TERRESTRIAL VERTEBRATE CONTAMINANT EXPOSURE AND EFFECTS DATA FOR MID-ATLANTIC NATIONAL PARK SERVICE LANDS

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ABSTRACT

The Contaminants Exposure and Effects-Terrestrial Vertebrates (CEE-TV) database was developed to provide access to ecotoxicological information, examine exposure trends, and identify data gaps. It contains 17,450 data records on amphibians, reptiles, birds, and mammals residing in the Atlantic, Gulf, and Pacific coasts, Alaska, Hawaii, and the Great Lakes. Information in the database was derived from over 1800 source documents, representing 483 species (~ 252,000 individuals), with dates spanning from 1884 to 2004. Contaminant exposure data is available for 209 chlorinated and brominated compounds, cholinesterase-inhibiting pesticides, metals, and petroleum hydrocarbons, while only 9.3% of the records contain biomarker or bioindicator effect data in terrestrial vertebrates. Temporal evaluation of exposure data indicates declining concentrations of certain organochlorine pesticides. However, concurrent data provides evidence of an increase in the detection and possibly the incidence of die-offs related to cholinesterase-inhibiting pesticides. When 192 database records with specific locations were combined with the boundaries of NP units in the National Capital Region and Mid-Atlantic Networks, data gaps were evident. There were no records for eight NP units and recent (1990-2004) data were available for only 11 of the 22 NP units in the study area. Characterization of real and potential pollution hazards of these areas lacking recent data revealed three NP units have significant pollution concerns. These areas of concern should receive priority for terrestrial vertebrate contaminant monitoring.

INTRODUCTION

The Biomonitoring of Environmental Status and Trends (BEST) Program of the U.S. Geological Survey (USGS) (1) assesses the exposure and effects of environmental contaminants on select species and habitats throughout the United States, (2) conducts research and synthesis activities that provide biomonitoring methods for field application, and (3) supports the development of methods and tools to assist the U.S. Department of the Interior (DOI) in assessing chemical threats to species and lands under its stewardship. Even with the achievements of this and other programs, pollutants continue to pose hazards to terrestrial vertebrates at many geographic scales. To address this hazard, the BEST Program seeks to identify critical data gaps through the retrospective compilation and analysis of ecotoxicological data, followed by active monitoring of terrestrial vertebrates at high priority sites and regions.

In 1996, efforts were initiated to develop and compile the CEE-TV database. It has been used to conduct exposure and effect data searches for a given species or location, identify temporal contaminant exposure trends, analyze NWR and NP unit data gaps, and rank terrestrial vertebrate ecotoxicological information needs based on data density and water quality problems.

Ecotoxicological data for terrestrial vertebrates were examined and contaminant threats to NP units in the National Capital Region and Mid-Atlantic Networks were identified. Our intent was to provide natural resource managers information on real or potential pollution hazards and identify and prioritize contaminant biomonitoring in 22 Inventorying and Monitoring (I&M) Program units in these regions.

METHODS

- Boundaries of 22 I&M NP units and 10 km buffers were mapped in ArcGIS
- NP buffer were overlaid with Toxic Release Inventory (TRI) sites, 303(d) Impaired Waters, Superfund National Priorities List (NPL) Sites, and Land Cover/Land Use Classes (LCLU) in ArcGIS
- Fish consumption advisories, pesticide use, solid waste and wastewater treatment facilities information were summarized
- A list of persistent and bioaccumulative pollutants was compiled
- Occurrence of persistent pollutants within each NP buffer were noted
- Compiled and plotted exposure and effects data for terrestrial vertebrates within units.
- NP units in critical need of ecotoxicological data were identified and prioritized using previously developed criteria to identify data gaps (EPA 1997, Cohen et al. 2003, Rattner et al. 2005)
- These data will be used to help focus management and remediation activities
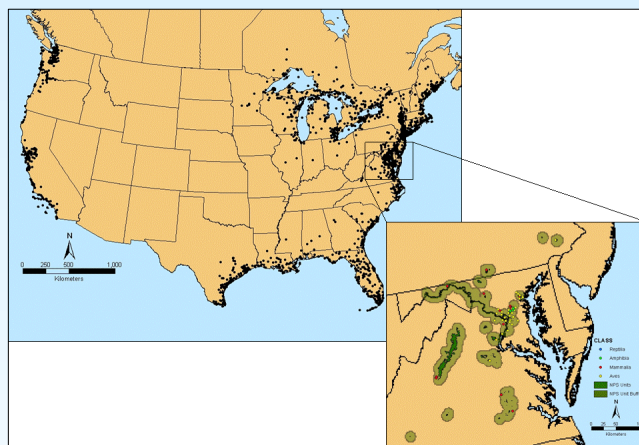
RESULTS

Figure 1. Geographical distribution of CEE-TV database records for the United States and the 22 NP units
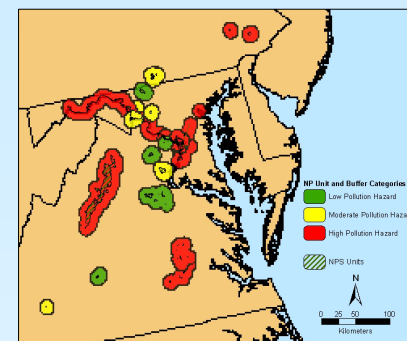

Figure 2. Pollution hazard categories for 22 NP Units and 10 km buffers in the Mid-Atlantic and National Capital Region Networks.
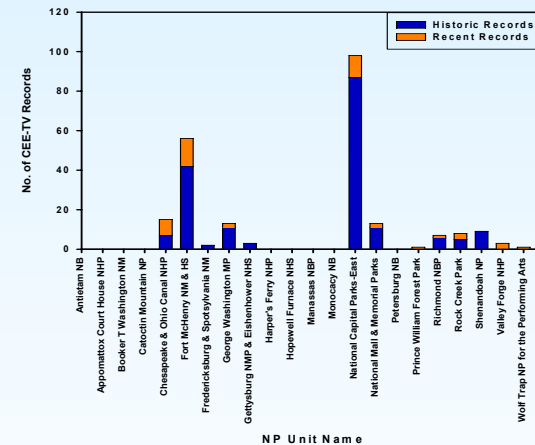

Figure 3. Number of historic (before 1990) and recent (since 1990) CEE-TV database records in Mid-Atlantic and National Capital Region Network NP Units.

Table 1. Classification[a] of real or potential pollution hazards for 22 Mid-Atlantic and National Capital Region Network Parks.

Park Name	No. and Toxicity of Pesticides Used[b]	No. of Toxic Release Inventory Sites		No. NPL Sites	No. Fish Consumption Advisories		Impaired Waters (%)
		Total Sites	Sites Releasing Priority Contaminant[c]		Restricted Consumption	No Consumption	
Antietam NB	4	1	0	0	1	0	24.8
Appomattox Court House NHP	3	1	1	0	0	0	18.1
Booker T Washington NM	1	0	0	0	2	2	18.1
Catoctin Mountain NP	1	2	0	0	3	0	3.5
Chesapeake & Ohio Canal NHP	1	39	11	2	8	5	14.7
Fort McHenry NM & HS	2	62	18	2	3	0	89.3
Fredericksburg & Spotsylvania NM	2	5	1	0	0	0	2.6
George Washington MP	0	9	3	1	3	2	19
Gettysburg NMP & Eisenhower NHS	8	2	0	0	3	0	0.8
Harper's Ferry NHP	5	3	2	0	1	1	20.4
Hopewell Furnace NHS	4	8	3	0	2	1	26.7
Manassas NBP	0	8	3	0	0	0	3.7
Monocacy NB	5	11	3	0	1	0	5.9
National Capital Parks-East	0	36	10	4	4	3	26.3
National Mall & Memorial Parks	0	9	3	1	3	2	31.2
Petersburg NB	1	28	9	0	2	0	28.4
Prince William Forest Park	1	5	2	1	2	0	9.7
Richmond NBP	2	58	15	1	2	1	14.8
Rock Creek Park	2	6	2	1	3	2	33.3
Shenandoah NP	5	11	1	2	2	3	25.3
Valley Forge NHP	1	32	4	2	2	1	44.3
Wolf Trap NP for the Performing Arts	0	2	0	0	1	0	8.7

[a] Classifications were based on previous developed criteria by EPA (1997), Cohen (2003), and Rattner (2005).

[b] Toxicity of pesticides used in NP units was categorized using existing acute exposure data.

[c] Priority contaminants were defined as Priority Persistent Bio-accumulative Toxic Chemicals listed by the EPA and Persistent Organic Pollutants listed by the United Nations.

CONCLUSIONS

- About half of the 22 NP units were located in areas with multiple pollution hazards, while 17.4% of NP units were located in areas with apparently minimal pollution hazard
- The NP units that lack recent data and are located close to multiple pollution hazards should receive priority for contaminant monitoring
- Population and ecotoxicological monitoring should focus on amphibians and reptiles because pesticide hazards posed to these taxa are unknown
- In order to best assess large-scale terrestrial vertebrate ecotoxicological trends in NPs, a monitoring program that incorporates some form of random sampling, and spatial and temporal replication is warranted
- At a minimum, a protocol for collection, submission, and analysis of samples from mortality events in terrestrial vertebrates should be developed