MAPPING ENVIRONMENTAL CRIME

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Abstract

Information technology applied to generate computer maps of "up-to-the-hour" crime data in metropolitan areas today gives police departments of the world a distinct advantage in criminal investigations. Significant and serviceable patterns exposed by these maps show the location, character and distribution of crime. Such computer-generated maps also aid in the conceptualization of the scope of environmental crime, a phenomenon of the late 20th century. Existing national and international environmental legislation, regulations and standards form the framework for prosecuting those involved in environmental crime. The challenge is to identify environmental crime perpetrated in the natural realms of land, air, water and biota. In the U.S., laws such as the National Environmental Protection Act (NEPA) and the Endangered Species Act help define this effort while on the international scene, treaties between nations serve the same purpose. The U.S. Occupational Safety and Health Act (OSHA) outlines much of the environmental crime involving the technology of the built environment, mostly relying on data from industry. International organizations seek to set standards to prevent technological "crimes against humanity" such as oceanic oil spills or accidents with nuclear technology. Mapping of environmental data often reveals point sources of pollution. Clues pointing to pollution endangering public health include the mapping of cancer clusters, autism clusters and other diseases. Clues indicating the potential for environmental crime arise from mapping of spatial distributions. Causal chains also provide clues for the collection of environmental data to be mapped. Some of the most puzzling large scale environmental situations are characterized by scientific controversy and uncertainty. The challenge is to apply a wide assortment of cartographic methods to map these issues in order to provide clues about these vexing environmental problems.

For the recently published atlas on crime, this research sought both a suitable conceptual outline for review of environmental crime and appropriate graphic images to depict the status of efforts to combat such offenses. Selection of a wide assortment of cartographic products was necessary to represent the broad variety of subjects covered under environmental crime. Among these are a time lapse polar projection which portrays the

globsal spread of Chernobyl's radiation in the atmosphere. Aerial photographs trace the pollution of land at Love Canal over time. Transposing the extent of the Exxon Valdez oil spill in Price William Sound Alaska to a map of a comparable size north-south stretch of the East coast of the United States illustrates the scale of that environmental degradation. A map of graduated symbols represents oil spills of the world ocean revealing both the regional and worldwide threat to the sea. Both satellite imagery or a simple data graph can aid those attempting to visualize the loss of ozone high over Earth's poles. Generally, aerial photography and satellite images complement time series computer maps to delineate trends in abuse of the environment. Future development of geographic information systems (GIS) encompassing the global environment could add even more meaningful tools for
addressing environmental crime.

Introduction

The concept of environmental crime only came into being in the second half of the 20th century. As societies gained everyday and scientific understanding about abuse of their environments, their governments made laws to protect their lands, air, water and biota. The particular statutes in each country provide a legal framework that defines the potential for environmental crime within that nation. Without such environmental laws, environmental crime could not be identified. In the United States, two basic types of crime are recognized.

Mala in se crimes are considered to be naturally evil, immoral or intrinsically wrong , such as murder, rape, burglary, arson and larceny while *mala prohibita* crimes are not naturally evil, but are forbidden because they infringe on the rights of others. Today, some
environmentalists claim that all environmental crimes are not only *mala prohibita*, but because of their negative cumulative effects on natural and built environments, they are *mala in se*, both immoral and intrinsically evil in themselves. As such, these are considered to be "crimes against humanity". In 1970, after the mass public protests of the first Earth Day in the U.S., the National Environmental Protection Act (NEPA) was passed and serves as the umbrella legislation under which the lead federal U.S. agency in targeting offenders, the Environmental Protection Agency (EPA), was organized (Golden et. al. 1979). Later U.S. legislation was not only enforced, but led to pollution research, standard setting and monitoring, activities which require creation of a wide variety of cartographic aids, especially computer generated products.

Defining the Environment

To distinguish what types of information must be assembled in order to establish the existence of environmental crime, a clear definition of the essential elements of the environment is necessary. This delineates the major categories of maps to be generated and their content. Key elements of the environment are suggested here.

1. Land
   A. Land with Water (Wetlands)
   B. Filled Land
2. Air
   A. Indoors
   B. Outdoors
3. Water
   A. Rivers and Lakes (fresh)
   B. Oceanic (salt)
4. Biota
   A. Plant Species
   B. Animal Species
5. Human Environment (Built Environment)
   A. Structures
   B. Technology
6. Global Systems

Depicting the Environmental Degradation of Land, Air, Water and Biota

For healthful maintenance of each of these elements, environmental standards must be established and cartographic constructions become crucial in order to report the results of monitoring of the environment according to these standards.. Clues for determining liability in many environmental cases arise from identification of point sources of pollution. Outflow from a pipe or smokestack at an exact location is the principal type of point source found contaminating land, air or water. In contrast, at any scale, it is extremely difficult to prove culpability for non-point sources of pollution since pollutants are found spread over such a wide area with no identifiable single source. The locations of hazardous substances that have become ubiquitous and diffused in small amounts in everyday life, such as asbestos, DDT, dioxin, lead and mercury, basically cannot be mapped. On the other hand, conspicuous and significant land pollution situations in the United States have been identified and their locations mapped for designation as National Priority List (NPL) sites for possible long-term remedial cleanup efforts. (EPA maps at <http://www.epa.gov/superfund/sites/reports.htm>). Aerial photos and satellite images play a vital role in identifying degraded or ruined lands. Aerial photos of Love Canal which revealed patches of land where underground chemical wastes were seeping to the surface allowing no vegetation to grow provided conclusive evidence in the first case in which the United States government forced evacuation of areas of a city to protect the health of residents from chemical contamination of the land (Aerial maps at <http://www.ublib.buffalo.edu/libraries/projects/lovecanal/>). Time lapse maps serve admirably for capturing the dispersal of atmospheric plumes of pollution. An example is the series of polar projections which portrayed the radioactive cloud emanating from Chernobyl and its path across northern Europe. Lawrence Livermore Laboratory

produced the polar map of April 27, 1986 showing the radioactive plume contained within the Chernobyl area, by May 6 a westward flow of diffusion is obvious, demonstrating the expansiveness of the cloud over time and the key role of wind systems in environmental hazards (See map at <http://www.brama.com/ukraine/cbyl.html>). In terms of water pollution, focusing on one U.S. river, the Mississippi, exposes the effects of its polluted waters on the Gulf of Mexico. A biologically dead zone, about the size of the state of New Jersey, presumably caused by the pollutants being poured into the Gulf by the Mississippi River now exists there. Maps of the dead zone show how it changes shape and moves from time to time along the Gulf coast. The spatial aspects of the Prince William Sound Alaskan Oil spill are brought into focus by transposing it to the East Coast of the United States. More than 1,000 miles of shoreline in the Kenai Peninsula-Kodak region of Alaska were contaminated by oil from the *Exxon Valdez* tanker accident in 1989. On the East Coast, beaches would have been soiled with oil from Maine to Georgia. For those who think the world ocean is too spacious to ever be seriously polluted, a 1960-1996 world map of ocean oil spills each more than 10 million gallons reveals the astounding coverage of ocean surface with spilled oil and the frequency in that 36 year period alone (*Oil Spill Intelligence Report*, Cutter Information Corporation <http://www.cutter.com/osir/biglist.htm>). This map plus statistical graphs revealing trends in oil spills substantiates the claims of environmentalists that ocean pollution is a "crime against humanity" in the making. In the biological realm, graphs of the statistics concerning declining plant and animal populations are valuable when paired with maps revealing the reduced locations and ranges of given species, in many cases establishing new endangered species.

Future Research

This investigation of how to map environmental crime was undertaken in the preparation of an atlas on crime. From the many possible cartographic depictions of environmental crime,

more easily produced today through information technology, it would be appropriate to assemble for any given country a national atlas on environmental crime. N.F. Leont'yev (1974) outlined the advantages of gathering and mapping data for an atlas focused on one nation suggesting that an atlas can serve as a scientific source for the resolution of problems. A national atlas on environmental crime could readily offer a new perspective on the impacts of such crime, especially on economic development and public health. Citing documented evidence of the many diverse uses of the maps produced in the Canadian National Atlas Project, Richard Groot reported that the maps served to answer questions from the public. Likewise, maps produced for an environmental crime atlas would help satisfy people who want to know what the environmental situation is. Maps produced for such an atlas would also make more available the source information needed for environmental education texts and issues of criminal justice would become more focued. Groot (1979) emphasizes that a national atlas can serve, "To be a readily-

accessible, timely source of information that would otherwise be available only from many unerelated, often unknown sources, usually in incompatible map formats or listings according to uncoordinated geographical classifications." This latter is a very apt description of the way information on environmental crime exists today. Organizing it into an atlas would bring full circle the intentions of those who promulgated environmental laws and regulations in the first place, to reduce further degradation of the environment. Eventually, selections from national atlases on environmental crime could be culled to produce an international atlas depicting the stresses on global ecosystems and the extent of human efforts by international treaties and regulations to reduce them.

Conclusions

The vital importance of the global environment and the many ecosystems of which it is comprised is substantiated by taking a spatial view of environmental crime through mapping, graphing, remote sensing for imaging and other cartographic approaches. Policy-making in the future could be enhanced by the increased awareness of the issues surrounding infractions of environmental laws and regulations. Mapping of environmental crime reveals patterns that benefit many researchers including those who study the magnitude of environmental damage, epidemiologists who investigate the location and diffusion of disease, and government agencies charged with clean-up missions, among others. Perhaps the most potent effect from the efforts of cartographers who present spatial distributions of environmental crime is the indicators they provide for locating and identifying the potential for future escalation of environmental crime in time for preventive actions to be mobilized.

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