

Developing a Digital Atlas of the Natural Ranges of Oaks of the World

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Worldwide forest resources are being digitally mapped by agencies and universities everywhere. A few programs are making efforts to draw together information on international forest resources and support for those programs is growing as recognition of the importance of global forests broadens. Here in California our native oak forests have been mapped twice in the past decade. We can present accurate maps showing local and statewide forest resources, alone, or with reference to other digital data.

Mexican forests, which include approximately 200 species of oaks, are also being mapped and assessed. Existing paper maps can be digitized, or GIS (Geographic Information Systems) coverages can be created directly from GPS (Global Positioning Systems), satellite or other remote sensing media. The Eastern United States is home to extensive native oak forests. The FNA (Flora of North America, Volume 3) project of the Missouri Botanic Garden has just published the authoritative flora of the *Fagaceae* for the US and Canada, including 97 (62 endemic) species, 90 of which are in the genus *Quercus*. A fairly good-quality graphic showing the range of each of the oak species is available on-line, but not geo-referenced. The World Conservation and Monitoring Center (Cambridge, UK) has recently published a CD of assembled GIS coverages of world forest resources, and presented this at the World Forest Congress in Ankara. A new Hammond Atlas of the World, the first atlas completely based on digital maps, has just been published and includes good climatic information. A digital atlas of the world has also been developed. The University of California at Santa Barbara has initiated a project known as the "Alexandria project" which includes a digital GIS library

Proposed Mapping Effort

I am proposing a project to map and develop a digital atlas of the approximately 400 species of *Quercus* worldwide. Although I can initially

lead this effort, the project needs broad involvement and support, and perhaps leadership provided by an agency or university. In order to get things underway. I am soliciting ideas, assistance and information. A metadata form is included in this paper, with which contributors may submit their data, information on existing datasets, or other relevant information. The information supplied becomes "metadata" or descriptive information about the structure and applicability of each GIS database or digital atlas contribution. The metadata text file contains information on the species, resolution, geographic extent, accuracy, tabular data, and nature of available datasets. I expect that applicable metadata and datasets could be made available online via Alexandria (UCSB) or another institution.

I have already found that information on oak forests, derived from so many sources, is highly variable. Although defined in the metadata and quite useful as stand-alone information, datasets may not be directly applicable to the Digital Oak Atlas project. As part of the effort to develop a digital oak atlas, I have adopted certain standards. The initial effort, for instance, is going to map the native ranges of the oak species, not the extent of oak forests. The Atlas is intended to provide a global and regional/national perspective on oak ranges, and therefore low resolution data is fine, presentable at a scale of 1:3000000 or better. Although a variety of coordinate systems and map projections can be accommodated, the Digital Oak Atlas database will be constructed interchangeably using the geographic (latitude/longitude) and UTM (Universal Transverse Mercator) coordinate systems. Data should be developed using a vector format compatible with GIS standards. I am most interested in receiving raster datasets, which may be converted to vector formats as necessary and applicable.

Accuracy is a matter that is somewhat subjective. Rather than set standards at this time, a statement of the source and anticipated accu-

racy of any submitted data should be attached (in a text file) to the metadata.

Presentation of maps will be feasible using ArcView[®], Arc-Info[®], BaseMap2000 GIS[®], or with a variety of Internet map query and presentation systems presently under development. Maps and datasets will be accessible using the Internet. Sources will be recognized in every instance.

Once the home range digital mapping is underway, I propose creating another adjunct dataset — a mapping of the oak forests of the world. This addition requires that another set of standards be developed in order to describe and define an "oak forest". For instance what is the species composition? What is the density? As many of our North American oaks are actually scrub species, it even becomes necessary to define a forest! Here in southern California many of the oaks grow in the chaparral and are not accurately mapped. How then to map these oaks? This is a subject that I will leave until later.

The overall goal of the program is to satisfy a curiosity, educating others and ourselves and, over the long-term, to promote monitoring of the oak forest resources of the world. Techniques in the use of Geographic Information Systems, Global Positioning Systems and remote sensing technologies are constantly changing and improving. As we enter the 21st century, technology is providing the opportunity to promote stewardship of natural resources. I strongly recommend that oak enthusiasts, and admirers of natural systems, move to embrace these technologies as tools for educating people, and that we use the information to service our needs. I do hope that pursuit of this project will lead to increased recognition of the importance of resource protection, inventory and monitoring.

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References and Project citations

Alexandria Digital Library Web Interface. The Alexandria Digital Library includes substantial information, including hundreds of GIS coverages, on California forests and natural systems. Alexandria seeks to build a worldwide digital atlas. **Contact:** Jason Simpson: simpson@alexandria.ucsb.edu
<http://alexandria.sdc.ucsb.edu/>

Brown & Lowe (1980). (Paper map of) Biotic Communities of the Southwest. University of Utah Press 1994.

Flora of North America. Generalized range maps for 30 oak species are accessible at this site. All oak range maps are published in: *Flora of North America*. Editorial Committee, eds. 1993. *Flora of North America North of Mexico* (Volume 3). Oxford University Press. New York and Oxford. **Contact:** "Mark A. Spasser" <mspasser@cbi.mobot.org>
Organization: Center for Botanical Informatics,
Subject: Re: FNA maps (Oaks, volume 3)
<http://www.fna.org/Libraries/plib/WWW/temp/online.html>

Forest Conservation IUCN Programme. BIODIVERSITY CONSERVATION INFORMATION SYSTEM is a joint initiative of 11 partner organizations. IUCN maintains information and biodiversity, landscape and forest and seeks to identify key data sources using globally accepted standards. **Contact:** Don Gilmour, IUCN Switzerland. Tel: +41.22.999.0263; Fax: +41.22.999.0025; E-mail: dag@hq.iucn.org

World Conservation Monitoring Centre (WCMC) and the Center for International Forestry Research (CIFOR). The World Conservation Monitoring Centre (WCMC) and the Center for International Forestry Research (CIFOR) maintains world forest maps, including data on forest location, by type, and protection status. A new (10/97) CD-ROM product contains GIS spatial data files on forests, protected areas and ecological zones, contributed from a variety of sources with extensive documentation. **Contact:** info@wcmn.org.uk or <http://www.wcmc.org.uk/forest>

Digital Atlas Metadata Form

(Natural Home Range of Oak Species or Extent of the Oak Forests the World)

Please list the following in your metadata submission:

1. Oak species.
2. Coverage name.
3. Brief description (including type of coverage and attribute data – species, density, size, forest type, etc.). Particularly note whether the coverage describes the home range of a species, or extent of oak forest(s). Please note mapping criteria & variables.
4. Organization/Individual from whom the coverage can be obtained.
5. Date of coverage.
6. Geographic extent of coverage: (Lat./Long.).
7. Scale /Coverage projection/units.
8. Path of coverage on local system or internet availability via FTP or Website address.
9. Software with which the coverage was developed.
10. Notes/comments

Please e-mail to: Tom Gaman, forester@compuserve.com. Tel/fax: 415 669 7426.