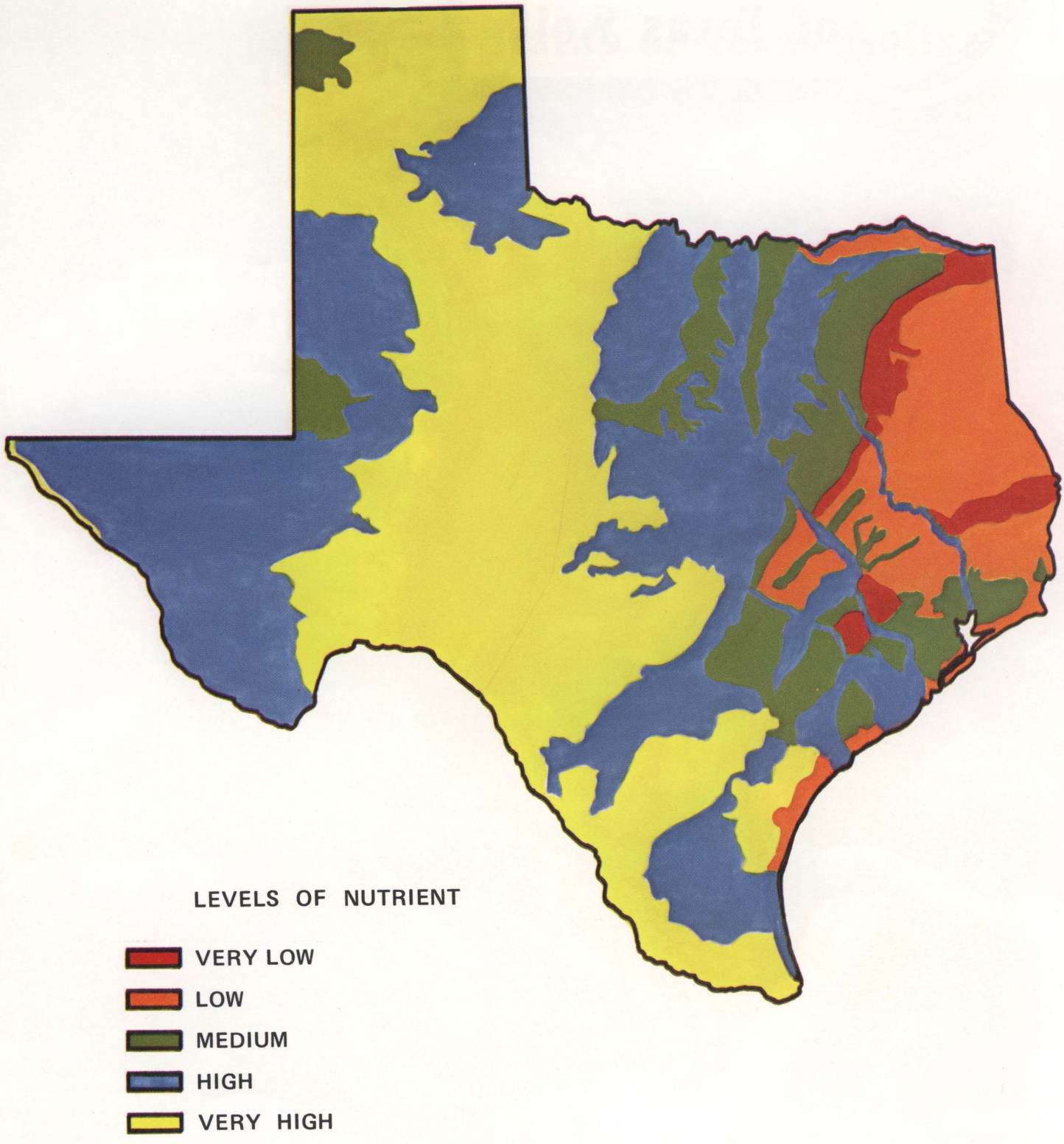

Fig. 4. Native soil levels of potassium.

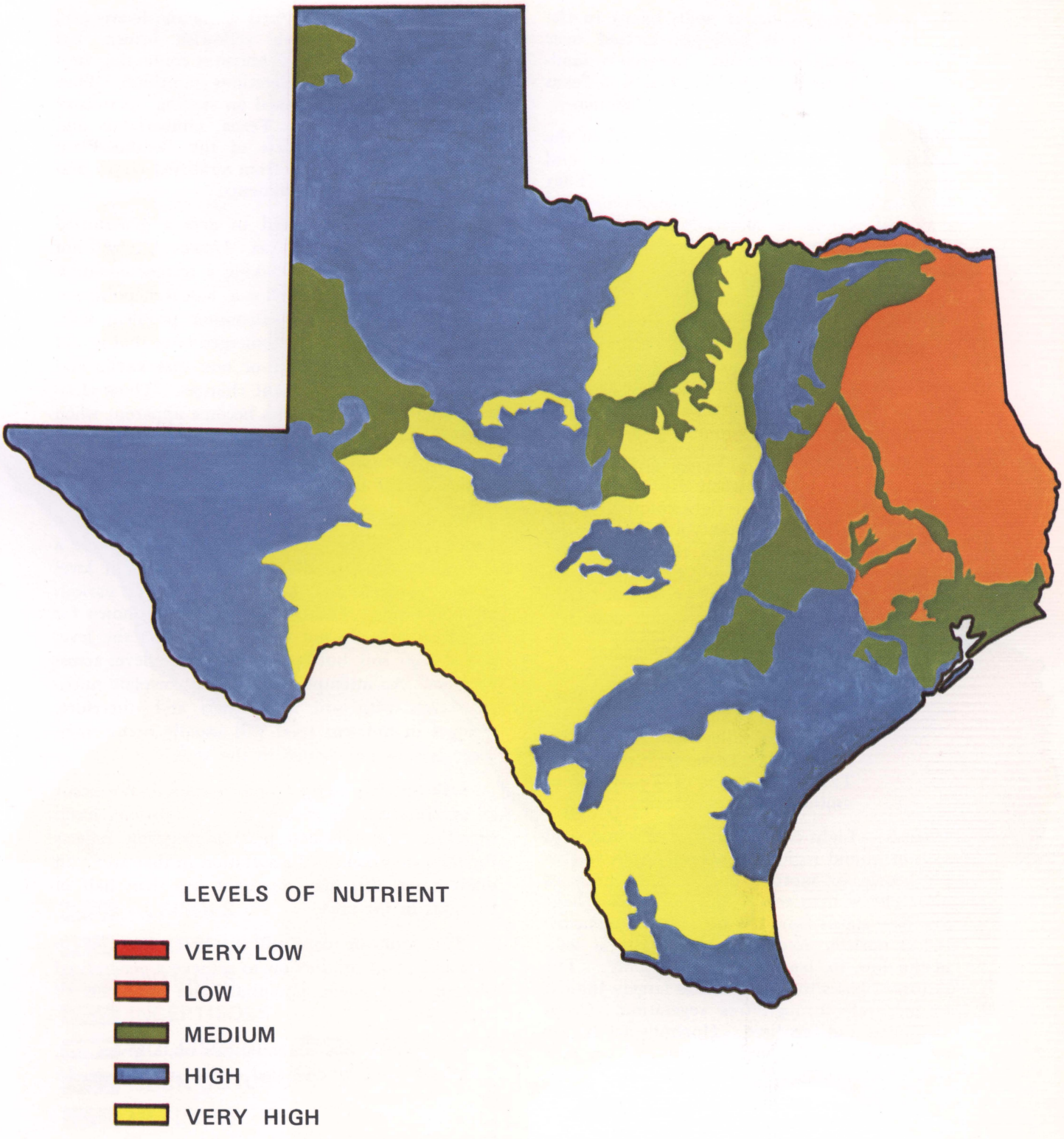

Fig. 5. Native soil levels of calcium.

Remarks: Reddish brown soils, loamy in the A and B horizons, formed over weakly cemented calcareous sandstone in the Rolling Plains of Texas and related areas of Oklahoma.

Mollisols — Soils that are dark colored in the surface, soft, (MOLLIS≅soft) granular and generally do not set hard when dry. They form under limited leaching in subhumid and semi-arid regions in materials high in bases, especially calcium, in contact with decomposing organic matter **in** rather than **on** the soil.

Remarks: Dark loamy soils with thick, more clayey B horizons; formed in calcareous water-laid sediments of nearly level to gently sloping uplands in the Rolling Plains of Texas and to a limited extent in southwestern Oklahoma.

Aridisols — Soils in dry places (ARID≅dry) that are normally soft when dry or have distinctive structure and are light colored. They are not leached and have zones of calcium carbonates or other salts in the profile, and may or may not have clayey B horizons. They form in water and windlaid calcareous sediments in subhumid to desert environments.

Remarks: Light-colored calcareous loamy soils with a zone of calcium carbonate accumulation at a depth of 20 to 40 inches; formed in broad nearly level filled valleys and on plateaus of the arid Edwards Plateau and Trans-Pecos areas of Texas and in southeastern New Mexico.

Ultisols — Light colored sandy and loamy acid soils of humid regions, commonly with yellowish brown or mottled illuviated B horizons more clayey than the A horizons. They have low base status from the surface into or below the B horizon accounted for by parent sediments low in bases and by leaching. The return of bases to the surface is largely limited to the cycle through tree vegetation. Crops are limed and fertilized. Horizons are highly contrasting in color and texture, and are thus well developed (ULT≅ultimate).

Remarks: Light-colored sandy and loamy acid soils with yellowish brown, red mottled B horizons containing iron oxide concretions (plinthite). They have formed on sloping uplands of the East Texas Timberlands and other parts of the Coastal Plain Province from stratified clayey and sandy sediments.

Figure 1 was designed to give a generalized picture of the soils of Texas. However, it will not be adequate for use in making a recommendation for a specific land area. It can, however, point out areas where one might encounter problem soils, such as soils that have a submerged layer that would restrict root development or one that swells and shrinks as moisture content changes. These characteristics and many others become apparent when a soil is studied as a three-dimensional system. This would allow one to obtain detailed data relative to the specific use to be made of the soil.

Inside this leaflet, maps on nitrogen, phosphorus, potassium and calcium attempt to give a generalized view of the natural or inherent level of each nutrient that nature provides the various soils of Texas. The levels of nutrients shown for a general area do not necessarily reflect the level of a specific soil, but rather the average level across the area. An attempt was made to correlate nutrient levels with soil associations and, therefore, changes in nutrient level will usually occur when there is a major change in the soils.

Soils are very complex and usually do not occur as continuously as shown by the nutrient level; therefore, the indicated level of nutrient reflects the most dominant soil association in that area. In many cases, this may represent less than half of the soils in the area.

This series of maps will allow the beginner in soils and plant production to achieve a generalized picture of nutrient potentials and problems of Texas soils.

For specific recommendations on a given soil, samples should be collected and a soil test made.

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