Curriculum Vitae – Phil A. Graniero

Work Address:
University of Windsor
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Citizenship: Canadian

Present Position

Associate Professor, Department of Earth and Environmental Sciences, University of Windsor
Researcher, Great Lakes Institute of Environmental Research, University of Windsor
Program Chair, Hons. Bachelor of Environmental Studies Program, Centre for Inter-Faculty Programs, University of Windsor

Education

PhD (2001). Geography (Environmental Modelling and Geographic Information Systems), University of Toronto. Thesis title: The effect of spatiotemporal sampling strategies and data acquisition accuracy on the characterization of dynamic ecological systems and their behaviours.

MES (1996). Geography (Hydrology and Geographic Information Systems), University of Waterloo. Thesis title: Modelling the distribution and boundary morphological conditions of blanket bog occurrence in southeastern Newfoundland.

BES (1994). Geography and Computer Science, University of Waterloo. Thesis title: ICOSA: A polyhedral globe projection system.

Academic / R&D Employment History

2008-present	Program Chair, Honours Bachelor of Environmental Studies Program, Centre for Inter-Faculty Programs, University of Windsor (stipend position)
2007-present	Associate Professor, Department of Earth and Environmental Sciences, University of Windsor
2001-present	Researcher, Great Lakes Institute of Environmental Research, University of Windsor
2005-2007	Assistant Professor (tenured), Department of Earth and Environmental Sciences, University of Windsor
2001-2005	Assistant Professor (tenure-track), Department of Earth and Environmental Sciences, University of Windsor
2000-2001	Lecturer (tenure-track), Department of Earth and Environmental Sciences, University of Windsor
1999-2000	Teaching Assistant Coordinator, Department of Geography, University of Toronto

1999	Web Instructional Tool Designer/Programmer, Department of Geography, University of Toronto
1999	Sessional Instructor, Department of Geography, University of Toronto
1999	Field Course Instructor, Department of Geography, University of Toronto
1997-1999	Web/Database Integration Consultant, Strangeloop Services, Toronto, Ontario
1996-2000	Teaching Assistant, Department of Geography, University of Toronto
1994-1995	Software Developer, Grand River Water Quality Monitoring Program, Department of Environmental Resource Studies, University of Waterloo
1994	Computing Assistant, Mapping Analysis and Design Centre, Faculty of Environmental Studies, University of Waterloo
1994	GIS Research Technician, School of Urban and Regional Planning, University of Waterloo
1993-1996	Teaching Assistant, Department of Geography, University of Waterloo

Honours and Awards

2001	Departmental Nominee, Governor General's Academic Gold Medal, PhD Dissertation, Department of Geography, University of Toronto
1996	Outstanding Achievement in Graduate Studies, University of Waterloo
1994	Lorne S. Russwurm Teaching Award for Outstanding Teaching Assistant, University of Waterloo

University Service

2008-present	Environmental Studies Counsellor
2002-present	Geoinformatics Program Counsellor
2007-2008	Graduate Program Committee, Earth & Environmental Sciences
2005-2006	University of Windsor Senate
2005-2006	Chair, Graduate Program Committee, Earth & Environmental Sciences
2004-2006	Graduate Program Committee, GLIER
2004-2005	Graduate Program Committee, Earth & Environmental Sciences
2004-2005	Space Committee, Earth & Environmental Sciences
2004-2005	Physical Geography Program Counsellor
2000-2002	High School Liaison/Promotion Committee, Earth & Environmental Sciences
2000-2001	High School Teachers Advisory Committee, Faculties of Science & Education

Professional/Academic Service

2008-present	Research Management Committee, GEOIDE NCE
2008-present	Scientific Committee, Spatial Knowledge and Information – Canada Conference Series (annual)
2005-present	Scientific Committee, GeoComputation Conference Series (biennial)
2009	Scientific Committee, International Community on Information Systems for Crisis Response and Management (ISCRAM) 2009 Conference
2008	Scientific Committee, 1st IEEE International Workshop on Automated and Autonomous Sensor Networks 2008
2006	Scientific Committee, GIScience 2006 Conference
2000-2003	Executive Council, Windsor-Essex Geomatics Cooperative

Academic Reviewing

Funding Proposals	Ontario Centres of Excellence - Collaborative Research, Proof of Concept, and Interact Programs NSERC - Discovery Grants and Strategic Grants Programs Wisconsin Sea Grant Programs University of Western Ontario
Journals	Canadian Journal of Civil Engineering; Computers & Geoscience; Computers, Environment, and Urban Systems; Environmental Modelling and Software; Fuzzy Sets and Systems; International Journal of Geographical Information Science; Photogrammetric Engineering and Remote Sensing; Transactions in GIS; Wetlands
Books	Scaling and Uncertainty Analysis in Ecology: Methods and Applications (Columbia University Press); Soft Computing in Defining Spatial Relations (Springer-Verlag); Fuzzy Modeling with Spatial Information for Geographic Problems (Springer-Verlag)

University Teaching

All courses except GGR379H and 67-280 were new courses introduced into the calendar, and I was first designer/instructor.

2nd Year:

67-210 Principles and Applications of Geographic Information Systems, U of Windsor: 2001, 2002, 2003, 2005, 2006
67-280 Field Measurement and Mapping Techniques, U of Windsor: 2003
GGR276S Geographic Information Processing and Mapping, U of Toronto: 1999

3rd Year:

67-310 GIS Problem Solving and Spatial Modelling, U of Windsor: 2001 (twice), 2002, 2003, 2004, 2005, 2007, 2008
67-320 Watershed Hydrology, U of Windsor: 2003, 2008
GGR379H Field Techniques in Physical Geography, U of Toronto: 1999

4th Year:

67-410 GIS and Spatial Decision Support Systems, U of Windsor: 2002
67-410 Advanced Methods in GIS Analysis, U of Windsor: 2004, 2005, 2008
61-470/60-475 Special Topics – GIS: A Computing Perspective, U of Windsor: 2001, 2003 (twice)
61-470 Special Topics – Wetland Ecohydrology, U of Windsor: 2005

Graduate:

61-574 Advanced Topics in Geoinformatics, U of Windsor: 2002, 2003, 2004, 2005, 2007, 2008
61-576 Environmental Modelling and Spatial Simulation, U of Windsor: 2005, 2008
61-590 Special Topics – Spatial Modelling and Environmental Sensors, U of Windsor: 2004
61-590 Special Topics – GIS and Environmental Modelling, U of Windsor: 2001
61-590 Special Topics – Geographic Information Systems for Problem-Solving, Analysis and Design, U of Windsor: 2008, 2009

Short Courses and Workshops:

Sensor Web Infrastructure. 1.5 day short course. GEOIDE Summer School, St. Mary's University, 2007; University of British Columbia, 2009

Introduction to GIS for libraries. With A.F. Grgicak-Mannion. 1 day short course. Ontario Library Association ACCESS 2002, University of Windsor, 2002.

Grade 9 Geography Teachers' GIS Workshop. With A.F. Grgicak-Mannion. 1 day short course. University of Windsor, 2001.

Grade 10 Science Teachers' GIS Workshop. With A.F. Grgicak-Mannion. 1 day short course. University of Windsor, 2001.

Other Teaching Activities:

2004: Developed the GLIER MSc/PhD in Environmental Science proposal, as a member the GLIER Graduate Committee. Approved by OCGS on first submission.

2001: Developed the Honours BSc Geoinformatics program, with I. Samson (Head, Earth Sciences) and S. Bandyopadhyay (Head, Computer Sciences). Approved by University of Windsor Program Development Committee on first submission.

Research Supervision

Supervised or co-supervised 9 Bachelors (thesis) students, 7 Masters students, 1 PhD student, 1 post-doctoral fellow, and 8 research technicians.

Certifications and Training

Transport Canada Training Certificate – Small Non-Pleasure Vessel Basic Safety (MED-A3), Georgian College, 2008

Certificate - 3 Day Ground-Penetrating Radar Short Course, Sensors & Software, 2001

Publications, Past 8 Years

Lifetime: 10 refereed journal articles; 2 book chapters (original, peer-reviewed research); 2 refereed conference proceedings; 3 technical reports; 16 non-refereed conference proceedings; 3 book reviews; 13 posters; 13 invited research seminars; 22 abstracts/ presentations.

Students, post-doctoral fellows, and research assistants are underlined.

Articles in Refereed Journals

All geomatics/GIScience articles are published in the seven first-rank GIScience journals as identified by Caron et al. (Trans. GIS, 2008, 12(3):293-321).

10) Jabeur, N., J.D. McCarthy, X. Xing and **P.A. Graniero**. In press. A knowledge-oriented meta-framework for integrating sensor network infrastructures. *Computers & Geosciences.* Doi:10.1016/j.cageo.2008.04.006.

9) McCarthy, J.D., **P.A. Graniero** and S.M. Rozic. 2008. An integrated GIS-expert system framework for live hazard monitoring and detection. *Sensors*, 8:830-846.

8) **Graniero, P.A.** 2007. The influence of landscape heterogeneity and local habitat effects on the response to competitive pressures in metapopulations. *Ecological Modelling*, 203:349-362.

7) Richardson, M.C., B.A. Branfireun, V.B. Robinson and **P.A. Graniero**. 2007. Towards simulating biogeochemical hot spots in the landscape: a geographic object-based approach. *Journal of Hydrology*, 342:97-109.
6) McCarthy, J.D. and **P.A. Graniero**. 2006. A GIS-based borehole data management and 3D visualization system. *Computers & Geosciences*, 32:1699-1708.
5) **Graniero, P.A.** and V.B. Robinson. 2006. A probe mechanism to couple spatially explicit agent and landscape models in an integrated modeling framework. *International Journal of Geographical Information Science*, 20:965-990.
4) MacIsaac, H.J., J.V.M. Borbely, J. Muirhead and **P.A. Graniero**. 2004. Backcasting and forecasting biological invasions of inland lakes. *Ecological Applications*, 14:773-783.
3) **Graniero, P.A.** and V.B. Robinson. 2003. A real-time adaptive sampling method for field mapping in patchy, heterogeneous environments. *Transactions in GIS*, 7:31-53.

Chapters in Books (original, peer-reviewed research)

2) Robinson, V.B. and **Graniero, P.A.**. 2005. An object-oriented approach to managing fuzziness in spatial explicit ecological models coupled to a geographic database. In Z. Ma (ed.) *Advances in Fuzzy Object-Oriented Databases: Modeling and Applications*. Idea Publishing Group. 269-300.
1) Robinson, V.B. and **Graniero, P.A.** 2005. Spatially explicit individual-based ecological modeling with mobile fuzzy agents. In M. Cobb, F. Petry and V.B. Robinson (eds.) *Fuzzy Modelling with Spatial Information for Geographic Problems.* Springer-Verlag. 299-334.

Articles in Refereed Conference Proceedings

2) Hutchinson, D.J., M.S. Diederichs, C. Carranza-Torres, R. Harrap, S. Rozic and **P.A. Graniero**. 2007. Four dimensional considerations in forensic and predictive simulation of hazardous slope movement. In E. Eberhardt et al. (eds.) *Rock Mechanics: Meeting Society's Challenges and Demands.* Taylor and Francis. 1:11-19.
1) Jabeur, N. and **P.A. Graniero**. 2007. A hybrid location-semantic approach to routing assisted by agents in a virtual network. In P. Thulasiraman et al. (eds.) *Frontiers of High Performance Computing and Networking – ISPA 2007 Workshops*. Lecture Notes in Computer Science No. 4743. Springer-Verlag. 523-533.

Technical Reports

3) Grzeszczak, P., A.F. Grgicak-Mannion, J. Ciborowski, **P.A. Graniero** and A. Kirkpatrick. 2005. *Windsor-Essex Environmental Metadata System (WEEMS) – A geospatial/biological metadata tool for the Windsor-Essex Region*. Status report for the Ontario Ministry of the Environment Lakeviews Project.
2) Fan, A. and **P.A. Graniero**. 2004. *A spatial analysis of GPS availability and radio data transmission reliability for real-time, wireless GIS updating in urban environments*. Report No. 5006, Office of Critical Infrastructure Protection and Emergency Preparedness.
1) Fan, A. and **P.A. Graniero**. 2004. *Decision support systems: An introduction to the concepts, tools, and issues*. Geotechnical In-Situ Sensor Technology Network White Paper Series.

Articles in Non-Refereed Conference Proceedings

17) Jabeur, N., J.D. McCarthy, and **P.A. Graniero.** 2008. Improving wireless sensor network efficiency and adaptability through an SOS server agent. *Proceedings of the 1st IEEE International Conference on the Applications of Digital Information and Web Technologies.* Ostrava, Czech Republic. 6pp.

16) McCarthy, J.D., **P.A. Graniero** and S.M. Rozic. 2007. An integrated GIS-expert system framework for live hazard monitoring and detection. *Joint CIG/ISPRS Conference on Geomatics for Disaster and Risk Management.* Toronto, ON. 10pp.

15) Jabeur, N. and **P.A. Graniero**. 2007. Agent-based clusters to virtually manage spatially distributed sensors. *GeoComputation 2007 Proceedings,* Maynooth, Ireland. 5pp.

14) McCarthy, J.D. and **P.A. Graniero**. 2007. Reasoning-ready sensor data. *GeoComputation 2007 Proceedings,* Maynooth, Ireland. 5pp.

13) Wintermute, J.S., **P.A. Graniero** and S. Reitsma. 2006. A kriging technique using flowline-based distances in flow-dominated environments. *GIScience 2006 Proceedings*, Münster, Germany. 6pp.

12) **Graniero, P.A.** and V.B. Robinson. 2005. Spatially explicit agents and landscape models coupled in a single framework? It all depends on how you view it. *GeoComputation 2005 Proceedings,* Ann Arbor, MI. 12pp.

11) McCarthy, J.D. and **P.A. Graniero**. 2005. A GIS-based borehole data management and 3D visualization system. *Proceedings of the 2005 Annual Conference of the International Association for Mathematical Geology,* Toronto, ON, 267-272.

10) Wintermute, J.S. and **P.A. Graniero.** 2005. Kriging in transport-dominated environments using flowline-based distances. *Proceedings of the 2005 Annual Conference of the International Association for Mathematical Geology*, Toronto, ON, 1210-1215.

9) Rozic, S.M. and **P.A. Graniero**. 2005. Representing domain and spatial knowledge with ontologies in a spatial decision support framework. *GeoComputation 2005 Proceedings*, Ann Arbor, MI, 15pp.

8) Robinson, V.B. and **P.A. Graniero**. 2005. Using extensible component objects for constructing observable spatially explicit ecological simulation models with fuzzy decision making. *Proceedings of GeoInformatics '05*, Toronto, ON, 9pp.

7) **Graniero, P.A.** and H.S. Miller. 2004. Real-time, wireless GIS updating: closing the workflow loop. *GITA Annual Conference 27 Proceedings*, Seattle, WA. 9pp.

6) **Graniero, P.A.** and H.S. Miller. 2003. Real-time, wireless field data acquisition for spatial data infrastructures. *Proceedings, GeoTec Event 2003.* Toronto, ON. 9pp.

5) **Graniero, P.A.** and V.B. Robinson. 2001. Investigating the role of fuzzy sets in a spatial modeling framework. *Proceedings of the Joint 9th IFSA World Congress and 20th NAFIPS International Conference*, Vancouver, BC. 2370-2375.

Book Reviews

3) **Graniero, P.A.** 2007. S. Rana and J. Sharma (eds.), *Frontiers of Geographic Information Technology*, 329pp, Springer, 2006. Review published in *Geomatica,* 61:70-71.

2) **Graniero, P.A.** 2005. R. de Caluwe, G. de Tre and G. Bordogna (eds.), *Spatio-Temporal Databases: Flexible Querying and Reasoning*, 392pp, Springer-Verlag, 2004. Review published in *Geomatica,* 59:189-190.

1) **Graniero, P.A.** 2003. H.R. Gimblett (ed.), *Integrating Geographic Information Systems and Agent-based Modeling Techniques for Simulating Social and Ecological Processes*, 344pp, Oxford University Press, 2002. Review published in *Geomatica*, 57:428.

Posters

15) **Graniero, P.A.**, M. Weiler, B.G. Nickerson, P. Arp, L. Danisch, S. Belshaw and J. Pianosi. 2008. SWAN – the Sensor Web Automation Network: Developing and evaluating an integrated sensor web infrastructure for hydrological and forest monitoring. *GEOIDE 10th Annual Scientific Conference*, Niagara Falls, ON.

14) McCarthy, J.D., N. Jabeur, **P.A. Graniero**, X. Xing and D.S. D'Alimonte. 2008. A knowledge-driven sensor web meta-infrastructure for integrating sensor networks, standards, and services. *GEOIDE 10th Annual Scientific Conference*, Niagara Falls, ON.

13) Xing, X., J.D. McCarthy, **P.A. Graniero**, D. Rudolph, B. Conant Jr., S. Belshaw and J. Pianosi. 2008. An integrated watershed telemetry system with a rule-based triggering system for adaptive monitoring. *GEOIDE 10th Annual Scientific Conference*, Niagara Falls, ON.

12) **Graniero, P.A.**, M. Weiler, B.G. Nickerson, P.A. Arp and N. Jabeur. 2007. SWAN – Sensor Web Automation Network: An integrated sensor web design and deployment infrastructure for watershed monitoring. *GEOIDE 9th Annual Scientific Conference*, Halifax, NS.

11) Xing, X., **P.A. Graniero**, S. Belshaw and J. Pianosi. 2007. A flexible telemetry system for complex environmental monitoring. *GEOIDE 9th Annual Scientific Conference*, Halifax, NS.

10) Jabeur, N. and **P.A. Graniero**. 2007. VWSN: Towards virtual management of wireless sensor networks. *GEOIDE 9th Annual Scientific Conference*, Halifax, NS.

9) McCarthy, J.D. and **P.A. Graniero**. 2007. Reasoning-ready sensor data. *GEOIDE 9th Annual Scientific Conference*, Halifax, NS.

8) McCarthy, J.D., S.M. Rozic, **P.A. Graniero**, R. Harrap, M. Diederichs and J.D. Hutchinson. 2006. An expert system approach to near-real-time spatial decision support: case studies. *GEOIDE 8th Annual Scientific Conference*, Banff, AB.

7) Rozic, S.M. and **P.A. Graniero**. 2005. Representing domain and spatial knowledge with ontologies in a SDSS framework. *GEOIDE 7th Annual Scientific Conference*, Quebec City, QC.

6) Hutchinson, J.D., R.M. Harrap, M.S. Diederichs, **P.A. Graniero**, D. Martin and B. Moulin. 2004. GIST II – Intelligent sensor data/knowledge fusion for geotechnical and policy decision support. *GEOIDE 6th Annual Scientific Conference*, Gatineau, QC.

5) Rozic, S.M., P. Andrew-McBride and **P.A. Graniero**. 2004. Developing an ontology for hydrologic sensors. *GEOIDE 6th Annual Scientific Conference*, Gatineau, QC.

4) Rozic, S.M., P. Andrew-McBride and **P.A. Graniero**. 2004. A conceptual schema design for environmental sensors. *Geotechnical In-Situ Sensor Technology Network Workshop*, Kingston, ON.

3) Harrap, R.M., Hutchinson, D.J., **Graniero, P.A.**, Villeneuve, M. and Ball, D. 2003. Geotechnical In-Situ Technology (GIST) Network - Constraining the interpretation of real-time sensor data from unstable rock masses in 3D, *3-D Geological Mapping: Geostatistical Analysis and Visualisation Workshop*, Ottawa, ON.

Invited Research Seminars

13) **Graniero, P.A.** 2009. Adaptive environmental monitoring with 'intelligent' sensor webs and GIS. University of Waterloo, January 29, 2009.

11-12) **Graniero, P.A.** 2008-09. An interoperable framework of sensor networks, GIS, and spatial decision support for 'intelligent' environmental monitoring and response.

Université Laval, January 23, 2009.
University of Münster, Germany, November 19, 2008.

6-10) **Graniero, P.A.** 2007-08. It's not about the numbers: Integrating sensor webs, GIS, and spatial decision support for 'intelligent' real-time environmental monitoring and response.
McMaster University, April 2, 2008.
Wilfrid Laurier University, March 7, 2008.
York University, February 8, 2008.
University of Windsor, January 17, 2008.
Carleton University, November 9, 2007.

5) **Graniero, P.A.** 2006. Breaking the data barrier: Novel spatial data collection and environmental modeling methods. Univ. of Western Ontario, March 24, 2006.

4) **Graniero, P.A.** 2004. How do spatial sampling design and measurement error affect ecosystem description? A simulation approach. Great Lakes Institute for Environmental Research, November 12, 2004.

3) **Graniero, P.A.** 2003. Spatially detailed data for environmental research: Why we need it and a field system to collect it. Wilfrid Laurier Univ., March 14, 2003.

2) **Graniero, P.A.** 2003. How do spatial sampling design and measurement error affect ecosystem description? A simulation approach. Rochester Institute of Technology, February 7, 2003.

Abstracts/Presentations

22) **Graniero, P.A.** 2008. An integrated sensor web design, acquisition, and evaluation framework for intelligent, adaptive environmental monitoring. *Sensing a Changing World International Workshop*. Wageningen, Netherlands.

21) **Graniero, P.A.** 2006. Live environmental monitoring in GIS. *University of Windsor/ City of Windsor GIS Day*, Windsor, ON.

20) Jabeur, N. and **P.A. Graniero**. 2006. Adding intelligence to conventional sensor networks. *Joint GIST/RGHRP Workshop*, Kingston, ON.

19) McCarthy, J.D. and **P.A. Graniero**. 2006. Reasoning-ready sensor data. *Joint GIST/ RGHRP Workshop*, Kingston, ON.

18) **Graniero, P.A.** 2006. Progress in developing advanced sensor networks and telemetry systems. *Joint GIST/ RGHRP Workshop*, Kingston, ON.

17) Andrew-McBride, P. and **P.A. Graniero**. 2006. Fine-scale spatial variability of infiltration characteristics in 'nano-catchments' during a rainfall event. *Joint CGU/CSSS Annual Meeting*, Banff, AB.

16) **Graniero, P.A.** 2006. Integrating GPR, GPS and GIS to build subsurface terrain models and constrain hydrological models. *Joint CGU/CSSS Annual Meeting*, Banff, AB.

15) Andrew-McBride, P. and **P.A. Graniero**. 2005. The influence of fine-scale infiltration variability on aquifer modeling. *31st Annual Meeting of the Canadian Geophysical Union*, Banff, AB.

14) **Graniero, P.A.** 2005. The surface eco-hydrology of a freshwater marsh, southwestern Ontario. *31st Annual Meeting of the Canadian Geophysical Union*, Banff, AB.

13) Wintermute, J.S., **P.A. Graniero**. 2005. Uses and limitation of using ground-penetrating radar (GPR) to characterize the subsurface structure of wetlands. *31st Annual Meeting of the Canadian Geophysical Union*, Banff, AB.

12) **Graniero, P.A.** 2005. What do you get with a field worker, sensor fusion, and a wireless acquisition system? A mobile node on the distributed sensor network. *International Association of Mathematical Geology Annual Meeting*, Toronto, ON.

11) Robinson, V.B. and **P.A. Graniero**. 2004. An object-oriented framework for incorporating fuzziness in individual-based spatially explicit ecological models. *23rd NAFIPS International Conference*. Banff, AB.

10) **Graniero, P.A.** 2004. GPS and radio reliability for GIS update in urban environments. *GeoTec 2004 Conference*, Toronto, ON.

9) Robinson, V.B. and **Graniero, P.A.** 2004. Spatially explicit individual-based modeling of natal dispersal using fuzzy agents. *International Association for Landscape Ecology, US Chapter 19th Annual Symposium*, Las Vegas, NV.

8) Harrap, R.M., J.D. Hutchinson, **P.A. Graniero**, M. Villeneuve and D. Ball. 2003. Constraining the interpretation of real-time sensor data from unstable rock masses in 3D. *3-D Geological Mapping: Geostatistical Analysis and Visualization Workshop*, Ottawa, ON.

7) **Graniero, P.A.** and H.S. Miller. 2002. A mobile environmental monitoring system with real-time database updates. *CRESTech Innovation Network Annual Meeting*, Toronto, ON.

Software Products

ProbeFusion is an application development platform for rapidly collecting and integrating spatially referenced data from a broad range of mobile environmental sensors, and automatically constructing them into custom records on a handheld field computer. ProbeFusion's engine includes device configuration, input/output management, measurement triggering mechanism, data record assembly, and wireless communication protocol management. User interfaces are then built on the engine to support specific applications and data collection platforms. Available upon request.

ECO-COSM is a simulation modeling framework for constructing and coupling landscape-based and agent-based simulations. It is a library of modular Java objects that manage the structure of space and time within a simulation, including mechanisms to handle concurrent activity among objects within the simulation. ECO-COSM has a probe-based architecture to give controlled access to the state of simulation components. Probe wrappers allow the reported state to be modified, allowing agents to apply identification errors or perceptual filters to the state of the landscape or of other agents, and allowing simulation of sensors with realistic measurement errors. Released for public download. http://matrix.memf.uwindsor.ca/projects/eco-cosm/

REASON is a framework for constructing sensor-oriented, real-time spatial decision support systems for environmental monitoring. REASON couples ArcGIS with CLIPS, a programming language geared toward the development of expert systems. Problem domains and monitoring problems are described using an ontology hierarchy linked to an ontological description of sensors and spatio-temporal concepts. The core engine dynamically binds to a variety of sensor data sources, and drives an update-and-evaluate cycle using the domain and application ontologies to determine the meaning of sensor values and take appropriate action. Available upon request.

BoreIS is an extension to ESRI's ArcScene 3D environment. It contains features to aid users of subsurface data to manage, query, and visualize their data in 3D. A Data Discovery process asks questions about a user's data stored in Excel spreadsheets to identify spatially and geologically relevant attributes, and manage the import procedure. Interactive query builders and automated symbolization allows users of borehole data to quickly identify spatial patterns in their data. Released for public download. http://matrix.memf.uwindsor.ca/projects/boreis/

GPR Construction Kit (GCK) is a data management and processing tool to support quantitative analysis and modeling of ground-penetrating radar (GPR) subsurface measurements. GCK integrates GPR field data with GPS logs to position each trace in three dimensions. Data management tools keep track of several data files and GPR sections, allow plan and profile visualization, editing, and synthetic section extraction. Boundaries between subsurface layers may be identified using image enhancement, then digitized and given geotechnical properties. These properties are used to convert reflection times to precise depths. Boundary layers may then be exported as 3D mass points in a format appropriate for use in GIS or other subsurface modeling software. Available upon request.

Research Funding, Past 8 Years

Lifetime: $1,937,025 Total Collaborative Project Funding (cash)
$1,090,028 Total Funding to Graniero (cash)

2008-2009 **Weglicki and 11 others.** Linking geospatial information with public health outcomes: modeling asthma morbidity across an international border. *Wayne State University, President's Research Enhancement Program, Clinical Translational Science in Urban Health.* $447,567USD Total. $0 to Graniero; acting in an advisory role only.
(NOTE: Not included in Lifetime Total Collaborative Project Funding)

2008-2009 **Graniero and Liscano.** Collaborative R&D for distributed sensors: challenges, priorities, and opportunities. *GEOIDE NCE, Workshop Funds, and OCE Centre for Earth and Environmental Technology, Interact Program.*
$40,500 Total, $40,500 to Graniero.

2007-2009 **Rudolph, Conant Jr. and Graniero.** A rule-based triggering system for adaptive watershed monitoring. *OCE Centre for Earth and Environmental Technology, Collaborative Research Program.*
$327,375 Total, $137,498 to Graniero.

2005-2009 **Hutchinson and 5 others.** GIST II – Intelligent sensor data/knowledge fusion for geotechnical and policy decision support. *GEOIDE NCE, Phase III Core Research Program.*
$490,000 Total, $98,000 to Graniero.

2007-2008 **Graniero and 4 others.** An integrated sensor web deployment infrastructure for watershed monitoring. *GEOIDE NCE, Strategic Investment Initiative.*
$212,000 Total, $103,880 to Graniero.

2006-2008 **Graniero.** Measuring and modeling hydrological parameter fields: strategies for sampling and integrating fine-scale surface and subsurface data in a spatial simulation framework. *NSERC, Discovery Grants Program.*
$25,000 Total.

2007	**Graniero.** *Great Lakes Institute for Environmental Research, Postdoctoral Support Fund.* $15,000 Total.
2006-2007	**Graniero.** An advanced telemetry system for complex environmental monitoring applications. *OCE Centre for Earth and Environmental Technology, Interact Program.* $27,000 Total.
2003-2006	**Graniero.** Development of a mobile geospatial data acquisition/fusion system and real-time, wireless integration with a spatial database infrastructure. *Centre for Research in Earth and Space Technology, Core Research Program.* $146,250 Total.
2002-2006	**Graniero.** Near-surface eco-hydrological interactions in wetlands: pattern, process and scale. *NSERC, Discovery Grants Program.* $85,840 Total, $85,840 to Graniero.
2001-2006	**Graniero.** *University of Windsor, Adademic Development and Travel Fund.* $4,250 Total.
2003-2005	**Harrap and 4 others.** Development of the Geotechnical In-Situ Technology Network (GIST): Spatial decision support integrating geomatics, reasoning, and geotechnical knowledge for the management of geohazards. *GEOIDE NCE, Sensor Webs Program.* $200,000 Total, $40,000 to Graniero.
2003-2005	**Graniero.** *Human Resources and Skills Development Canada, Summer Career Placement Program.* $1,600 Total.
2003-2004	**Graniero.** A spatial analysis of GPS availability and radio data transmission reliability for real-time, wireless GIS updating in urban environments. *Office of Critical Infrastructure Protection and Emergency Preparedness, Ideas Program.* $25,000 Total.
2002	**Graniero.** Concept study: a mobile geospatial data acquistion/fusion system and real-time, wireless integration with a spatial database infrastructure. *Centre for Research in Earth and Space Technology & Canada Centre for Remote Sensing, In Situ Sensor Concept Study Initiative.* $19,838 Total.
2001-2002	**Graniero.** An integrated field acquisition and modeling facility for the study of hydrologic interactions in patchy environments, from point to catchment scales. *CFI New Opportunities Fund, and Ontario Innovation Trust.* $195,372 Total.