Plan 673: Information Systems for Disaster Management and Humanitarian Assistance
Syllabus Spring 2016
Friday 9:00 AM – 11:45 AM

This course provides core concepts, tools and skills necessary for disaster management and humanitarian assistance. Along with demonstrating analytical capability of GIS for planning, risk and vulnerability assessment, this course introduces students to different tools required in this field. It assumes that students have some experiences with GIS and basic statistics as well as an interest in the topics of disaster management. The course is composed of a lecture and discussion period based on readings provided by the instructor focused on various subject matters related to the data collection, analysis and interpretation for disaster management, as well as a lab period for hands on experience in using GIS, HAZUS-MH, ComMIT, CAMEO, SLOSH and damage assessment tools. The course will primarily focus on natural disasters, but may require students to read and discuss materials that are not specific to natural disasters rather broader coverages of planning and decision making for disaster management and humanitarian assistance.

Instructor's Office Hours and Contact Information

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Reference Books

Law, M. & Collins A. (2015). *Getting to Know ArcGIS Desktop*. Redlands, CA: ESRI Press.
Paperback: 794 pages
Publisher: ESRI Press; Forth Edition, for ArcGIS 10.2 & 10.3 edition (2015)

ISBN-10: 1589482603
ISBN-13: 978-1589482609

Greene, R.W. (2002). *Confronting Catastrophe, a GIS Handbook.* Redlands, CA: ESRI Press.

Pine, J. (2008). *Natural hazards analysis: reducing the impact of disasters*: CRC Press.

Tools used in this course

ArcGIS 10.2.2 - Geographic Information System. This software is installed on each PC machine in the Department of Urban and Regional Planning GISLAB (Saunders Hall Room 110). There are 24 PC based machines available, and each student is encouraged to use the same machine throughout the semester since data for this class are stored locally on each machine.
Student version of ArcGIS (one-year education use only) software will be provided free of cost to those students who plan to install the ArcGIS 10.2.2 software in her/his PC based machine, make sure that your pc meets the following minimum requirements:

HARDWARE:

- CPU speed 2.2 Ghz dual core or higher
- Memory 2 GB or higher
- Disk space minimum 2.4GB with another 500MB for swap space
- Video adapter with 24 bit graphic accelerator capability and at least 128 MB of video memory

SOFTWARE:

- Minimum running on Windows XP (Professional or Home Edition) SP3 for 32-bit, or SP2 for 64-bit
- .NET Framework 3.5 SP1, which must be installed before installing ArcGIS
- Microsoft Internet Explorer 7.0 or 8.0 for installation process

Detailed information on system requirements can be found at:
http://resources.arcgis.com/en/help/system-requirements/10.2/index.html

While it is possible to run ArcGIS on Intel based Mac system using "BootCamp" method, the result is often not very satisfactory. Refer to the following article for details if you intend to install ArcGIS on Mac:
http://blogs.esri.com/esri/gisedcom/2007/09/05/arcgis-on-a-mac/

Other software that will be included in this class are HAZUS-MH, Sea Lake Overland Surges from Hurricanes (SLOSH), Community Model Interface for Tsunami (ComMIT), and Computer-Aided Management of Emergency Operation (CAMEO). Hazus-MH is an add-in module for ArcGIS. It provides a nationally applicable standardized methodology and models for estimating potential losses from earthquakes, floods, and hurricanes. Except ArcGIS, other software can be downloaded free of cost. Links are:
HAZUS-MH: https://www.fema.gov/hazus-software
SLOSH: http://www.nhc.noaa.gov/surge/slosh.php
ComMIT: http://nctr.pmel.noaa.gov/ComMIT/

CAMEO software suite: http://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/response-tools/cameo-software-suite.html

Prerequisite
Basic knowledge of GIS is preferred for this class. Consent will be given based on student's exposure to other GIS courses or learning, or working experience using GIS.

Course Requirements
Students are encouraged to actively participate in class discussions, which will cover reading materials on disaster related issues. Students will need to submit a 1-page single spaced reflection paper for that week's readings. The reflection paper should concisely preview, synthesize, and critique the readings. A PAPER COPY is due at the start of the class session.

Students are required to complete lab assignments. Each assignment will have a clear deadline. The assignments are designed to enhanced students' skills that they receive during the lab exercise. It is important for students to submit the lab exercise on time, since the assignment will be discussed during the lecture session. Each student should submit her/his own work. Copying other's work is not acceptable.

Project proposal is considered as a substitute for the mid-term exam. The project is an individual task. Project proposal should be submitted by the week-9 (3.11.2016). Proposal should be 2-3 pages long (8.5" x 11"), typed using 12 point Times New Romans font or equivalent, in 1.5 line spacing format, and use 1 inch margins. It should cover background, research question(s) that would be answered, tools in GIS that would be used, expected outputs and some references. Students are encouraged to discuss the project closely with instructors.

Each student is expected to do a poster presentation towards the end of the course. The presentation should include a brief explanation on the research question(s), method and GIS techniques, findings, and conclusions. Use of tables and maps are preferable in explaining findings. Poster will be printed on Arch D size paper (24" x 36").

Beside presentation, each student is also required to submit a final report describing the background, literature review, research question(s), GIS and other techniques used to answer the question(s), findings, and conclusions. GIS methodology and products (i.e. maps) should be used as the main tool in answering the research question(s). Final report should be no more than 16 pages long (8.5" x 11") but not less than 10 pages, typed using 12 point Times New Romans font or equivalent, in 1.5 line spacing format, and use 1 inch margins.

Helpful tools for writing can be found @ University of Hawai'i Writing Program: http://manoa.hawaii.edu/mwp/resources . For Citations: (APA or MLA Style): http://www.lib.ncsu.edu/citationbuilder/

It is each student's responsibility to learn about plagiarism and how to avoid it. The following definition of plagiarism comes from The University of Hawaii System wide Student Conduct Code (page 9):

The term "plagiarism" includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

For the entire Student Conduct Code, see:
http://studentaffairs.manoa.hawaii.edu/downloads/conduct_code/UHM_Student_Conduct_Code.pdf

Grading Policy

Grade for this course is determined by several factors:

Reflection Papers:	15%
Lab assignments	45%
Final Project:	
Project Proposal	5%
Presentation	10%
Final report	25%

Points	Grade	Points	Grade
97-100 points	**A+**	77-79.9 points	**C+**
94-96.9 points	**A**	74-76.9 points	**C**
90-93.9 points	**A-**	70-73.9 points	**C-**
87-89.9 points	**B+**	67-69.9-points	**D+**
84-86.9 points	**B**	64-66.9 points	**D**
80-83.9 points	**B-**	60-63.9 points	**D**
		Less than 60 points	**F**

Students are expected to turn in assignments on time. Any late submission will be penalized by an accumulation of 20% per 12 hours from the deadline up to a maximum penalty of 100%. Student who misses project proposal or presentation, or final report will automatically receive a failing grade for the course.

Course Evaluations

The Department of Urban and Regional Planning is committed to the continual improvement of the quality of its course offerings. Toward the end of the semester, you will be informed that the eCAFE system is available to you to complete your course evaluation. We encourage you to submit your evaluations by logging in to http://www.hawaii.edu/ecafe/.

Schedule

Week 1 (01/15/16)
Introduction and course overview

Lab 1 (January 15): Lab Management & mapping basics.

Learning objectives:

- Learn about datum, coordinates, projections (NOAA Training on Understanding Datum, Coordinate Systems and Map Projection – 62 minutes https://coast.noaa.gov/digitalcoast/_/elearning/datums/player.html).
- Assign and change projections in ArcGIS.

Readings

ESRI. 2004. *Understanding Map Projections*. ESRI Press: Redlands, CA.

Shekhar, S., Feiner, S., & Aref, W. G. (2015). From GPS and virtual globes to spatial computing-2020. *GeoInformatica*, *19*(4), 799-832.

Sophia B. Liu & Leysia Palen (2010) The New Cartographers: Crisis Map Mashups and the Emergence of Neogeographic Practice, *Cartography and Geographic Information Science, 37:1*, 69-90, DOI: 10.1559/152304010790588098.

Week 2 (01/22/16)
Field mapping and use of UAV for data collection

HARD COPY reflection on readings is due on 01/22/16 before starting of the class.

Lab 2 (January 22): Exploring different sources of geographic data (GPS, UAV, and online mapping and data acquisition).

Learning objectives:

- Learn about geographic data collection techniques – GPS, field surveys, and others.
- Learn basics of operation of UAV.
- Acquire data from GPS, UAV and other field survey instruments.
- Use online explorers (Google Earth, online maps) for data generation.

Readings:

Kim, K., & Davidson, J. (2015). Unmanned Aircraft Systems Used for Disaster Management. *Transportation Research Record: Journal of the Transportation Research Board*, (2532), 83-90.

Khudabadi, R., Ranjan, A., Varma, H., Kadam, S., & Kalokhe, P. V. (2015). A Recent Study on Early Disaster Warning & Evacuation System on Mobile Phones Using Google Cloud. *Current Trends in Technology and Science. Volume : 04, Issue : 02 (Feb.- Mar. 2015)*

Gilman, D. (2014). Unmaned Aerial Vehicles in Humanitarian Assistance. OCHA Policy and Study Series, June 2014. UN OCHA.

Laefer, D. F., Koss, A., & Pradhan, A. (2006). The need for baseline data characteristics for GIS-based disaster management systems. *Journal of urban planning and development*, *132*(3), 115-119.

Week 3 (01/29/16)

Basic spatial analysis using ArcGIS

HARD COPY reflection on readings is due on 01/29/16 before starting of the class.

Lab 3 (January 29): Basic spatial analysis and mapping using ArcGIS

Learning objectives:

- Georeference aerial imagery.
- Conduct basic spatial analysis (extracting, joining, calculating, etc.).
- Manipulate attribute table.
- Use basic cartography to produce maps.

Readings:

Pande, S., Asokan, M., Prasad, K. S., & Mohd, I. A. (1998). Basics of Geographic Information System. In *Nematode pests in rice-wheat-legume cropping systems: proceedings of a Regional Training Course, 1–5 September 1997, CCS Haryana Agricultural University, Hisar, Haryana, India: Rice-Wheat Consortium Paper Series 4. New Delhi, India.*

Tran, P., & Shaw, R. (2007). Towards an integrated approach of disaster and environment management: A case study of Thua Thien Hue province, central Viet Nam. *Environmental Hazards*, *7*(4), 271-282.

Gunes, A. E., & Kovel, J. P. (2000). Using GIS in emergency management operations. *Journal of Urban Planning and Development*, *126*(3), 136-149.

Frye, C. 2001. Making Maps That Communicate. *ArcUser*, October-December 2001.

Harvey, F. 2008. *Chapter 1*, *Goals of Cartography and GI: Representation and Communication.* A primer of GIS: fundamental geographic and cartographic concepts. New York: Guilford Press.

Week 4 (02/05/16)

Use of census data in disaster management

HARD COPY reflection on readings is due on 02/05/16 before starting of the class.

Lab 4 (February 5): Census data analysis at level 1 (block groups) and level 2 (tracts) for Waikiki/Downtown Honolulu

Learning objectives:

- Understand the use Census and other socio-economic data for risk and vulnerability assessment.
- Use Census data and ArcGIS to find exposure to hazards and threats.
- Identify differences between level 1 and level 2 analyses.

Readings:

Khomarudin, M.R., Strunz, G., Post, J., Zosseded, K., & Ludwig, R. (2008). Spatial improvement of information on population distribution using GIS approaches: an input for tsunami people exposure assessment. *Presented at the International Conference on Tsunami Warning (ICTW), November 2008*

Kim, K., Pant, P. Yamashita, E., Ghimire, J., Brunner, I. M. (2013). The Spatial Criticality of Transportation Risks from Sea Level Rise, Strom Surge and Tsunami Hazards in Honolulu. *Presented at The Transport Research Board (TRB) 92nd Annual Meeting*. Jan 13-17, 2013, Washington D.C

Maantay, J., & Maroko, A. (2009). Mapping urban risk: Flood hazards, race, & environmental justice in New York. *Applied Geography*, 29, 111-124

National Research Council. (2007). *Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises*. Washington, D.C.: The National Academies Press. Downloadable at: http://www.nap.edu/catalog/11895.html

Week 5 (02/12/16)

Risk & exposure analysis using Hazus MH

HARD COPY reflection on readings is due on 02/12/16 before starting of the class.

Lab 5 (February 12): HAZUS-MH 3.0

Learning objectives:

- An overview of the capabilities of Hazus-MH, FEMA's loss estimation tool for earthquake, flood, and hurricane wind hazards using ESRI virtual campus training: Getting Started with HAZUS MH: http://training.esri.com/gateway/index.cfm?fa=catalog.webCourseDetail&courseid=2451
- Create deterministic scenario (Hurricane INIKI through Ewa) – RVA of Waikiki

Readings:

Miura, H., Midorikawa, S., Fujimoto, K., Pacheco, B. M., & Yamanaka, H. (2008). Earthquake damage estimation in Metro Manila, Philippines based on seismic performance of buildings evaluated by local experts' judgments. *Soil Dynamics and Earthquake Engineering, 28*(10-11), 764-777. doi: 10.1016/j.soildyn.2007.10.011

Chock, G. (2005). Modeling of Hurricane Damage for Hawaii Residential Construction. *Journal of Wind Engineering, 93*(8), 603-622

Cummings, C. A., Todhunter, P. E., & Rundquist, B. C. (2012). Using the Hazus-MH flood model to evaluate community relocation as a flood mitigation response to terminal lake flooding: The case of Minnewaukan, North Dakota, USA. *Applied Geography, 32*(2), 889-895. doi: 10.1016/j.apgeog.2011.08.016

Dierauer, J., Pinter, N., & Remo, J. W. F. (2012). Evaluation of levee setbacks for flood-loss reduction, Middle Mississippi River, USA. *Journal of Hydrology, 450-451*, 1-8. doi: 10.1016/j.jhydrol.2012.05.044

HAZUS-MH Manuals (References)

Federal Emergency Management Agency, *Multi-hazard Loss Estimation Methodology Earthquake Model, Hazus-MH2*. Washington DC: Department of Homeland Security. Downloadable at: http://www.fema.gov/library/viewRecord.do?id=4713

Federal Emergency Management Agency, *Multi-hazard Loss Estimation Methodology Hurricane Model, Hazus-MH2*. Washington DC: Department of Homeland Security. Downloadable at: http://www.fema.gov/library/viewRecord.do?id=4713

Federal Emergency Management Agency, *Multi-hazard Loss Estimation Methodology Flood Model, Hazus-MH2*. Washington DC: Department of Homeland Security. Downloadable at: http://www.fema.gov/library/viewRecord.do?id=4713

Week 6 (02/19/16)

Sea level rise and storm impact analysis

HARD COPY reflection on readings is due on 02/19/16 before starting of the class.

Lab 6 (February 19): Building disaster intensity map combining SLR and storm surge.

Learning objectives:

- Generate storm surge results using SLOSH.
- Conduct sea level rise modelling using DEM/LIDAR.
- Identify hurricane surge/impact level.
- Create hazard intensity map.

Readings:

Heberger, M., Cooley, H., Herrera, P., Gleick, P.H., & Moore, E. (2009). The impacts of Sea-Level Rise on the California coast. California Climate Change Center.

Marcy, D., Brooks, W., Draganov, K., Hadley, B., Haynes, C., Herold, N., McCombs, J., Pendleton, M., Ryan, S., Schmid, K., Sutherland, M., & Waters, K. (2011). New mapping tool and techniques for visualizing Sea Level Rise and coastal flooding impacts. Available: https://www.csc.noaa.gov/digitalcoast/tools/slrviewer/_pdf/Solutions_paper_final.pdf

Neumann, J.E., Hudgens, D.E., Herter, J., & Martinich, J. (2010). Assessing sea-level rise impacts: A GIS-based framework and application to coastal New Jersey. Coastal Management, 38, 433-455. Available http://dx.doi.org/10.1080/08920753.2010.496105.

SLOSH resources: http://www.nhc.noaa.gov/surge/slosh.php

Week 7 (02/26/16)
Hazard intensity mapping

HARD COPY reflection on readings is due on 02/26/16 before starting of the class.

Lab 7 (February 26): Hazard intensity mapping for Waikiki

Learning objectives:

- Prepare different hazards maps (SLR, storm surge, flooding, and hurricane) for Waikiki.
- Calculate the intensity of hazards (individual and combined).

Readings:

Little, R. G. (2002). Controlling cascading failure: understanding the vulnerabilities of interconnected infrastructures. *Journal of Urban Technology*, *9*(1), 109-123.

Cova, T. J. (1999). GIS in emergency management. *Geographical information systems*, *2*, 845-858.

Zerger, A. & Wealands, S. (2004). Beyond Modelling: Linking Models with GIS for Flood Risk Management**.** *Natural Hazards, Volume 33, Issue 2, pp 191-208.*

Odeh, D. (2002). Natural Hazards Vulnerability Assessment for Statewide Mitigation Planning in Rhode Island. *Nat. Hazards Rev.*, 10.1061/(ASCE)1527-6988(2002)3:4(177), 177-187.

Chen, K., McAneney, J., Blong, R., Leigh, R., Hunter, L., & Magill, C. (2004). Defining area at risk and its effect in catastrophe loss estimation: a dasymetric mapping approach. *Applied Geography*, *24*(2), 97-117.

Week 8 (03/04/2016) & Week 9 (03/11/2016)
Risk and vulnerability assessment

HARD COPY reflection on readings of both weeks is due on 03/04/16 before starting of the class.

Lab 8 (March 4): Risk and vulnerability assessment (RVA) for Waikiki

Learning objectives:

- Compile data from multiple sources including Census.
- Run vulnerability and risk assessment at different levels (Tract, block group) under different hazard scenarios (Single and multiple) for Waikiki

Readings:

Hystad, P. W., & Keller, P. C. (2008). Towards a destination tourism disaster management framework: Long-term lessons from a forest fire disaster. *Tourism Management*, *29*(1), 151-162.

National Research Council. (2007). *Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises*. Washington, D.C.: The National Academies Press. Downloadable at: http://www.nap.edu/catalog/11895.html

Pine, J. (2008). Social, Economic and Ecological Vulnerability. In *Natural hazards analysis: reducing the impact of disasters (Chapter 6, pp. 135-158)*: CRC Press.

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*(2), 242-261.

Moreno, A., & Becken, S. (2009). A climate change vulnerability assessment methodology for coastal tourism. *Journal of Sustainable Tourism*, *17*(4), 473-488.

Jongman, B., Ward, P. J., & Aerts, J. C. J. H. (2012). Global exposure to river and coastal flooding: Long term trends and changes. *Global Environmental Change, 22*(4), 823-835. doi: 10.1016/j.gloenvcha.2012.07.004

Week 10 (03/18/16)

Damage assessment tools

HARD COPY reflection on readings is due on 03/18/16 before starting of the class.
Final Project Proposal due

Lab 9 (March 18): Damage assessment tools (NDPTC damage assessment course: Module 4- Damage Assessment tools)

Learning objectives:

- Understand basics of damage assessment
- Use five tools (Paper based, Ushahidi, MERCI, VizOps, Crisis Track) for damage assessment.

(Guest Lecture)

Readings:

Lue, E., Wilson, J. P., & Curtis, A. (2014). Conducting disaster damage assessments with Spatial Video, experts, and citizens. *Applied Geography*,*52*, 46-54.

Boyd, S. (2008). Formulating a Damage Assessment Plan. Kingsport, Tennessee: Kingsport Fire Department.

Barrington, L., Ghosh, S., Greene, M., Har-Noy, S., Berger, J., Gill, S., ... & Huyck, C. (2012). Crowdsourcing earthquake damage assessment using remote sensing imagery. *Annals of Geophysics*, *54*(6).

Cutter, S.; Mitchell, J.T., & Scott, M.S. (1997). Handbook for Conducting a GIS-Based Hazards Assessment at the County Level. Prepared for South Carolina Emergency Preparedness

Division, Office of the Adjutant General.
http://webra.cas.sc.edu/hvri/docs/handbook.pdf

Week 11 (04/01/16)

Plan for and respond to chemical emergencies, threat zone estimates for various types of chemical hazards and risk and vulnerability assessment for volcanic disaster.

HARD COPY reflection on readings is due on 04/01/16 before starting of the class.

Lab 10 (April 1): Vulnerability and exposure of road networks, houses and other facilities to volcano in Big Island.

Learning objectives:

- Demonstration of CAMEO software suite to plan for and respond to chemical emergencies.
- Demonstration of ALOHA software to generate threat zone estimates for various types of hazards.
- Lava vulnerability and risk analysis.

Readings:

Pareschi, M. T., Cavarra, L., Favalli, M., Giannini, F., & Meriggi, A. (2000). GIS and volcanic risk management. In *Natural Hazards* (pp. 361-379). Springer Netherlands.

Scaini, C., Felpeto, A., Martí, J., & Carniel, R. (2014). A GIS-based methodology for the estimation of potential volcanic damage and its application to Tenerife Island, Spain. *Journal of Volcanology and Geothermal Research*, *278*, 40-58.

Felpeto, A., Martí, J., & Ortiz, R. (2007). Automatic GIS-based system for volcanic hazard assessment. *Journal of Volcanology and Geothermal Research*, *166*(2), 106-116.

Kim, K., Pant, P. & Yamashita, E. (2016). Managing Uncertainty: Lessons from Volcanic Lava Disruption of Transportation Infrastructure in Puna, Hawaii. *Paper presented at the National Academy of Sciences, 95th Transportation Research Board Annual Meeting, Jan 10-14, 2016, Washington D.C.*

Week 12 (04/08/16)

Tsunami risk assessment using ComMIT

HARD COPY reflection on readings is due on 04/08/16 before starting of the class.

Lab 11 (April 8): Japan Tsunami modelling using comMIT

Learning objectives and lab assignment:

- Conduct tsunami modelling around Fukushima NPP area using ComMIT
- Integrate results of ComMIT with ArcGIS.
- Run exposure analysis.

Readings:

Leidig, M., & Teeuw, R. (2015). Free software: A review, in the context of disaster management. *International Journal of Applied Earth Observation and Geoinformation*, *42*, 49-56.

Van de Walle, B., & Comes, T. (2015). On the Nature of Information Management in Complex and Natural Disasters. *Procedia Engineering 107 (2015) 403 – 411.*

Titov, V. V., Moore, C. W., Greenslade, D. J. M., Pattiaratchi, C., Badal, R., Synolakis, C. E., & Kânoğlu, U. (2011). A new tool for inundation modeling: Community Modeling Interface for Tsunamis (ComMIT). *Pure and applied geophysics*, *168*(11), 2121-2131.

ComMIT manual: http://nctr.pmel.noaa.gov/ComMIT/docs/ComMIT_manual.pdf

WEEK 13 (04/15/16), WEEK 14 (04/22/16), WEEK 15 (04/29/16)

Work on Individual Project

WEEK 16 (05/06/16)

Final Presentation - Poster

WEEK 17 (05/13/16)

Final Paper Submission