

NRE 639.039 | Winter 2014

Ambient and Volunteered Geographic and Environmental Information

Dr. Dan Brown

Logistical Details

Meeting Time & Place: 10-11 am on Thursdays; 1046 Dana

Office hours & contact: Thursdays 3-5pm or by appointment; danbrown@umich.edu

Course Description

The goal of this seminar is to explore novel approaches to collecting geospatial information for environmental research and problem solving. In particular, a range of applications have taken advantage of social media, mobile devices, and citizen volunteers to crowd source environmental information. While traditional scientific and management enterprises rely on either authoritative information, collected and certified by professionals, or researcher-collected information, collected following specific measurement, sampling, and data quality protocols, these new data sources create both opportunities and challenges for users. While volunteered observations have been used for decades (e.g., in the Breeding Bird Survey), the convergence of mobile, computational, and communication tools in recent years has amplified both the opportunities and the questions.

We will explore literature that makes use of these newer streams of information, and to evaluate the challenges and best practices associated with their use. We will focus primarily on reading literature on projects that have been implemented and evaluated, discussing the specific techniques and approaches that were used, and evaluating the quality and scientific or management value of the information acquired.

The core activity of the course is a weekly meeting for discussion of the opportunities and challenges associated with both ambient and volunteered geographic-environmental information. We will read literature on the topic, investigate existing projects, and report to each other with critical evaluations of the value of these novel sources of information for the conduct of environmental research and management. We will also explore web-based and programming tools for collecting, compiling, and analyzing volunteered information.

Course Requirements and Grading

For one credit: All students are required to identify and evaluate a project/application that involves, or an issue that affects, use of volunteered, ambient, or citizen-collected environmental information for science or management. Project topics can be selected from the list provided on the next page, or you can identify your own (there are many more). You are to read and collect information, both published and on-line, about the project or issue you are investigating and assign readings for the class. At our second class meeting, we will discuss project characteristics that can be used to guide evaluations of the projects, and the issues that arise and could be addressed.

As a result of your evaluation you are to prepare a 10-15 min. presentation, present that to the group, and lead a discussion in class by providing provocative questions for the class to discuss. Your grade will reflect: (a) the quality of the graphic and information content of the presentation file (Powerpoint or similar format); (b) the clarity of the presentation; (c) the content of the ensuing discussion; and (d) your participation in discussions throughout the semester.

For two credits: In addition to the meeting the requirements for one credit, students taking the course for two credits are required to develop a project or proposal for collecting or harvesting ambient or volunteered information in pursuit of a specific environmental science or management goal. In either case (project or proposal) you need to outline the question or goal, design and describe the data collection activity, and evaluate the strengths and weaknesses of the approach in a written paper. A project involves implementing the idea (at least in pilot) and should involve some mapping of information, whereas a proposal should spend more effort in outlining the significance of the application for a particular purpose.

Resources

Citizen Science Toolkit (www.birds.cornell.edu/citscitoolkit/toolkit)

Scistarter.com

Ushahidi

Mechanical Turk (www.mturk.com/mturk/)

References

Overview

- Elwood, S. (2008a) Volunteered geographic information: future research directions motivated by critical, participatory, and feminist GIS. *GeoJournal*, 72, 173-183.
- Elwood, S. (2008b) Volunteered geographic information: key questions, concepts and methods to guide emerging research and practice. *GeoJournal*, 72, 133-135.
- Elwood, S., Goodchild, M. F., & Sui, D. Z. (2012). Researching volunteered geographic information: Spatial data, geographic research, and new social practice. *Annals Association of American Geographers*, 102(3), 571-590.
- Goldberg DW, Wilson JP, Knoblock CA. Extracting geographic Features from the internet to automatically build detailed regional gazetteers. *International Journal of Geographic Information Science* 23(1): 93-128 (2009).
- Goodchild, M. F. (2007). Citizens as sensors: the world of volunteered geography. *GeoJournal*, 69(4), 211-221.
- Stefanidis, A., Crooks, A., & Radzikowski, J. (2012). Harvesting ambient geospatial information from social media feeds. *GeoJournal*, 1-20.
- Sui, D., Elwood, S., and Goodchild, M. (Eds.) 2013. *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice*. Dordrecht: Springer.
- Tsou, M-H., & Leitner, M. 2013. Visualization of social media: Seeing a mirage or a message. *Cartography and Geographic Information Science*, 40(2): 55-60.

Example Projects

Geo-Wiki (geo-wiki.org)

- Fritz, S., McCallum, I., Schill, C., Perger, C., See, L., Schepaschenko, D., ... & Obersteiner, M. (2012). Geo-Wiki: An online platform for improving global land cover. *Environmental Modelling & Software*, 31, 110-123.
- Fritz, S., See, L., van der Velde, M., Nalepa, R. A., Perger, C., Schill, C., ... & Obersteiner, M. (2013). Downgrading Recent Estimates of Land Available for Biofuel Production. *Environmental Science & Technology*, 47(3), 1688-1694.

E-bird (ebird.org)

- Hochachka, W. M., Fink, D., Hutchinson, R. A., Sheldon, D., Wong, W. K., & Kelling, S. (2012). Data-intensive science applied to broad-scale citizen science. *Trends in Ecology & Evolution*, 27(2), 130-137.
- Hurlbert, A. H., & Liang, Z. (2012). Spatiotemporal variation in avian migration phenology: citizen science reveals effects of climate change. *PloS one*, 7(2), e31662.

IceWatch (www.naturewatch.ca/english/icewatch)

- Futter, M. N. (2003). Patterns and trends in Southern Ontario lake ice phenology. *Environmental Monitoring and Assessment*, 88(1-3), 431-444.

USA National Phenology Network (www.usanpn.org)

- Schwartz, M. D., Betancourt, J. L., & Weltzin, J. F. (2012). From Caprio's lilacs to the USA National Phenology Network. *Frontiers in Ecology and the Environment*, 10(6), 324-327.

Urban (urbanmonitoring.ca)

Cartwright, L. A., Cvetkovic, M., Graham, S., Tozer, D., & Chow-Fraser, P. (2013). URBAN: Development of a Citizen Science Biomonitoring Program Based in Hamilton, Ontario, Canada. *International Journal of Science Education, Part B*, (ahead-of-print), 1-21.

Ushahidi Haiti (www.ushahidi.com)

Morrow, N., Mock, N., Papendieck, A., & Kocmich, N. (2011). Independent evaluation of the Ushahidi Haiti project. *Development Information Systems International*, 8. (<http://ggs684.pbworks.com/w/file/fetch/60819963/1282.pdf>)

Openstreetmap (openstreetmap.org)

Haklay, M., & Weber, P. (2008). Openstreetmap: User-generated street maps. *Pervasive Computing, IEEE*, 7(4), 12-18.

CrowdAtlas (grid.sjtu.edu.cn/mapupdate/)

Wang, Y., Liu, X., Wei, H., Forman, G., Chen, C., Zhu, Y. 2013. CrowdAtlas: Self-updating maps for cloud and personal use. *MobiSys'13*, June 25-28, Taipei, Taiwan. <http://grid.sjtu.edu.cn/mapupdate/papers/mbs.pdf>

Data Quality

Goodchild, M. F., & Li, L. (2012). Assuring the quality of volunteered geographic information. *Spatial Statistics*, 1, 110-120.

Jackson, S. P., Mullen, W., Agouris, P., Crooks, A., Croitoru, A., & Stefanidis, A. (2013). Assessing completeness and spatial error of features in volunteered geographic information. *ISPRS International Journal of Geo-Information*, 2(2), 507-530.

Comber, A., See, L., Fritz, S., Van der Velde, M., Perger, C., & Foody, G. (2013). Using control data to determine the reliability of volunteered geographic information about land cover. *International Journal of Applied Earth Observation and Geoinformation*, 23, 37-48.

See, L., Comber, A., Salk, C., Fritz, S., van der Velde, M., Perger, C., ... & Obersteiner, M. (2013). Comparing the quality of crowdsourced data contributed by expert and non-experts. *PloS one*, 8(7), e69958.

Crall, A. W., Newman, G. J., Stohlgren, T. J., Holfelder, K. A., Graham, J., & Waller, D. M. (2011). Assessing citizen science data quality: an invasive species case study. *Conservation Letters*, 4(6), 433-442.

Kremen, C., Ullman, K. S., & Thorp, R. W. (2011). Evaluating the Quality of Citizen-Scientist Data on Pollinator Communities. *Conservation Biology*, 25(3), 607-617.

Foody, G. M., See, L., Fritz, S., Van der Velde, M., Perger, C., Schill, C., & Boyd, D. S. (2013). Assessing the accuracy of volunteered geographic information arising from multiple contributors to an Internet based collaborative project. *Transactions in GIS*.

Haklay, M. (2010). How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. *Environment and planning. B, Planning & design*, 37(4), 682.

Mummidi, L. N., & Krumm, J. (2008). Discovering points of interest from users' map annotations. *GeoJournal*, 72(3-4), 215-227.

Privacy and Ethics

Friedland, G., Sommer, R. 2010. Cybercasing the Joint: On the Privacy Implications of Geo-Tagging. 5th Usenix Hot Topics in Security Workshop (HotSec2010), Washington DC, August 2010."

Kounadi, O., Lampoltshammer, T. J., Leitner, M. and Heistracher, T. 2013. Accuracy and privacy aspects in free online reverse geocoding services". *Cartography and Geographic Information Science*, 40(02): 140-153.