Michael F. Goodchild
good@geog.ucsb.edu

Michael F. Goodchild is Professor of Geography at the University of California, Santa Barbara, and Director of spatial@ucsb. He received his BA degree from Cambridge University in Physics in 1965 and his PhD in Geography from McMaster University in 1969. After 19 years at the University of Western Ontario, he moved to Santa Barbara in 1988. He was Director of the National Center for Geographic Information and Analysis from 1991 to 1997. He was elected member of the National Academy of Sciences and Foreign Fellow of the Royal Society of Canada in 2002, and member of the American Academy of Arts and Sciences in 2006. He has received honorary doctorates from Laval University, Keele University, McMaster University, and Ryerson University. He has received the Canadian Association of Geographers Award for Scholarly Distinction, the Association of American Geographers award for Outstanding Scholarship, the Canadian Cartographic Association's Award of Distinction for Exceptional Contributions to Cartography, and the Educator of the Year Award from the University Consortium for Geographic Information Science. He has received Lifetime Achievement Awards from Environmental Systems Research Institute, Inc. and the Geospatial Information and Technology Association, and has been inducted into the GIS Hall of Fame of the Urban and Regional Information Systems Association. In 2007 he received the Prix Vautrin Lud. He was Editor of *Geographical Analysis* between 1987 and 1990 and Editor of the Methods, Models, and Geographic Information Sciences section of the *Annals of the Association of American Geographers* from 2000 to 2006. He serves on the editorial boards of ten other journals and book series. His published books include *Accuracy of Spatial Databases*; *Geographical Information Systems: Principles and Applications*; *Environmental Modeling with GIS*; *Scale in Remote Sensing and GIS*; *Interoperating Geographic Information Systems*; *Geographic Information Systems and Science*; *Uncertainty in Geographical Information*; *Foundations of Geographic Information Science*; *Spatially Integrated Social Science*; *GIS, Spatial Analysis, and Modeling*;

and *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools*. In addition he is author of some 350 scientific papers. He was Chair of the National Research Council's Mapping Science Committee from 1997 to 1999, and currently chairs the Advisory Committee on Social, Behavioral, and Economic Sciences of the National Science Foundation. His current research interests center on geographic information science, spatial analysis, and uncertainty in geographic data.

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Department of Geography

University of California, Santa Barbara

The Evolving Landscape of MCMD Information Flow

Geospatial information -- information about what is where -- plays an invaluable role in all aspects of emergency management, from preparedness and response to recovery and mitigation. Because of the costs associated with its production, geospatial information has traditionally been created and distributed by government agencies, with some assistance from the private sector, in a top-down, radial pattern. In recent years new technologies, including GPS and GIS, have dramatically reduced the cost of acquiring and disseminating geospatial information, effectively to zero, and have also dramatically reduced the time delays involved. The term *neogeography* describes a world in which there is no longer any effective distinction between amateur and expert, since the skills and tools needed to produce geospatial information are in effect available to all.

Nowhere are these changes more apparent than in the domain of emergency management. While citizens used to rely on official sources for current information on the progress of disasters, evacuation orders, and the locations of shelters and other facilities, today much of this information is being generated and disseminated by citizens. The general public provides a dense network of observers who are typically enabled by devices that range from cellphones to computers, and connected through broadband networks. By contrast government agencies cannot field large numbers of observers, and must rely instead on remote sensing and other technologies with fine spatial resolution -- but such technologies are impacted by smoke, cloud, infrequent overpasses, and many other constraints.

Moreover official information must be verified before it can be disseminated, a process that inevitably takes time in what are often time-critical situations. Numerous examples of the transition from agency-dominated to citizen-dominated information flow can be found, ranging from recent wildfire emergencies in Santa Barbara to the base mapping that has supported the Port-au-Prince relief effort.

This new landscape raises numerous issues, perhaps the most important being accuracy. Rather than guarantee accuracy, crowd-sourced data invites the user to balance timeliness with accuracy, accepting risky data that is available now rather than reliable data that may not be available for some time. False positives are more likely than false negatives, but are more acceptable because the associated risks are less severe. The geospatial nature of the information also invites several specific strategies for addressing accuracy, including the importance of context, the difficulty of faking geospatial information, and the role of the crowd in driving toward consensus.

A variety of literatures are relevant, including the literature on trust, on uncertainty in geographic information, and on spatial data infrastructures. Systematic research is just beginning, and is starting to yield some important insights.