JENNIFER HORSMAN, M.S. **Research Planning, Inc.**
Geospatial Specialist/Geologist

Ms. Horsman is a geospatial specialist with experience in Geographic Information Systems (GIS), scientific data visualization, data management, programming/scripting, geophysics, and remote sensing with applications in various fields including environmental science, natural resource management, climate change, conservation, forestry, and meteorology.

EDUCATION AND CERTIFICATION

- FAA Part 107 Remote Pilot Certificate, #406872 (2019)
- Certification as a GIS Professional (GISP), GIS Certification Institute, #64702 (2011)
- M.S., Environmental Science and Policy, Plymouth State University, Plymouth, NH (2008)
- A.B., Geophysics, University of California, Berkeley (1993)

PROFESSIONAL EXPERIENCE

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

1. GIS analysis and data management
2. Online map and mobile app development
3. GIS application development
4. Remote sensing
5. Uncrewed Aircraft Systems (UAS)
6. Three-dimensional (3D) visualization

GIS ANALYSIS AND DATA MANAGEMENT

Environmental Sensitivity Index (ESI) Mapping: Ms. Horsman has led the shoreline creation and classification effort for the following ESI projects used for coastal zone management, contingency planning, and hazardous material/natural disaster responses: Louisiana, Texas, Washington & Oregon, Delaware Bay, Chesapeake Bay, Southwest Peninsular Florida, Florida Panhandle, South Florida, East Florida, Georgia, South Carolina, Lake Erie, Lake Ontario, St. Lawrence River, St. Marys River, Straits of Mackinac, St. Clair/Detroit River System, and the Panama Canal. She also contributed much of Chapter 3 in the NOAA ESI Guidelines document (Petersen et al., 2019).

National Park Service (NPS) Nine Watersheds Resources at Risk: Ms. Horman created maps for documents that identify potential impacts or threats from discharges or releases of oil or hazardous substances to lands, waters, and resources managed by the NPS. These nine documents were produced on a watershed scale to support Sub-Area Contingency Plans and to aid local, state, and federal spill responders. Maps display locations of important resources such as critical habitat, dams, gauging stations, national monuments, and conservation areas along with locations of potential threats such as refineries, oil wells, pipelines, railways, and roads.

Estimating Potential Impact of Oiling on Beaches: Using LiDAR topo-bathymetry, NOAA CO-OPS observed water levels, and NOAA Wavewatch III hindcast model output, Ms. Horsman calculated an estimate of the extent of beach impacted by stranded and potentially buried oil during an off-shore oil spill incident.

USDOT Pipeline and Hazardous Material Safety Administration (PHMSA) Drinking Water for Unusually Sensitive Areas: Ms. Horsman used GIS analyses to create guidelines for assigning Pettyjohn

classifications to groundwater wells in the USA based on aquifer geology and well data (e.g., location, depth, pump rate). She then developed a set of rules from these that were applied to the groundwater wells of each state within a GIS model to determine drinking water unusually sensitive areas (DW USA).

GIS Supervisor and Incident Response Data Manager: As a GIS Specialist with the USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Ms. Horsman supervised the GIS Technicians in each state of a six-state region. She was also the GIS Manager for a Grasshopper Suppression Program Incident Response in 2010 where she managed a team of 3-5 GIS Technicians and coordinated with pilots applying aerial insecticide treatments.

Central Shortgrass Prairie Ecoregional Assessment: As a GIS Analyst at The Nature Conservancy (TNC), Ms. Horsman managed a two-year conservation assessment of the Central Shortgrass Prairie. She was responsible for gathering all spatial information for the project which included 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 utilized spatial optimization programs, SPOT and MARXAN, to prioritize locations for conservation areas (Neely et al., 2006).

ONLINE MAP AND MOBILE APP DEVELOPMENT

Panama Canal ESI Field Observations: RPI created an ESI atlas for the Panama Canal Authority in 2004 that is being updated for 2023. Ms. Horsman developed a QuickCapture app to record shoreline observations and photos during her field trip to the Panama Canal. She also created a Field Maps app with layers that include the 2004 ESI shoreline, water navigation landmarks, and the data collected via QuickCapture.

Vessel, All-hazards, and Debris Response (VADR) Online Database and Mobile Apps: Ms. Horsman is part of a hurricane response team that developed and maintains an ArcGIS Online geodatabase called VADR. The database is deployed in anticipation of a U.S. Coast Guard (USCG) response after a major hurricane makes landfall. We developed Collector and Field Maps used by the USCG (and sometimes state agencies) to collect and monitor identification and activity information on potential pollution hazards such as displaced vessels. During the response, the VADR database is fed into NOAA's Environmental Response Management Application (ERMA), which is used as the Common Operating Picture (COP).

Florida Keys Abandoned and Derelict Vessels (ADV) and Submerged Debris: RPI has had several projects in the Florida Keys with the goal of identifying derelict vessels and debris. For each of these projects, Ms. Horsman has helped create ArcGIS online geodatabases and mobile apps in Collector, QuickCapture, and Field Maps for making observations during aerial overflights and on-water navigation. She also used these apps to collect data in the field and helped produce ArcGIS Online Dashboards to display the results. For the last effort in May 2022, Oriented Imagery was used in QuickCapture.

UAS Flight Logs: Ms. Horsman created a Survey123 mobile app that RPI remote pilots use to record information about all UAS missions. The survey form contains sections for date and time of mission, pilot in command and visual observer(s), equipment used, weather observations, type of mission, controller app(s) used, number of batteries used, and type of data collected. The app also includes images of pre-flight and takeoff checklists.

ArcGIS Survey123, Story Maps, and Dashboards for the St. Simons Sound Incident (SSSI): RPI participated in the response to the oil spill caused by the grounding and capsizing of the M/V Golden Ray in St. Simons Sound, Georgia. Ms. Horsman was part of a team that developed a geodatabase and field data collection app in Survey123 that was used to record natural resource observations during the wreck salvage operations. Observation statistics were displayed in several ArcGIS Online Dashboards that were accessible through a Story Map that operations managers used to monitor activities.

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 served as a supplement to the NPS Area Contingency Plans (ACP) for response to oil discharge or release of hazardous substances. The HTML document contained embedded maps that were housed and managed in CartoDB.

GIS APPLICATION DEVELOPMENT

ArcGIS ESI Tools: As part of a team at RPI, Ms. Horsman developed tools in ArcMap for displaying ESI data and producing printable ESI map atlases. These tools were originally developed in Visual Basic .Net (VB .Net), ESRI ArcObjects, and iTextSharp and are currently being adapted for ArcGIS Pro.

An Interactive Climate Change Vulnerability Assessment Tool: A climate change vulnerability framework was specifically developed for Corales del Rosario y San Bernardo National Natural Park (PNNCRSB), Colombia, a park designated to protect coastal and marine environments. Vulnerability scores for resources were developed based on sensitivity, exposure, and adaptive capacity to several climate change factors (sea surface and air temperature, precipitation, ocean acidification, sea level rise and inundation from extreme events). Ms. Horsman developed a custom, interactive ArcMap visualization application with a tool panel that contained radio buttons for easily switching between unweighted/weighted vulnerability scores and optimistic/pessimistic scenarios; a transparency slider; check boxes for turning on and off the current inundation (sea level) line, basemap imagery, and pop-up information windows; drop-down menus for choosing a particular resource to view and for selecting an island to zoom to; and a button for displaying a table of selected attributes for just those grid cells currently visible in the map. Also, a histogram chart displayed in the tool panel illustrated the total area in km^2 in each of ten score ranges from low to high (Bejarano et al., 2016).

HEA Tools: Ms. Horsman was part of a team at RPI that 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 for use in ArcMap and ArcCatalog using Python.

REMOTE SENSING

Mayflower, Arkansas Pre- and Post- Oil Spill Vegetation Classification: Ms. Horsman 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: As part of a collaborative team from CSU and the U.S. Forest Service (USFS) Rocky Mountain Research Station, Ms. Horsman used ENVI to classify forest structure from AVIRIS hyperspectral imagery (Jia et al., 2006). Ms. Horsman displayed the analysis results in maps that were then used for validation, fire behavior modeling, and forest treatment planning. Ms. Horsman 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.

UNCREWED AIRCRAFT SYSTEMS (UAS)

RPI UAS Program Lead: In 2019, Ms. Horsman obtained her FAA Part 107 Remote Pilot certificate and created a UAS program at RPI. She currently manages a team of four certified pilots and two visual observers. Ms. Horsman also manages a UAS fleet consisting of one Parrot Anafi, one DJI Mavic 2 Pro, one DJI Mavic 3, and one DJI Mavic Mini. She has used Agisoft Metashape, Pix4Dreact, Drone2Map, and Maps Made Easy for imagery mosaic processing. In March 2022, she joined the FAA Safety Team as a DronePro Representative (volunteer position).

Job Aids for the Use of Small UAS (sUAS) in Oil Spill and Hurricane Response: Ms. Horsman led a team in developing sUAS Job Aids for the NOAA Office of Response and Restoration (OR&R). The job aids provide guidance for the effective use of consumer-grade sUAS with photo and video capability to supplement oil spill response activities such as reconnaissance overflights and shoreline assessments and hurricane response activities such as post-storm derelict vessel/pollution source identification and removal (Horsman et al., 2021).

Use of sUAS for Incident Response: Ms. Horsman has collected UAS aerial imagery and video and processed imagery mosaics for the following incidents: M/V Golden Ray grounding and capsize in St. Simon Sound, GA, September-November 2019; post-Hurricane Irma submerged debris detection and identification in the Florida Keys, May 2021; Hurricane Ida wellhead spill in Bayou Perot, LA, October 2021; and Pipeline P00547 spill near Huntington Beach, CA, October 2021. Ms. Horsman also processed UAS imagery mosaics for an oil discharge into a marsh area near High Island, TX, April-June 2022.

THREE-DIMENSIONAL (3D) VISUALIZATION

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 designs. 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 USFS.

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).

RPI

SELECTED PUBLICATIONS

NOAA Environmental Sensitivity Index (ESI) Maps: https://response.restoration.noaa.gov/esi_download

Horsman, J., M. White, C. Childs, J. Stout, and G. Graettinger. 2021. Uncrewed Aircraft Systems Oil Spill Response Job Aid, https://response.restoration.noaa.gov/jobaid/UAS-hurricane, 2021; Uncrewed Aircraft Systems Hurricane Response Job Aid, https://response.restoration.noaa.gov/jobaid/UAS-hurricane, 2021.

Petersen, J., D. Nelson, T. Marcella, J. Michel, M. Atkinson, M. White, C. Boring, L. Szathmary, and J. Weaver. 2019. Environmental Sensitivity Index Guidelines, Version 4.0. NOAA Technical Memorandum NOS OR&R 52. https://response.restoration.noaa.gov/resources/esi-guidelines

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

Meyer, J., E.W. Bethel, J.L. Horsman, S.S. Hubbard, H. Krishnan, A. Romosan, E.H. Keating, L. Monroe, R. Strelitz, P. Moore, G. Taylor, B. Torkian, T.C. Johnson, and I. Gorton. 2012. Visual data analysis as an integral part of environmental management. IEEE Transactions on Visualization and Computer Graphics 18(12): 2088-2094. https://ieeexplore.ieee.org/document/6327213

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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. 2011. Advanced simulation capability for environmental management (ASCEM): An overview of initial results, Technology and Innovation 13: 175-199 *(cover art and figures)*.

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Neely, B., S. Kettler, J. Horsman, C. Pague, R. Rondeau, R. Smith, L. Grunau, P. Comer, G. Belew, F. Pusateri, B. Rosenlund, D. Runner, K. Sochi, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative. The Nature Conservancy of Colorado and the Shortgrass Prairie Partnership. 124 pp. and Appendices. https://mountainscholar.org/bitstream/handle/10217/47006/CSP_Final_Report_2006.pdf

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