

I WISH to make a few comments on the map of Arizona on the cover of the June 1984 issue of *Photogrammetric Engineering and Remote Sensing*.

As a retired cartographic designer for many years (13) at the Army Map Service (now the Defense Mapping Agency Hydrographic/Topographic Center) and erstwhile resident (seven years) of Arizona, the cover map held much fascination for me. I'm much impressed with the splendid images of the Earth available now through the magic of satellite photography. Earlier in my mapping career I drew, very painstakingly, these same topographic images with a tiny airbrush. Visions of the Earthen landscape from the artist's (my training) view and cartographer's (experience) are still very much with me.

Looking at the cover map, I was immediately struck by the notion that the cartographers encountered here one of the most difficult and frustrating color problems facing map-makers, that is, combining shaded relief configuration, vegetation patterns, and textures with the disruptive device of showing ranges of elevation with layer (gradient) tints. This combination always spells trouble. I wrestled with this problem for years.

Further study of the cover map led me to "quarrel" with the choice of using green values to express ranges of elevation. I am very much opposed to green as layer tints (some exceptions). It is an elemental psychological truism that greens on a map connote vegetation even to the most inexperienced map user.

The green layer tints on the cover map imply vegetation in the higher elevations of Arizona and absence of vegetation in the lower areas symbolized by the orange-brown and tan tints. This, of course, presents a distorted and ambiguous vegetation view of the state.

On the title page describing the map colors, we're told: "Traditional color coding was abandoned in order to produce a *more natural appearance for Arizona* (my italics), where higher elevations are vegetated and lower ones are desert."

There are areas in the high desert that are virtually devoid of vegetation, such as parts of the Painted Desert. In the low desert the landscape contains much coverage of giant saguaros, wide variety of cacti, palo verde trees, creosote bushes, sage,

assorted grasses, and beautiful flowers. Also, there are tremendous agricultural fields in the Valley of the Sun, around Phoenix.

The flora of Arizona provides a significant and beautiful aspect of mountains, canyons, and valleys. It demands critical attention from the map makers. I realize that the cover map is at a very tiny scale—yet at this scale, vegetation is part of the total picture.

May I suggest, respectfully, to the cartographers that green be reserved only for vegetation. I strongly advocate the method of darker values in the lowlands and graduating to lighter values in the highlands. Top value white—if the terrain heights warrant it. The white tops are very effective on the cover map.

I also suggest—for layer tint colors—experiments with tints made by mixing (printing) orange and green (not related to vegetation green) in various percentages of tints. When the layer tints have some content of green, there is less change of the green hue (vegetation) when the vegetation color is printed over the layer tint colors.

Years ago I conducted many color tests by printing graduated tints on other graduated tints. When I was designing (with Henry Kibler, of Navy) the DoD Wall Map (9 sheets) Series 1142, I evolved the land layer tints with only two press plates—one printed graduated tints of orange and the other plate graduated tints of green. In this case the green values served to define the continental lowlands and cultivated areas.

As for the "more natural appearance for Arizona," I envision very little similarity of the subject map to the natural coloration of Arizona. At most, the colors of the cover map are pleasant chromatic judgments, more symbolic than relating directly to nature—and designed to produce a particular graphic effect. And does this very well.

To ascertain the "natural appearance" of Arizona's highly subtle and variegated colors would be a most taxing project of the first magnitude. It *might* be done by a team (or just me) of high caliber, experienced artists blessed with a bountiful budget. Of course, color satellite photos would help a lot, too!

—Thomas R. Yanosky

Response

WITH REGARD to Mr. Yanosky's letter, I would like to clarify a few things about the map of Arizona used on the cover of the June, 1984 issue

of *Photogrammetric Engineering and Remote Sensing*.

The map is not a satellite image; it was made en-

tirely from computerized contour maps. No photography of any kind was involved except for the film image written by the computer after the digital processing was complete.

The information shown on the map relates to surface elevation and morphology alone. We wished to use some scheme for encoding elevation values, and we chose color. These colors were intended to be "pleasant chromatic judgments, more symbolic than relating directly to nature." It happens that the dominant surface coloration of the higher elevations in Arizona is green and that of the lower elevations is brown, so we reversed the traditional scheme just to see how it would look. It looked good to us, which was remarkable because the three of us have never before agreed on anything so subjective as color coding. We have each lived and worked in Arizona much longer than seven years, if that has anything to do with our qualifications to suggest a "natural"-looking scheme. It certainly looks more natural than a preliminary test in which we retained the tradition of using green for lower elevations and brown for the higher ones.

I am not prepared to dispute Mr. Yanosky's contention that the color green should be eliminated

altogether from this kind of cartographic use, although it seems to me that if we do that, we must also eliminate reds, yellows, and browns, because they may be confused with many kinds of rocks and soils. Also, if green is reserved strictly for vegetation, what are we to do with false-color infrared image maps, in which vegetation appears in several shades of red? It seems to me that regulations of this kind impose more ambiguity than they resolve.

The cover map is a relatively inexpensive by-product of a project to generate a regional digital terrain model for Arizona; the digital shaded-relief and color-slicing techniques were applied more or less as an afterthought, and were not intended to advocate any particular way to encode color elevation data. If a map of this kind is needed to display the vegetation regime of Arizona, Mr. Yanosky is quite correct in suggesting that it would have to be a much more heavily funded project.

—R. M. Batson

—Kathleen Edwards

—E. M. Sanchez

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