Teaching the Complexities of Map Boundaries

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Abstract. The authoritarian perception of categorical boundary lines on maps tends to leave students with the false impression that all categorical map boundaries are more-or-less immutable. Additionally learners often perceive that such lines are based on a single, easy-to-define, geographical phenomenon and that the exact spatial location of that phenomenon is both known and recordable. Among the more important geospatial concepts geography students must learn however is that the definition of these zones of inclusion as "regions" is often based on multiple interacting phenomena requiring a geographer's skill at both delineation and perhaps more importantly integration of often subtle but important geospatial phenomena. Regional geographers would argue that this latter skill is a hallmark of the geographer's craft. This talk provides examples of field and discussion-based exercises from biogeography, census geography, climatology, and cultural geography that expose students to the problems, solutions, and implications of categorical boundary determination.

1   Introduction

Spatial thinking is considered a critical skill of a well-educated geographer and is therefore a component, although more often an implicit rather than explicit component, of much of geographic education, yet research shows it can be learned (Gersmehl and Gersmehl 2007) and should be included as part of a modern geography education (Bearman, et. al. 2016).   The term spatial thinking however as it is applied in the field of geography is markedly different and contains far more meaning than that of being able to recognize a 3-D form from a 2-D diagram. Employing instead the term "geospatial thinking," the patterns, boundaries, arrangements and juxtapositions of earth's features as observed on imagery or stylized on cartographic products carry with them cause and effect relationships that are often at the heart of geographic inquiry. I will restrict my talk to that of categorical map boundaries as they are conceived of and abstracted to represent internal regional uniformity.

Geography students, especially those who are relatively new to the discipline, are often unaware of the complexity of categorical boundaries – often accepting soils and vegetation categories found in textbooks and distribution maps in atlases as absolute and the internal content as uniform. Perhaps more importantly these novices infrequently consider the implications of both the category boundaries and the assumptions about their internal content.   While these concepts are often implicit in a full program of study, students often miss the subtleties because of the intrinsic and extraneous cognitive load inherent in every learning experience.   Rather than relying on incidental or situated learning for these concepts, I provide a few simple exercises whose intended learning objectives are specifically related to regional classification.

2   Exercises

The following exercises provide a cross section of possible approaches to teaching about regional boundaries with intended learning objectives. The examples are not meant to be comprehensive nor are they intended to necessarily be used as is, but rather modified to adjust for setting, course, or faculty uniqueness.

2.1   Vegetation Map Exercise

Vegetation maps are common in general physical geography texts and as separate maps and supplements. But do introductory physical geography students really know what they represent?   Here is a quick exercise to get them thinking.

Learning objectives:

1.   Identify what is actually being mapped in a number of different maps.
2.   Recognize that there are different criteria used for different vegetation maps.
3.   Define plant communities. Explain how different vegetation communities might be classified – what criteria are being used?
4.   Define ecoregions. Explain the differences and similarities of methods of ecoregions mapping approaches, especially concentrating on the US EPA system and the USDA Forest Service method.
5.   Explain why you might choose vegetation structure, versus floristics, versus a combination in mapping vegetation.

Assignment: Materials: Selected large and small scale vegetation maps. Ask the students to read Kuchler (1956) and DeMers (1991). They will then perform web quests for questions whose answers they are unclear of, and then describe the following for each map in a discussion channel of their class LMS or Blog: What is actually being mapped?   Are these maps of tulips, roses, or other specific species, or is the cartographer mapping other things?   What is a plant community?   An ecoregion?   How are these determined?   Why would you choose to map vegetation composition (floristics) versus structure versus some combination? Does scale affect your decision?   How about the potential uses? How might this affect research?

2.2   Census Exercise

The US Census Bureau organizes geographic space into geographic areas: in fact it is one of their primary research areas (https://www.census.gov/geo/research/) [last visited May 17, 2015].   They also conduct research on how data are to be collected to allow them to detect changes in geographic boundaries. Here is an easy field example to allow students to conduct their own similar investigations.

Learning objectives:

1.   Develop ways to define a neighborhood in their local town or city.

2. Develop methods of collecting data used to define areas that would allow the learner to revisit the study years later and get measurable results.

Assignment: Materials: Cell phones with GPS enabled, or simply notebook and pen. Base maps of the town/city. Ask the students to spend a week or so traveling around their town or city (or portion of the city if it is a large city) and collect data about what they observe (architecture, paving or curb type, vegetation types, cars, etc.). Upon completion, have the students map what they see as neighborhoods, give the neighborhoods descriptive names, and using the course discussion channel or blog, begin a dialogue about what they decided and why. Make sure to ask them what specific data elements they used and whether or not these would provide an adequate framework for analyzing changes through time.

2.3 Climate Map Exercise

Climate change is a hot topic these days with both supporters and deniers raising the stakes for membership in their respective camps. Although there are many social issues behind this debate, part of the issue is a lack of understanding of what climate is, what variables go into its description, and how they are used for classification. Once again the importance of not just recognizing and describing climatic pattern, but defining underlying principles behind its determination, becomes paramount in the process of geospatial education. Without belaboring the massive data analytics the following exercise simply forces the learner to consider general principles.

Learning objectives:

1. Identifying basic Koeppen-Geiger climate patterns and explaining topographic, longitudinal, and coastal-interior factors patterns from its maps.
2. Listing the basic factors used in the Koeppen-Geiger climate classification and its relationship to the Grisebach vegetation maps.
3. Recognizing and explaining the stability of Koeppen-Geiger climate maps.
4. Explain why the system stability can contribute to climate change research.

Assignment: Have your students read Peel, et al. (2007) focusing on the general concepts rather than the quantitative techniques. Combining this with webquests (Google searches) ask your students to answer the following questions in open discussion via the their course LMS or blog: (1) describe how topography (especially mountains), longitude, and coastal or interior position contribute to these climate zones' locations, (2) list the basic factors used in developing the Koeppen-Geiger climate classification system and describe what relationship the patterns might have with the Griseback vegetation maps, (3) given what you have described, how do you explain the relative stability of the Koeppen-Geiger classification system and how this stability might contribute to climate change research.

2.4 Land Settlement Patterns Exercise

There are some regional boundaries whose location is based on simple, easy-to-identify criteria observed on aerial photography or other imagery yet whose configurations tell a message of cultural or religious significance. Perhaps the most obvious of such patterns to the experienced geographer but not necessarily to the beginner is that of general land use patterns. Recognizing these patterns requires little more than experience. This simple exercise gives the learner that experience.

Learning objectives:

1. Familiarize one-self with three major cultural land configurations.
2. Describe the cultural significance of pairs of different locations on the earth.

Assignment: Have students locate the following pairs of cities and towns: (1) Phoenix, AZ and Salt Lake City Utah; (2) Pincourt, Quebec, Canada and Convent, Louisiana, USA; (3) Santa Fe (zoom into the round building at about eye level of 14,000 feet (New Mexico Legislature building) and Mexico City, Mexico (eye altitude about 4500 ft. Now, using your class LMS or blog answer the following questions. How are the street patterns of Phoenix and Salt Lake City similar? What do the two cities have in common? (Hint, think early settlement history and religion). How would you describe the street patterns of Santa Fe, NM and Mexico City, Mexico? What is the cultural significance of this similarity? What do the land use patterns along the rivers in Pincourt, Quebec, Canada, and Convent, Louisiana have in common? What does this suggest as a cultural linkage between them? What is the underlying theme of these three comparisons? By that, what general pattern of activity does each pair share? (Hint: consider when these locations were founded).

3 Concluding Remarks

This paper describes a small set categorical map boundary determination exercises. While the set is only representative of even that small category of possible exercises, it is meant to provide examples and promote both creativity and further discussion. It would be possible to create an entire section of exercise in, for example, a map/air photo techniques course just based on this single topic.

References

1. DeMers, M., 1991. Classification and Purpose in Automated Vegetation Maps, Geographical Review, 81(3):267-280.
2. Gersmehl, P., and C.A. Gersmehl, 2007. Spatial Thinking by Young Children: Neurological Evidence for Early Development and "Educability," Journal of Geography, 106:181-191.
3. Peel, M.C., B.L. Finlayson, and T.A. McHahon, 2007. Updated World Map of the Köppen-Geiger Climate Classification. Hydrol. Earth Syst. Science 11, 1633-1644.
4. Küchler, A.W., 1956. Classification and Purpose in Vegetation Maps. Geographical Review 46(2), 155-167.