RPI

Jennifer Horsman — Research Planning, Inc.

Jennifer Horsman is a spatial analyst and geophysicist specializing in Geographic Information Systems (GIS), scientific data visualization, data management, programming and scripting for scientific data processing, GIS and web-site development, ground-penetrating radar, and remote sensing. She has experience in a wide variety of applications including environmental science, geology, climate change, meteorology, forestry, and conservation.

EDUCATION/CERTIFICATION

Certification as a GIS Professional (GISP), GIS Certification Institute (2011)

FAA Remote Pilot Certificate Number 4068762

M.S., Environmental Science and Policy, Plymouth State University, Plymouth, NH (2008)
Thesis Title: The origin of several stream terraces in eastern Taylor Valley, Antarctica, from Ground Penetrating Radar: A test of the Glacial Lake Washburn delta interpretation

A.B., Geophysics, University of California, Berkeley (1993)

PROFESSIONAL EXPERIENCE

Ms. Horsman has expertise in seven main technical areas as outlined below:

1. Geospatial Technology and Geoscience
2. Three-dimensional (3D) visualization of scientific data
3. Scientific programming and GIS application development
4. Web site development
5. Ground-penetrating radar data collection, processing, and interpretation
6. Remote sensing and UAS

GEOSPATIAL TECHNOLOGY AND GEOSCIENCE

Environmental Sensitivity Index (ESI) Mapping: Since joining RPI in December 2012, Ms. Horsman has participated in shoreline classification for the following ESI projects used for coastal zone management, contingency planning, and hazardous material/natural disaster responses:

Louisiana	2012-2013
Florida West Peninsula II	2013-2014
Mississippi River	2013-2014
Delaware, New Jersey, & Pennsylvania	2013-2014
Washington & Oregon	2014
Georgia	2014-2015
South Carolina	2014-2015
Maryland & Virginia	2014-2015
Southwest Florida	2016-2017
East Florida	2017-2018

U.S. Department of Transportation Pipieline and Hazardous Material Safety Administration (PHMSA) Drinking Water for Unusually Sensitive Areas: Ms. Horsman creates guidelines for assigning Pettyjohn classifications to groundwater wells in each of all 50 U.S. states based on aquifer geology and well data

(e.g., location, depth, pump rate). She then develops a set of rules from these guidelines that are applied to the groundwater wells within a GIS model.

Marmot Peak Quadrangle, Geologic Map, Park and Chaffee Counties, Colorado: As a GIS contractor for the Colorado Geological Survey, Ms. Horsman edited geologic vector datasets and performed all cartography for a published geologic quadrangle map (Houck et al., 2012).

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA/APHIS/PPQ): Ms. Horsman served as a GIS Analyst for a six-state region of PPQ. She provided data management, QAQC, analysis, and mapping for several PPQ programs including: Grasshopper Monitoring and Suppression, Fruit Fly Exclusion and Detection, Imported Fire Ant Management, Emerald Ash Borer Management, and Smuggling Interdiction and Trade Compliance (SITC). Her participation in the Grasshopper Suppression Program included acting as GIS Manager in the field for an Incident Response Team in 2010 where she managed a team of 3-5 GIS Technicians tasked daily with creating multiple maps for use in the field. She also coordinated with teams of pilots applying aerial insecticide treatments and provided them with polygonal datasets defining treatment areas for upload to their aircraft-mounted GPS units and incorporated the GPS data (spray tracks) they collected back into the GIS.

Central Shortgrass Prairie (CSP) Ecoregional Assessment: As a GIS Analyst at The Nature Conservancy (TNC), Ms. Horsman was the GIS team leader for a two-year conservation assessment project of the CSP. Her duties involved using GIS for analysis, cartography, and map production. The data she gathered for the project included spatial information on species locations, distributions, and/or suitable habitat; ecological systems; riparian systems and hydrography; and threats to targeted species and systems. The data came from a wide variety of sources including state agencies (Colorado Division of Wildlife, Nebraska Game and Parks Commission), federal agencies (DOD, USDA, USGS, USFWS, FEMA), non-governmental organizations (Natureserve, Colorado Natural Heritage Program), academic institutions (University of Kansas, University of Colorado), and industry. Ms. Horsman performed all spatial analysis including landscape connectivity/ecological integrity, ecological drainage unit (EDU) delineation, habitat modeling (regression and ecological niche factor analysis), and cumulative threats modeling. She also applied a spatial optimization program to the data to prioritize locations for conservation areas.

Map of Deformation Caused by Earthquakes in California: While working as a geophysicist at the U.S. Geological Survey (USGS), Ms. Horsman produced maps illustrating damage caused by deformation due to the 1992 Landers and 1994 Northridge earthquakes in California. These maps were created using MapInfo and Adobe Illustrator and showed shaded topography along with locations and magnitude of displacement of geodetic monuments, locations of damaged engineered structures, surface cracking, liquefaction, and landslides.

3D VISUALIZATION OF SCIENTIFIC DATA

Stream Restoration in Sumter National Forest: Using ArcGIS 3D and animation capabilities, Ms. Horsman created animated before and after visualizations of three different proposed stream restoration methods. The pre-restoration visualizations displayed current conditions at three different sites in the Sumter National Forest based on detailed measured topography and using simulated trees and water. The post-restoration visualizations were based on conceptual designs applied to the same sites. The resulting animation was used as an information tool at public meetings held by the U.S. Forest Service.

Advanced Simulation Capability for Environmental Management (ASCEM): As part of the Visualization team at Lawrence Berkeley National Laboratory, Ms. Horsman created 3D visualizations and time-series animations of datasets from the Savannah River F-Area Site as part of the U.S. Department of Energy (DOE) ASCEM project. The visualizations contained a variety of datasets including aerial imagery, topography, roads, rivers, structures, monitoring wells, geologic interpretation, and time-series of

measured contaminants. Ms. Horsman used the open source software VisIt for all visualizations and wrote scripts in Python for manipulating tools and animations in VisIt (Williamson et al., 2011).

Visualization of Well Failures in Diatomite Reservoirs: For work on a project to analyze well damage in California diatomite reservoirs induced by compactable formation deformation, Ms. Horsman produced visualizations used for identification of failure mechanisms. Her visualizations of ground subsidence, production and injection data, and well failure locations helped improve understanding of casing damage due to reservoir compaction (Myer et al., 1996).

Site Characterization of the Proposed Yucca Mountain Waste Repository Site: During the geologic site characterization phase of the proposed Yucca Mountain Waste Repository site, Ms. Horsman created a 3D geological model from borehole lithology and used fault horizons as interpolation boundaries. She then produced 3D visualizations of the geologic model as fence diagrams (slices) shown along with topography, surface streams, fault horizon surfaces, and tunnel locations.

Simulation of Infiltration in Fractured Rock at the Idaho National Engineering Lab (INEL): Using the results from a simulation of hydrologic flow in fractured rock, Ms. Horsman created 3D visualizations showing borehole lithology, fence diagrams of a volumetric interpolation of lithology, tracer and selenium concentrations in boreholes, neutron data, and locations of fractures in wells. She also created animations of the changes in selenium and tracer concentrations through time.

SCIENTIFIC PROGRAMMING AND GIS APPLICATION DEVELOPMENT

HEA Tools: RPI has developed a suite of ArcGIS tools for NOAA's Assessment and Response Division to allow for automated calculation of Habitat Equivalency Analyses (HEA). These tools were written using Python. Ms. Horsman authored some tools, updated existing tools to work with the latest version of Python in ArcGIS (ArcPy), and modified the functionality of some tools.

Improved Geolocation and Earth Incidence Angle Information of the SSM/I Sensors: Ms. Horsman wrote scripts in Matlab and IDL for analyzing and measuring error in the results from improved geolocation algorithms and for producing figures for publication (Berg et al., 2013). She also helped debug and modify the geolocation programs written in C and FORTRAN.

ASCEM: Tools, operators, and algorithms can be written in C++ to enhance the VisIt visualization software. While working on the ASCEM project, Ms. Horsman wrote operators to perform a modified Delaunay Triangulation on lithologic data and to load and parse project-specific data. She also wrote scripts in Python for creating animations and scenes in VisIt.

STARFire, A Spatial Planning and Analysis System for Wild Fire Management: As part of a team in the Department of Forestry Economics at Colorado State University (CSU), Ms. Horsman helped develop a stand-alone GIS-based software application used by the National Park Service for forest fire Appropriate Management Response (AMR). The application was initially written using Visual Basic 2008 and ESRI MapObjects, and later using VB .net and ESRI ArcObjects.

Meteorological Boundary Layer Studies: Ms. Horsman wrote scripts in Matlab for analyzing multi-dimensional climate model (Eta, MM4) data and radiosonde observations to gain a better understanding of planetary boundary layer dynamics.

WEB SITE DEVELOPMENT

National Park Service (NPS) Annex to Area Contingency Plans (ACP): Ms. Horsman created the HTML source and CSS style sheet for an operational guide created by RPI for the National Park Service that serves as a supplement to the NPS Area Contingency Plans (ACP) for response to oil discharge or release

of hazardous substances. The HTML document contains embedded maps that are housed and managed in CartoDB.

http://jencarta.com web site: The web site for jencarta, LLC was designed and created by Ms. Horsman. It uses PHP, CSS, and javascript, and takes advantage of the following javascript libraries: prototype, script.aculo.us, jquery, and qTip. The site also uses SimpleViewer for organizing and displaying portfolio images. *This web site is not actively being updated and so some links have been disabled.*

Departmental web sites: Ms. Horsman has been creating and maintaining web sites throughout her career. She began writing HTML in 1994 when creating and maintaining the departmental web site for the Earth Sciences Division at Lawrence Berkeley National Laboratory (http://www-esd.lbl.gov). When working for the U.S. Geological Survey (USGS), she helped maintain and updated the web site for the Earthquake Hazards Program (http://quake.wr.usgs.gov/study/deformation) and she contributed to a FEMA earthquake hazards site (http://www-socal.wr.usgs.gov/fema) that displayed earthquake deformation maps. Ms. Horsman created and maintained the web site for the McMurdo Long Term Ecological Research (LTER) which provided access to all the LTER data for streams, meteorology, glaciers, soils, and lakes (http://www.mcmlter.org/). The LTER web site also used javascript for automatically playing through a set of images on the front page. *These web sites have all changed significantly since the time Ms. Horsman worked on them*.

GROUND-PENETRATING RADAR DATA COLLECTION, PROCESSING, AND INTERPRETATION

Glaciofluvial and Glaciolacustrine Sediments in the Dry Valleys, Antarctica: In 1999-2000 and in 2006-2007, Ms. Horsman was part of a team of scientists that conducted ground-penetrating radar (GPR) and GPS surveys of sediments in the Dry Valleys of Antarctica. For her Master's thesis, she processed and interpreted data collected on terraces that were previously believed to be lacustrine deltas (Horsman, 2008). Ms. Horsman also helped process and interpret GPR data collected on subglacial depositional features (eskers), terminal moraines, and lateral moraines.

Lacustrine Sediments in Squam Lake, New Hampshire: As part of her Masters research, Ms. Horsman collected, processed and interpreted GPR profiles of lake-bottom sediments and the bedrock below.

Barchan Dunes at Killpecker Dunes, Wyoming, as Potential Mars Analog Sites: Ms. Horsman provided GPS support and GPR data processing for a team using GPR to determine presence of ice in the active Barchan Dunes in the Red Desert of Wyoming. The studies were conducted to determine the effectiveness of using the site as an analog for determining the presence of ice in dunes on Mars.

Glacial Till in Loch Vale, Colorado: Ms. Horsman was contracted by a research group at Colorado State University to conduct a pilot study of the use of GPR for determining depth to bedrock on steeply sloped glacial till in Loch Vale, Colorado.

REMOTE SENSING AND UAS

Unmanned Aircraft Systems (UAS): Ms. Horsman obtained her FAA Remote Pilot Certificate in November 2017. She has experience flying quadcopters for surveying remote areas and for photo and video collection.

Mayflower, Arkansas Pre- and Post- Oil Spill Vegetation Classification: RPI obtained an eCognition license to use in detection and classification of marine debris during which time Ms. Horsman was trained by a fellow employee to use the software. Ms. Horsman then used eCognition to classify general vegetation types in two separate WorldView-2 images of the area where an oil spill occurred in Mayflower, Arkansas on March 29, 2013. One image was obtained before the oil spill on July 9, 2011,

and the other was obtained on July 31, 2013, after initial response efforts. Ms. Horsman used GIS to conduct post-classification analyses of differences in vegetation.

Spatial Patterns of Forest Fuels Using AVIRIS Hyperspectral Imagery: Ms. Horsman was trained to use ENVI software for hyperspectral and multispectral imagery classification. As part of a team from CSU and the U.S. Forest Service (USFS), she applied her training towards the classification of forest structure from AVIRIS imagery. Ms. Horsman displayed the analysis results in maps that were then used for validation, fire behavior modeling, and forest treatment planning. Ms. Horsman has also used ENVI and ERDAS Imagine for image georeferencing and orthorectification and for classification of forest canopy cover from aerial photography.

Earthquake Deformation Patterns Revealed by Interferometric Synthetic Aperture Radar (InSAR): Interferograms from SAR data acquired before and after earthquake events reveal patterns of deformation caused by earthquake activity. Ms. Horsman modified programs in C and FORTRAN originally created by the Centre National d'Etudes Spatiales (CNES) for processing InSAR datasets and applied them towards datasets acquired in the vicinity of earthquakes that occurred in southern and central California.

SELECTED PUBLICATIONS AND ABSTRACTS

Bejarano, Adriana C., C. Anna Toline, Jennifer Horsman, Esteban Zarza-González, and Kelly Cogollo, "A climate change vulnerability framework for Corales del Rosario y San Bernardo National Natural Park, Colombia", Climate Research 70(1): 1-18, 2016

Berg, Wesley K., Mathew R. P. Sapiano, Jennifer Horsman, and Christian D. Kummerow, "Improved Geolocation and Earth Incidence Angle Information for a Fundamental Climate Data Record of the SSM/I Sensors", IEEE T. Geoscience and Remote Sensing 51(3-1): 1504-1513, March, 2013

Houck, Karen J., Jonathan A. Funk, Robert M. Kirkham, Christopher J. Carroll, and Alyssa D. Heberton-Morimoto with Cartography by Jennifer L. Horsman, "Marmot Peak Quadrangle Geologic Map, Park and Chaffee Counties, Colorado", published map of the Colorado Geological Survey, 2012

Berg, W., M. Sapiano, C. Kummerow, J. Horsman, and F. Weng, "A Fundamental Climate Data Record of Intercalibrated Brightness Temperature Data from SSM/I and SSMIS", poster at IGARSS 2011, Vancouver, Canada, July 24-29, 2011

Williamson, M., J. Meza, D. Moulton, I. Gorton, M. Freshley, P. Dixon, R. Seitz, C. Steefel, S. Finsterle, S. Hubbard, M. Zhu, K. Gerdes, R. Patterson, Y. T. Collazo et al., Advanced Simulation Capability for Environmental Management (ASCEM): An overview of initial results, Technology and Innovation 13: 175-199, 2011

Hubbard, S., B. Faybishenko, M. Freshley et al., ASCEM Phase I Demonstration Plan, ASCEM-SITE-102010-0, December 2010

Prentice, M. L., S. A. Arcone, J. L. Horsman, E. A. Medley, J. D. Toner, R. Sletten, and K. Shoemaker, "Response of the Ross Sea Ice Sheet to the Last Deglaciation: New Evidence from Taylor Valley, Antarctica", poster at AGU Fall 2009 Meeting, San Francisco, CA, December 16, 2009.

Prentice, M. L., S. A. Arcone, M. G. Curren, A. J. Delaney, J. L. Horsman, S. L. Letsinger, E. A. Medley, and J. R. Gaynor, "Stratigraphy and Geomorphology of Late Pleistocene Moraine at the Mouth of Taylor Valley, Antarctica: Implications for the Melting History of the West Antarctic Ice Sheet During the Last Deglaciation", poster at AGU Fall 2008 Meeting, San Francisco, CA, December 17, 2008.

Horsman, J. L., "The origin of several stream terraces in eastern Taylor Valley, Antarctica, from Ground Penetrating Radar: A test of the Glacial Lake Washburn delta interpretation", unpublished Master of Science Thesis, Plymouth State University, August 31, 2008, Plymouth, New Hampshire.

Arcone, S. A., A. J. Delaney, M. L. Prentice, and J. L. Horsman, "GPR Reflection Profiles of Sedimentary Deposits in Lower Taylor Valley, Antarctica", 12th International Conference on Ground Penetrating Radar, June 15-19, 2008, Birmingham, UK.

Delaney, A. J., J. L. Horsman, M. L. Prentice, and S. A. Arcone, "Multi-frequency ground-penetrating radar method for revealing complex sedimentary facies", 4th International Workshop on Advanced Ground Penetrating Radar, June 27-29, 2007, Naples, Italy.

Horsman, J. L., M. L. Prentice, S. A. Arcone, and A. J. Delaney, "Late Pleistocene-Holocene Lacustrine Deltas in Eastern Taylor Valley, Antarctica: Implications for Lake Levels from Ground-Penetrating Radar", oral presentation at AGU Fall 2007 Meeting, San Francisco, CA, December 12, 2007.