Title
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Modernizing Environmental Analysis: Mapping the Next Step for NEPA

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Abstract

The National Environmental Policy Act (NEPA) was enacted in 1970 as a federal law tasked with reducing man made impacts on the environment through more informed federal decision making. This law helped ensure that environmental factors are considered by federal agencies and provides a process for implementing these environmental goals (1). NEPA documents are a critical tool used by federal agencies to aid in the decision making process when presented with a major proposed action that is likely to have an environmental impact. These documents provide an extensive amount of information that includes everything from the socioeconomic factors to the physical and biological environment where a proposed action will take place. The current infrastructure for handling these documents is extremely dated, and a recent effort to modernize their accessibility leaves much to be desired. A mandatory public comment period is required for all Environmental Impact Statements (EISs), however the lack of easy access to these documents can inhibit the potential of this process.

This project investigates the potential development of a geospatial NEPA database for the marine environment in an effort to create a more user-friendly and publicly accessible platform. Suggested changes to the existing NEPA document requirements are described. These recommendations are designed to aid in enabling the use of a geographic information system (GIS). In order to demonstrate the potential benefits of a geospatial NEPA database, this project identified and mapped over 30 NEPA documents with project areas within the United States West Coast and Alaska Exclusive Economic Zones (EEZs) using ESRI ArcGIS 10 software.
NEPA Overview

The National Environmental Policy Act (NEPA) was enacted in 1970 to improve agencies' understanding of how their actions affect the environment. The National Oceanic and Atmospheric Administration (NOAA) has described the purpose of the Act as follows (2):

- To declare a national policy that will encourage a harmonious relationship between humans and their environment,
- To promote efforts that will prevent, mitigate, or eliminate damage to the environment,
- To promote efforts that will stimulate the health and welfare of humans,
- To enrich the understanding of the ecological systems and natural resources important to the nation, and
- To establish a Council on Environmental Quality.

To achieve the Act's objectives, agencies are tasked with analyzing environmental impacts of major proposed actions, and the Act and implementing regulations creates a process for such analysis through the development of environmental assessments (EAs) and environmental impact statements (EISs; combined these are referred to as NEPA documents). EAs and EISs are environmental analysis documents created by federal agencies to determine the impact of a proposed action on the environment.
Each NEPA document is prepared by an agency and must contain multiple alternative actions to accompany the "preferred alternative" being submitted by the applicant. One alternative evaluates the impact of "no action," while other alternatives may describe varying degrees of mitigation. The guidelines establish three categories as starting points for analysis. First, categorical exclusions (CEs) are used when a federal agency is confident that a proposed action will have no significant environmental impact. Environmental assessments (EAs) are created to determine if significant impacts will occur (10). Two outcomes can be reached: finding of no significant impact or FONSI (where environmental impacts are deemed insignificant or can be mitigated) or the proposed federal undertaking will have significant environmental impacts. The latter of the two findings leads to the preparation of an EIS. A flow chart demonstrating the NEPA process can be seen in Figure 1 (3).

When preparing an EIS, there is a specific list of requirements that must be included and evaluated within the document:

- Purpose and need for proposed action,
- Description of purposed alternatives, including a No Action Alternative,
- Description of affected environment,
- Description of environmental consequences of the alternatives, and
- List of preparers. (2)
Public comment periods occur at two points during the EIS process: when agencies initially announce the decision to prepare an EIS while the scope of the proposed action is being determined, and after the submission of Draft EISs.
Introduction to Project

The wealth of information that is stored within the more than four decades of NEPA documents has yet to be used to its true potential. "Since 1970 more than 25,000 federal environmental impact statements have been prepared with approximately 500 draft and final EISs completed annually" (4). It is estimated that approximately 50,000 pages of information are created each year for EIS documents. Additionally, there are 30,000-50,000 Environmental Assessments (EA) produced annually (3). This large volume of environmental analysis has great potential to allow decision making for environmental policy more thorough.

The cost of creating NEPA documents is also something that bears consideration when exploring how NEPA documents are managed. "The average cost of an EIS at the Department of Energy was $6 million, whereas EAs cost around $100,000" (3). Although the cost per document will vary dependent upon many factors including the proposed location and lead agency, it is apparent that significant federal capital are used to create NEPA documents. According to the Department of Energy:

In 1995, for example, a single federal agency, the federal Department of Energy (DOE), spent $20-30 million on "routine" assessments, plus $90 million on more elaborate assessments for special projects— a total of around $120 million for that one agency alone. The amount of information produced is substantial. (3)

With the considerably high costs associated with doing environmental analysis required by NEPA, one would expect that there must be considerable benefit to be had, as well. Unfortunately, so far, few of the benefits have been realized.
Currently, no central registry or database exists to enable the easy acquisition and use of these public assessments. Upon completion, many of the documents are archived and often lost inadvertently, preventing researchers and preparers of future NEPA documents the opportunity to benefit from the base of knowledge developed with past analysis. According to Bradley Karkkainen, the author of “Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance”:

In most agencies, even the NEPA compliance officers at agency headquarters do not track or compile EAs and FONSI s, devolving such duties to the regional or sub-regional offices where record keeping may be lax or inconsistent across regions. Thus, in many cases it is difficult, if not impossible, for interested persons even to learn that an EA has been produced, much less to gain access to its contents. (6)

The process by which EISs can be acquired, involves identifying a specific past EIS title and document number that is desired. Once a document is determined, one must, “identify each potential government agency, federal, state, and local, that might be involved in such projects, and then make a document request from each individual agency” (3). After contact with a number of agencies, it was found that most documents prior to 2004 and many documents since that time are only available in hard copy. This lack of access to past environmental analysis creates a significant gap in environmental information for future proposed actions.

Access to relevant past documents and data is critical for the advancement of environmental understanding. It also plays a key role in contributing to environmental policy and decision-making.
...disappointment has arisen over regulatory failures—often traceable to information gaps—that remain pervasive despite numerous regulatory reform initiatives. Uncertainty seems to be the hallmark of the environmental domain. Disagreements over how best to cope with information deficits have translated into bitterly partisan and divisive environmental politics and limited progress in recent years in pollution control and natural resource stewardship. (5)

The information gaps that have been pervasive within NEPA cannot be remedied by any one change. However, steps can be taken to improve the existing system.

The most reasonable first step to improve the existing NEPA process is to make EIS and EA documents easily available online. An ideal world would have all agencies submit reviewable and finalized documents into a single searchable database. This project creates a working example of a new system to begin the process of modernizing NEPA.

A geospatially-referenced database containing EISs and EAs using ESRI ArcGIS 10 software was created. The location of each NEPA document collected within the study area was mapped. The study area for this project includes the U.S. West Coast and Alaska exclusive economic zone (EEZ). Relevant information was extracted from each document and added to the associated data layer, and a link to the complete federal document was also created.

In addition to summarizing the methods and results, this paper examines the difficulties involved in creating the database and the overall benefits of using a GIS database.
Methods

The purpose of developing the geospatial database for NEPA documents is to demonstrate the potential benefits of using a GIS-based platform to aid in improving the accessibility and capability of the NEPA process. The processes involved in acquiring documents and creating the database for this project will be discussed in detail within this section.

Materials

The initial planning stages for this project required an outline of what an ideal project would contain. This included the number of NEPA documents that would be needed in order to effectively show the potential of using a geospatial database. For an initial goal, a range of 20 to 30 documents spread across the West Coast and Alaska study area would be incorporated into a database. The ratio of environmental assessments to impact statements was left open, dependent upon availability of marine based documents. Only complete documents were incorporated into the database.

The second piece to this project was determining which mapping software would be best suited for creating an effective and user-friendly map. ESRI ArcGIS 10 was chosen and access to the full suite of ESRI software was acquired through Scripps Institution of Oceanography (SIO) Marine Physical Lab. A one-terabyte external
hard drive was provided by SIO Center for Marine Biodiversity and Conservation and used for storage of the projects geodatabase and document files. These files were organized in a way that enabled easy linking to the geodatabase. In order to simplify the demonstration of the map, documents were saved as PDF files along with the geodatabase.

Document Search

The NEPA document search proved to be one of the most challenging aspects of the project. Prior to beginning the search, an outline of agencies to contact regarding past projects within the designated area was created. This included NOAA, the Environmental Protection Agency (EPA), the Bureau of Ocean Energy Management (BOEM) (formerly the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)), the Department of Defense (Navy and Air Force), and a number of private environmental consulting firms that work with multiple agencies and private interests. This collection of agencies and organizations are all major contributors to NEPA documentation and evaluation.

The EPAs online NEPA database was used to create an excel spreadsheet with the information from all EISs that occurred in the study area. EISs were selected based on the title of the document along with consideration of the lead agency involved in the project. Numerous Internet searches were performed, however it became clear
that most of the documents could not be found, or abbreviated summary documents were found instead.

The need for complete NEPA documents was critical for the effectiveness of this project. Finding these documents required contacting NEPA coordinators from many federal agencies via email. Each respondent was given a detailed description about the projects purpose and scale. It was decided that electronic copies of documents would be used.

The next step involved narrowing the search to a few known EIS documents. The targeted documents were created by the U. S. Department of the Navy for their regional training complexes. The Southern California Range Complex EIS had a known location that took place within the study area. The document information was found using the EPAs EIS database and the contact listed on the website was called. The first break in finding full NEPA documents online came when the Navy's contact was reached. The individual provided a link to a NOAA, Office of Protected Resources, website which contained EISs and EAs that have requested incidental take authorizations for marine mammals (9). The site contained over 60 documents from 2006 to 2012, and more then 20 of the documents occurred within the study area. After reviewing the documents that had been provided by agency contacts as well as relevant files found on the NOAA incidental take website, 32 complete EIS and EA documents had been found. The documents ranged in age from proposals in 2002 to current. A majority of the documents, however, occurred since 2009. This
collection surpassed the target document count of 30 and the map design could begin.

Document List:

Environmental Assessments

EA 1) Conducting Open Water Seismic & Marine Surveys in the Chukchi & Beaufort Seas
    July 2010
    Lead Agency: NOAA-NMFS

EA 2) Conducting Open Water Shallow Hazards Surveys by Stat Oil USA E&P Inc. in the Chukchi Sea, Alaska
    July 2011
    Lead Agency: NOAA-NMFS

EA 3) Replacement and Repair of Northern Fur Seal Observation Towers and Walkways on St. Paul Island, Alaska
    January 2010
    Lead Agency: NOAA-NMFS

EA 4) Alaska Apache Corporation 3D Seismic Program in Cook Inlet, Alaska
    October 2011
    Lead Agency: NOAA-NMFS

EA 5) Conducting Open Water Seismic Surveys & Shallow Hazard & Site Clearance Surveys in the Chukchi & Beaufort Seas, Alaska
    July 2008
    Lead Agency: NOAA-NMFS

EA 6) Marine Geophysical Survey by the R/V Marcus G. Langseth in the Arctic Ocean
    September 2011
    Lead Agency: NOAA-NMFS

EA 7) Exploratorium Relocation Project in San Francisco, California
    October 2010
    Lead Agency: NOAA-NMFS

EA 8) Conducting a Polar Bear Capture-Recapture Program in the U.S. Chukchi Sea,
    March 2011
    Lead Agency: NOAA-NMFS

EA 9) Black Abalone Research Surveys on San Nicolas Island, California
    2004
    Lead Agency: NOAA-NMFS

EA 10) Coastal Fireworks Display within the Monterey Bay National Marine Sanctuary, California
    2006
    Lead Agency: NOAA-NMFS

EA 11) U.S. Navy Missile Launch Activities at San Nicolas Island, California
    2009
    Lead Agency: NOAA-NMFS
EA 12) Marine Geophysical Survey by the R/V Marcus G. Langseth in the Western Gulf of Alaska
       July 2011
       Lead Agency: NOAA-NMFS

EA 13) Pile Driving During the Pier 36/Brannan Street Wharf Project
       2012
       Lead Agency: NOAA-NMFS

EA 14) Planned Low-Energy Marine Seismic Survey
       2009
       Lead Agency: NOAA-NMFS

EA 15) Conducting Exploratory Drilling Programs in the U.S. Beaufort & Chukchi Sea
       2012
       Lead Agency: NOAA-NMFS

EA 16) Conducting an Open-Water Marine Survey Program in the Chukchi Sea,
       Alaska
       2009
       Lead Agency: NOAA-NMFS

EA 17) Russian River Estuary Management Activities
       2010
       Lead Agency: NOAA-NMFS

EA 18) Lighthouse Restoration and Maintenance Activities on St. George Reef Lighthouse Station in
       Del Norte
       2010
       Lead Agency: NOAA-NMFS

EA 19) Trinidad Pier Reconstruction Project
       2009
       Lead Agency: NOAA-NMFS

EA 20) Marine Geophysical Survey by R/V Marcus G. Langseth in the Central-Western Bering Sea
       August 2011
       Lead Agency: NOAA-NMFS

EA 21) Marine Geophysical Survey by the R/V Marcus G. Langseth in the Central Gulf of Alaska
       June 2011
       Lead Agency: NOAA-NMFS

EA 22) Marine Geophysical Survey of Parts of the Arctic Ocean
       August 2010
       Lead Agency: NOAA-NMFS

EA 23) Space Vehicle and Test Flight Activities from Vandenberg Air Force Base, CA
       2009
       Lead Agency: NOAA-NMFS

EA 24) Marine Geophysical Surveys by the R/V Marcus G. Langseth in the
       Northeastern Pacific Ocean
       2012
       Lead Agency: NOAA-NMFS
Environmental Impact Statements

EIS BSAICrab Fisheries
  Bering Sea Aleutian Islands Crab Fisheries
  August 2004
  Prepared by: NOAA-NMFS & North Pacific Fishery Management Council

EIS NWTrainingRangeComplex
  Northwest Training Range Complex
  September 2010
  Prepared by: Department of the Navy

EIS SOCALRangeComplex
  Southern California Range Complex
  December 2008
  Prepared by: Department of the Navy

EIS PtMuguSeaRange
  Point Mugu Sea Range
  March 2002
  Prepared by: Department of the Navy

EIS BallastWater
  Ballast Water Discharge Standards
  2012
  Prepared by: U.S. Coast Guard

EIS PacGroundfishFishery
  Allocation of Harvest Opportunity Between Sectors of the Pacific Coast Groundfish Fishery
  June 2010
  Prepared by: NOAA-NMFS & The Pacific Fishery Management Council

EIS EffectsofOilGasinArctic
  Effects of Oil and Gas Activities in the Arctic Ocean
  December 2011
  Prepared by: NOAA-NMFS

EIS GulfofAlaskaNavyTrainingActivities
  Gulf of Alaska Navy Training Activities
  December 2009
  Prepared by: Department of the Navy
Database Design

Through the use of ESRI ArcGIS 10 software, a geodatabase was created in order to organize all data. The first step of visualizing the data was identifying the database base map files. The desired features to be incorporated into the map were considered, and a higher resolution base layer was chosen from an ESRI base map file. The value of using the extra bathymetry resolution is that it could potentially aid in future analysis of important features such as seamounts and submarine canyons.

National jurisdictional boundaries were another important feature to include. Maritime boundaries provide some scale as well as outline the U.S. exclusive economic zone (EEZ). The territorial sea, contiguous zone and EEZ are all available within the geodatabase table of contents. The 3-mile state water boundary was added to aid in determining the potential for state agency involvement in coastal actions. The basemap, as well as the jurisdictional maritime boundaries, can be seen below in Figure 2. The maritime boundaries layer was downloaded from NOAA's Office of Coast Survey website.
Figure 2. Project study area and basemap layer. Outermost boundary line represents the United States EEZ.

Additional layers were added in order to demonstrate the type of analyses that could be done by using a geospatial NEPA database. The two data files that were added include a complete listing of U.S. marine protected areas for 2012, and a marine mammal ranges layer. A marine protected area shapefile was downloaded from NOAA National Marine Protected Area Center website. A shapefile for marine mammal ranges was downloaded from the International Union for the Conservation of Nature (IUCN) Red List webpage; within the spatial data download section. These shapefiles provided a valuable example of the ease at which data can be added and used for analysis.
For each NEPA document collected, a shapefile with polygons representing the location of the proposed action were created. This task required analyzing all document maps as well as reading any written descriptions of the proposed actions project area. Polygons were created based on a visual approximation of the information provided because there were some documents that did not contain lat/long coordinates. A direct link to a complete copy of all NEPA documents was added by using the hyperlink tool. This allows the user to compare the provided document information to the polygons that were created.

Figure 3. Screenshot of geodatabase with maritime boundaries and all NEPA document layers activated.
The final step to creating the database involved adding attribute fields to each polygon file attribute table. This was accomplished by extracting the desired information from each NEPA document. The fields that were added to the environmental assessment polygons were: document type, document title, year, lead agency, applicant and affected wildlife. For EISs, lead agency and applicant fields were replaced with a "Prepared by" field. Affected wildlife was determined based on description of affected environment and presence of potential impact with mitigation measures factored in. If there were a potential impact on species within select groups (mammals, sea turtles, birds and fish), they would be listed within the shapefile attribute table. These additions allow for easier identification of NEPA shapefiles for potential users. For demonstration of the geodatabase created for this pilot project please visit http://youtu.be/cssE4gnZKPE.
Discussion

The Geodatabase

This pilot project was created to demonstrate a new and effective way to create a centralized database for housing and analyzing NEPA documents. By creating a GIS database, NEPA documents can be not only organized spatially, but also allow for considerable analysis in the future. This format shows great potential to benefit both federal agencies as well as the public.

In order to improve NEPA going forward, document availability is paramount. The process of acquiring these documents is currently slow and tedious. For documents that are more than a decade old, the current NEPA system lacks the organization needed for easy acquisition. Older documents are stored in archives at a number of agency offices, but many have not been cataloged thoroughly. At this point, it would take considerable effort to organize these documents and remedy the problem. This leads me to suggest that only documents that are currently in electronic format should be used within the geodatabase. Fortunately, many federal agencies have been maintaining electronic copies of NEPA documents for a number of years. Ensuring that complete NEPA documents continue to be linked in this database is important for both agency and public use going forward.
Having current and past NEPA documents available for agency use has numerous benefits. When these benefits are combined with the capabilities of GIS, the efficiency of these benefits can be increased. An example of this would be if an agency were evaluating a proposed federal action within the Chukchi Sea. By using this geodatabase an agency can quickly search the location of the new proposed action and view historic documents in their entirety. This can streamline the production of a new NEPA analysis, because information from similar past projects within the proposed area can be extracted and used in the current document. Mitigation measures from past federal actions can also be considered for new proposed actions.

For the public, the use of a geodatabase provides an opportunity for increased input during the NEPA process. Draft EISs could be submitted for public comment within the geodatabase. Individuals would have the ability to search for (and contribute to) documents occurring within their area of interest. Adding NEPA data to an established GIS website such as the U.S. Marine Cadastre, which is maintained by BOEM and NOAA, or to the Google Earth platform would be an ideal starting point for this undertaking. By using these platforms a great deal of analysis can immediately be done by users through manipulation of the data already available. Also, these sites could provide enough storage space to continue to grow year to year.
Streamlining NEPA Documents

NEPA requirements could be updated to accommodate the continued development of a geospatial database. First, during this project, difficulty was frequently encountered because of poor maps and vague location descriptions included within documents. Many documents do not have clear coordinate lines or references for scale within provided map figures. The study area descriptions written within the document also often left much to be desired. Because of the lack of specific geospatial information, the geospatial database polygons are based on best estimations using map images in the NEPA documents and project descriptions. In the future, document preparers should be required to provide digital files of the project area map and/or include GPS coordinates.

While extracting information from each document, I often found it difficult to find any conclusive statements regarding environmental consequences and affected wildlife. There was what seemed to be purposeful vagueness when an impact would be described, then revoked, through the use of mitigation measures. In order to ascertain affected wildlife for the shapefile attribute table, the documents were analyzed to determine whether any species within the defined groups had the potential to be negatively impacted by the proposed project. Final decisions were based on precautionary principle. In order to maximize the benefit of using a GIS database, creating a document template with desired information for document preparers to extract would help to streamline the creation of data files.
This template would require input of information to be provided upon submission of draft and final documents. This information would include:

1. Proposed Action
2. Defined Study Area
3. Timeline of Proposed Action
4. A List of All Affected Wildlife (Before mitigation measures and after mitigation measures.)
5. A Brief List of Mitigation Measures

The questions required can be adapted based on needs, but the hope is that this information would be provided in the geodatabase. The purpose of listing mitigation measures is to initiate categorization of frequently used measures that could eventually lead to analysis of their effectiveness. This has the potential to guide future monitoring and policy decisions.

Furthermore, this GIS database will allow for a closer look at the impacts of a project versus their cumulative and broader impacts. Cumulative impacts will be easier to visualize and will lead to easier monitoring of the annual impacts on species and ecosystems. For example, the annual harassments of a given species can be analyzed to determine the overall impact on the population.

Lastly, the relationship between environmental policy and economics is strongly interconnected. These two fields play significant roles in the decisions that are
made for the environment. As the use of GIS continues to grow, it will enable deeper analysis across disciplines. Not only will it allow for easier communication of complex environmental issues, but will lead to better-informed decision-making.

Conclusion

In the past, the NEPA process has failed to evolve with the times, and because of this, it is grossly under utilized. By using a GIS database, many of the historic flaws can be resolved. The geographic cataloguing of NEPA documents provides a communication tool where users can visualize and analyze the greater impacts of proposed federal actions.

The potential of this project is virtually limitless because of the ability to incorporate data layers from any field. Data layers can also be added as new information becomes available. Analysis and comparisons can be done across disciplines that will make for improved policy in the future. Through visualization and easier access to NEPA information, greater accountability for environmental impacts can be achieved.
References


(2) NOAA NEPA overview


