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7. Title EXPLOITING INFORMATION TECHNOLOGY TO UNCOVER PATTERNS IN COMPLEX SYSTEMS			
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Outputs: This project has involved the continuing development of a comprehensive database system, Mandala (http://www.inhs.illinois.edu/research/mandala/), for documenting information about specimens and taxonomic name history with its associated literature and illustrations. The Mandala database structure (requires the cross-platform database engine, FileMaker(R) Pro) is available upon request for scientific uses and is licensed through the University of Illinois. Mandala was documented in a book chapter (see 2009 Publications). The database structure has followed emerging standards through TDWG (http://www.tdwg.org), for sharing data globally with the Global Biodiversity Information Facility (GBIF http://www.gbif.org), and DiscoverLife (http://www.discoverlife.org/), and through queries to online databases (http://www.inhs.illinois.edu/research/therevidphp/ , http://www.inhs.illinois.edu/research/fijiphp/ , http://data.gbif.org/species/13143061/ , http://www.discoverlife.org/mp/20q?search=Therevidae). An integral part of sharing information so that patterns between and among species may be detected is the development of standards for sharing information. This project helped facilitate the involvement in the international standards body for biodiversity information, TDWG (http://tdwg.org/), and to encourage the development, knowledge, and use of emerging biodiversity standards particularly in the entomological community, and to promote contributions to global data initiatives. Key to more effective sharing of information about species and biodiversity in the future was the ratification in 2009 (http://www.tdwg.org/homepage-news-item/article/darwin-core-ratified-as-a-tdwg-standard/) of the Darwin Core (DwC http://rs.tdwg.org/dwc/), a pivotal standard rooted in the Dublin Core Metadata Initiative (http://www.dc.org/). In working to recognize and motivate additional data stewards to provide a more comprehensive view of biodiversity, an obvious hole in traditional biodiversity assessments has been contributions by the agricultural community. The 2009 TDWG meeting in Montpellier, France focused for the first time on the importance of developing standards for the exchange of information about agriculture. Those involved with genebanks of agricultural crops and their wild relatives emphasized the importance of standards to the stability of the food chain. But generally forgotten or ignored are the data generated by monitoring agricultural pests. Were this agricultural community encouraged to contribute their data to these global initiatives, it could be invaluable to land managers and climate change specialists http://www.tdwg.org/fileadmin/2009conference/slides/Kampmeier_PestsInBiodiversityAssessment.ppt .			
Outcomes/Impacts: The systematics and biodiversity projects that use the Mandala database system (see 2004-2005 reports and http://www.inhs.illinois.edu/research/mandala/) have helped drive many initiatives over the life of this project, including using a database for collating information during a public outreach event such as a 24-h local bioblitz (see 2006 report and http://www.inhs.illinois.edu/research/legacy/gkamp/24hrs_BWBB.pdf). As with many projects, the needs of the research have pushed and been pulled by technological advances in database design and function (see 2009 publications) and other collaborative opportunities for sharing biodiversity information (see 2007-2009 reports). Over the life of this project, strides have been made to recognize and encourage the contributions of smaller data providers to global biodiversity data sharing initiatives (DiscoverLife http://www.discoverlife.org/ and Global Biodiversity Information Facility http://data.gbif.org/). Because of a talk			

presented at a TDWG meeting in 2007, subsequent discussions resulted in a memorandum of understanding (see 2007-2008 reports) being developed between DiscoverLife.org and the Global Biodiversity Information Facility (GBIF <http://www.gbif.org/>) to not only map data across taxa but to aid small providers in sharing their data with the world <http://data.gbif.org/>. Mobilizing small providers to contribute to larger initiatives is an ongoing theme (see 2008 report), and it has played a part in spurring GBIF's attempts at simplifying the process to enable contributions by those with few IT (information technology) resources (see <http://www.gbif.org/informatics/infrastructure/publishing/#c889>). Funding has enabled participation in these national and international activities, including presentations to and involvement of the entomological community (2006-2009).

Publications:

Kampmeier, G.E. 2009. Integrating the monitoring of agricultural pests into biodiversity assessments. In A.L. Weitzman and L. Belbin (eds.), Proceedings of TDWG (2009), Montpellier, France. <http://www.tdwg.org/proceedings/article/view/459>.

Kampmeier, G.E. and Irwin, M.E. 2009. Meeting the interrelated challenges of tracking specimen, nomenclature, and literature data in Mandala. In T. Pape, D. Bickel, and R. Meier (eds.) Diptera Diversity: Status, Challenges and Tools. Leiden: Brill Academic Publishers, 407-437, http://www.inhs.illinois.edu/research/mandala/Ch15_Mandala_DiptDiv2009.pdf.

Participants:

Collaborators, contacts, partner organizations: John Wieczorek, Univ. California-Berkeley; John Pickering, Discover Life <http://www.discoverlife.org/>; Irina Brake, National Museum of Natural History, London, EDIT Scratchpad for Diptera <http://diptera.myspecies.info/>; Derek Liebert, Urbana Park District; Daphne Fautin, University of Kansas <http://www.nhm.ku.edu/inverts/daphne.html>; David Remsen, Programme Director, GBIF-ECAT (Global Biodiversity Information Facility-Electronic Catalog of Names); Biodiversity Information Standards (TDWG) <http://www.tdwg.org/>; Global Biodiversity Information Facility (GBIF) <http://data.gbif.org/>; Entomological Collections Network (ECN); National Science Foundation; and the Schlinger Foundation.

Target Audiences:

Biologists, taxonomists, conservationists, ecologists, landscape architects, urban planners, biogeographers, agriculturalists, developers of biodiversity information standards, database users and developers, and the public.

Project Modifications:

Not relevant to this project.

Approved (Signature)	Title	Date

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