

A Personalized National Atlas of the United States

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The U.S. Geological Survey published the *National Atlas of the United States of America* in 1971. Since then times have changed, and the technological revolution in cartography today makes it mandatory to take a close look at the concept of a national atlas. This paper focuses on two concepts related to national atlases: the popular conception of a national atlas and the notion that a comprehensive national atlas would contain information on the United States that most commercial atlases would not include. Ideas are presented that describe what a future, comprehensive, digitally produced national atlas for the United States (CD-NAUS) might look like.

INTRODUCTION

The U.S. Geological Survey published the *National Atlas of the United States of America* in 1971. That edition is out of print and the U.S. Geological Survey does not plan to reprint that edition. One hundred years earlier, following the 1870 Census, Francis Walker published a *Statistical Atlas of the United States* (Walker 1874). No decennial long term follow-ups to that publication occurred. On the basis of this record, the next atlas of the United States published by a U.S. Government agency should be in the year 2070. One could question why I am talking about a national atlas now. We have 75 years yet to worry about it. However, since those earlier atlases were published, times have changed, and the technological revolution in cartography today makes a close look at the concept of a national atlas mandatory. The change in technology requires us to reexamine almost all the concepts on which cartographers have based their science for the past three centuries. I want to single out two concepts related to national atlases and then speculate on what a comprehensive, digitally produced national atlas for the United States (CD-NAUS) could be like in the future.

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The first concept, and actually the less important, is the popular conception of a national atlas. I think that the words "national atlas" evoke in most Americans the mental image of an expensive, large book that occupies a prominent place in the reference section of each public library, in the reading rooms of private clubs, and in the home libraries of the wealthy. There is justifiable reason for this conception. Any atlas that is truly national in scope and produced by analog technology is going to be big and expensive. So, few individuals will actually have copies of their own. The United States is a large nation with a large population and has the capability to collect huge quantities of data. Because of our freedom of information laws, any comprehensive atlas of the nation will be a large undertaking. In short, no matter how one looks at it, a national atlas of the United States is a "big" thing.

The second concept is that a comprehensive national atlas would contain information on the United States that most commercial atlases would not include. Commercial atlases must make a profit, and most

individuals will not purchase a book that costs several hundred dollars. Therefore, commercial firms must trade off comprehensive content against production and distribution costs in order to assure that sales will be sufficient to recover their financial investment. This means that commercial atlases must concentrate on content that has the greatest appeal to the largest number of map readers. On the other hand, a national atlas should contain information that is of interest and utility to every person in the country, but it should also contain more technical information that may or may not have general appeal to the map reading public. A national atlas should include specific information mandated by law and collected by Federal agencies. I believe that these statements hold true regarding an analog or a digitally produced national atlas. A CD-NAUS should contain data and information that might have little commercial appeal but that documents the condition of the United States at a point in time. Thus, one could expect there to be a profound conceptual difference and also a major practical difference between a commercially and a governmentally prepared national atlas.

We cannot expect a commercial firm, in isolation, to produce a comprehensive national atlas. In addition, given today's economic situation, we should not expect a single Federal agency to produce such a comprehensive national atlas either. Hence any successful effort must be made by a consortium of organizations.

All else being equal, 2070 is as good a date to target for another national atlas as any other date. But because changing technology has altered the conditions which resulted in the above described situation using analog cartography, we in the United States now need to look seriously at the potential for a digital CD-NAUS. Let me suggest a number of ideas that, when sorted out, may make a large project like that of a CD-NAUS possible, probable, and useful.

First of all, such a project will have to be a joint effort among agencies of the Federal Government, the States, and private enterprise. Let me suggest that a small part of the National Spatial Data Infrastructure (NSDI) be reserved for the CD-NAUS. We are building in the United States a National Information Infrastructure (NII) that will eventually provide every home and office with access to spatial data. The NSDI is that subset of the NII concerned with spatial data. Let me define the CD-NAUS as a four-part facet of the NSDI, consisting of the following: (1) base data (spatially referenced points, lines, and areas that rarely or only slowly change); (2) a set of thematic data (spatially referenced points, lines, and areas that may or may not change rather rapidly); (3) a set of standards, data input and data maintenance requirements, and network requirements; and (4) a set of optional additions.

In the parlance of the NSDI, base data include data that constitute the "foundation" and "framework" (Mapping Science Committee 1994). I would propose that the base data for a CD-NAUS consist of a set of areas and regions that are widely recognized legal entities, or that are stable (defined by no expected changes for 10 years), and that often serve as data collection unit areas. For example, such framework data would have to include State and county boundaries. I would enhance this framework data by adding zip code areas, telephone area codes, census subdivisions (decennial censuses), defined watersheds, congressional districts, and other legally mandated areas such as national parks, wildlife refuges, and national forest boundaries.

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BASE DATA

A second set of data layers would consist of base point features. For example, the Geographic Names Information System (GNIS) is a listing of legal geographic names that are standardized for government use (U.S. Geological Survey 1987). All of the names in the file are georeferenced, and the changes per year are minimal. Another set of point data that changes relatively infrequently is elevation above sea level. A digital elevation model (DEM) for the entire United States would be part of the foundation data for the CD-NAUS.

Certain linear data sets, like the basic highway network (interstates, State highways, and so on) and the hydrography of the Nation, would be considered linear framework data. One, of course, could consider boundaries themselves. The most famous and perhaps elusive boundary is the coastline.

The exact needs for base reference data in a CD-NAUS must be debated. I would expect the base data, especially the framework and foundation layers, to be available on CD-ROMs as well as on the network. It would seem that some benefit would accrue from having available both a vector line set of reference, or base maps, and complete orthophoto coverage. With widely available software and DEM's, individuals could create fly-throughs or fly-arounds of any part of the country. Software could be written to allow simulated vegetation or buildings (that is, land cover types) to be fractalized on the surfaces created and visualized. Orthophotos are an example of another foundation data layer.

THEMATIC DATA

Thematic data sets would be national in scope and collected to standards that would assure their conformance to the base data. Weather data could be produced continually. Other thematic data would include socioeconomic data collected for unit areas. The locations of McDonald's restaurants (provided to the networked CD-NAUS by McDonald's for a fee), the locations and names of casinos in Reno (provided by the Reno Chamber of Commerce as part of a data layer maintained and paid for by the U.S. Chamber of Commerce on the Internet), the latest census statistics by collection unit area (provided by the Bureau of the Census), and the location of fragile ecosystems or wetlands (provided by the Nature Conservancy or a Federal agency) are all examples of thematic data that could become part of a CD-NAUS. The requirements would be adherence to the standard specifications and maintenance of the data layers. The possibilities are almost limitless.

STANDARDS, INPUT, MAINTENANCE, AND NETWORK REQUIREMENTS

To enable a CD-NAUS to work, a common exchange standard would be required (National Institute of Standards and Technology 1992). Data quality and information about data sets (metadata) would also require standardization (Federal Geographic Data Committee 1994). A standard graphic user interface (GUI) would make the use of a CD-NAUS efficient. We need a "home page" for CD-NAUS on the Internet.

It is envisaged that the thematic data of the CD-NAUS would be distributed. Any agency—Federal, State, or local, or any private firm—could make data available on a server over the Internet for use in a CD-NAUS context. In some instances, private firms could charge for access to their thematic data, and in other cases, they could be charged for the advertising of their thematic data. However, governmental or nonprofit organizations would not charge for data access. The overall costs for data maintenance and CD-NAUS user fees would have to be decided. Such a system could be instituted now on the Internet.

The fun part of this speculation concerns the options that could be made available. Most of you have probably been visualizing maps displayed on a screen that look much like the thematic maps that are part of any printed atlas. However, current technology allows us to go far beyond that stage.

First, we must consider several multimedia options. Pictures of entities in the real world would make any map legend come to life. Consider a land cover map. One could access a picture of each land cover class type. Imagine that a category defined as "needleleaf evergreen trees, growth singly or in groups or patches" could have representative photographs to accompany the areas on the map where that category spatially occurs. Maps of the habitats of endangered species could be accompanied by pictures of the species. A diagram of the soil horizon of each soil type could be available with the spatial data. Think of how pictures could make a map showing the incidence of tornadoes or earthquakes come to life for the map reader. In maps of cultural features, photographs from each city cemetery, airport, historical site, and so on could be available.

Now add sound to the pictures and the map. A white-water river sound could accompany a picture of such a river or the mapped position of the designated scenic river. The sounds of cities (for example, Los Angeles, Miami, Washington D.C., or New York) or the sounds of airports could greatly enhance the meaning of a map. Speaking of airports or parks, it would be possible to have an enlarged inset map of the airport or park itself as a window on your screen. Imagine being able to chart your course through an airport terminal before you ever left home. Imagine being able to see your hotel in an unknown city before your plane lands. These add-on options could easily be part of a CD-NAUS. And, these add-ons could be made available on the Internet by private firms for an advertising fee; they would be accessible on the terminal at your airline seat.

Another innovation is the capability for the user to keep a journal or notes as he or she travels through the CD-NAUS. It should be a standard tool for the user to be able to make notes or comments that can be assembled and printed after a session with the CD-NAUS.

We are teased by the talk of being able to produce smells at some future time to accompany multimedia presentations. Eventually, someone will try to create the sense of touch as well. But for the first edition of a CD-NAUS, let us limit ourselves to the senses of sight and sound. Let us not limit ourselves to maps, however, but allow accompanying photographs, videos, and graphics with sounds, music, and monologue as appropriate.

Today we are technologically capable of creating a CD-NAUS. A set of CD-ROMs to introduce the user to CD-NAUS could be sold for a nominal cost; they would contain the base data and instructions on how to access the CD-NAUS thematic data sets available on the Internet. Agencies and firms could be encouraged to create national data sets to specified standards and to make these data sets accessible on the Internet. Such processes could be ongoing, with new distributions or layers being added daily. The planning for such an atlas would be done by a consortium of interested agencies and firms. Planning and agreement on specifications to meet the CD-NAUS standards would take some time. Many data sets exist already and many more are being created. A set of specifications, a user-friendly graphic interface, and exchange, quality, and metadata standards would foster the creation of a wide variety of national thematic data sets. This would allow for a personalized national atlas for each individual.

OPTIONS

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CONCLUSION

REFERENCES

- Federal Geographic Data Committee. 1994. *Content Standards for Digital Geospatial Metadata*. Reston, VA: Federal Geographic Data Committee Secretariat.
- Mapping Science Committee. 1994. *Toward a Coordinated Spatial Data Infrastructure for the Nation*. Washington, D.C.: National Research Council. The National Academy Press.
- National Institute of Standards and Technology. 1992. *Federal Information Processing Standard Publication 173 (Spatial Data Transfer Standard)*. Washington, D.C.: U. S. Department of Commerce.
- U.S. Geological Survey. 1987. *Geographic Names Information System: Data Users Guide*. Reston, VA: U.S. Geological Survey.
- U.S. Geological Survey. 1970. *The National Atlas of the United States of America*. Washington, D.C.: U.S. Geological Survey.
- Walker, Francis Amasa. 1874. *The Statistical National Atlas of the United States*. New York, NY: Julius Bien.

RESUMEN

The U.S. Geological Survey de los Estados Unidos publicó el atlas nacional de los Estados Unidos de América en 1971. Desde ese entonces, el tiempo ha cambiado y la revolución tecnológica en cartografía ha obligado a prestar más atención al concepto de un atlas a nivel nacional. Este trabajo hace énfasis en dos conceptos relacionados con atlas nacionales: La concepción popular de un atlas nacional y la noción que un atlas nacional puede contener información sobre los Estados Unidos que la mayoría de atlas comerciales no contienen. Se presentan ideas que describen el futuro, la comprensión y la producción nacional de atlas digitales para los Estados Unidos. (CD-NAUS).

SOMMAIRE

La U.S. Geological Survey a publié en 1971 le *National Atlas of the United States of America*. Les temps ont changé depuis la publication de ces anciens atlas; aujourd'hui, la révolution technologique en cartographie nous force à étudier de près le concept d'un atlas national. Le présent document se focalise sur deux concepts ayant trait aux atlas nationaux: la conception populaire d'un atlas national et la notion qu'un atlas national détaillé et complet contiendrait sur les Etats-Unis des informations n'apparaissant pas dans la plupart des atlas commerciaux. Le document présente des idées qui décrivent l'apparence que pourrait prendre un futur atlas national des Etats-Unis détaillé et complet, produit numériquement.