USGS National Hydrography Dataset Newsletter
Vol. 13, No. 4, February 2014
by Jeff Simley, USGS

Alan Rea Selected as Hydrography Data Manager

Al Rea has been selected for the Hydrography Data Manager position in the National Geospatial Program's Topographic Data Services Team at the U.S. Geological Survey. Al brings to the team a wealth of knowledge and a user perspective on hydrography and elevation data. He will work alongside Jeff Simley to lead the hydrography program's NHD and WBD datasets as they continue to evolve as cutting-edge solutions for geospatial data in water science and management.

Al graduated with dual B.S. degrees in Agricultural Engineering and Soil Science in 1986, and an M.S. degree in Agricultural Engineering in 1988, with a minor in Statistics, all from Oregon State University. He started using Arc/Info Rev 3 on a Prime minicomputer as part of his thesis research in 1987. Al worked in the era of 9-track tape, 300-MB hard drives the size of washing machines, and trying to run Arc over a remote terminal connection on a 300-baud dialup modem. He began working for USGS in 1989 in the Oklahoma City office, where he did field groundwater well inventories, drill crew, statistical, and GIS work for one of the first National Water Quality Assessment (NAWQA) pilot studies. He led a project that produced a hydrologically-conditioned 60-meter DEM of Oklahoma in 1995, gaining experience in raster data analysis for hydrologic applications. His first exposure to NHD was in 1998 when he was brought in to provide technical support for the "Friends of the NHD Review", basically the beta test of the brand-new NHD. (He got his first look at the NHD data model at the same time the users did.) In 1999 he moved to the Boise, Idaho office of USGS, and developed hydrologically-conditioned 30-meter DEMs of Idaho for a project that evolved into the Idaho StreamStats application after Al joined the national StreamStats development team. In the early 2000's Al also began working with the team that has become known as the NHDPlus development team, focusing on raster processing techniques to integrate the elevation with hydrography data. Over the years Al has been an instructor for many week-long courses in Raster Data Analysis and StreamStats Data Development, and has developed many of the data processing tools used by StreamStats and NHDPlus.

Indiana Conflation Project by Joel Skalet

In the February–June timespan of 2008, the Indiana Waters Framework Data Workgroup conducted a survey of potential stakeholders for building a local resolution NHD conflation project. The survey conclusions provided by Mike Martin, Agency GIS Coordinator Indiana Department of Natural Resources are as follows:

• Users of Waters Framework Data are a diverse group with diverse needs, but with a consensus that a variety of NHD and water-related data is a necessity for work being completed across the State.
• Data from the NHD would seem to meet the needs of most users seeking the Waters Framework Data, if available at higher resolutions.
• While the 1:24,000-scale of the high–resolution NHD meets the needs of many, most need data at a larger scale. Data at a scale of 1:6,000 would meet the needs of most, but a large percentage need data at a scale of 1:2,000 or better.
• Needs for mapping can be met by providing shapefiles of statewide NHD Lines, Areas, Waterbodies, and Points which can be downloaded from a state or Indiana Geographic Information Council website. These will be projected (UTM, NAD83) with a projection file included. Additionally, users will also be provided with how to work with projected data combined with non-projected data (e.g., using statewide shapefiles with USGS geodatabases in Geographic Coordinate System).

• Needs for in–depth analysis and modeling could be met by the topology–based feature classes for watersheds which can be downloaded from the USGS NHD website.
The project commenced in 2011. Using AECOM as a contractor, to this date, 10 subbasins have been completed and uploaded to the National Database. Thirty percent of the state has been finished, and Phase 2 of the project will continue into the northern part of the state.

Coastal Salmonid Monitoring Program by Tom Christy

The multi-agency California statewide CMP (Coastal Salmonid Monitoring Program) has been ramping up lately. About a year ago the program contacted Tom Christy to help with developing a high resolution stream gradient model they could use in their sampling universe development phase. He had been working on stream gradient modeling for another project. After several months of working out procedures he was able to come up with a series of geoprocessing models that transform elevation reaches from 10-meter NED DEM derived streams to NHD flowlines as linear events. Since the CMP wanted high resolution data to pinpoint gradient barriers to salmon he decided to diverge from the seemingly standard practice of averaging gradient over defined reaches. Instead, Tom created reaches defined by ranges of slope, which in effect models spatially relevant gradient changes. Also, since the CMP wanted to overlay several of the variables together that they use to determine sampling universe, he found an effective way to transform events from the DEM streams to the flowlines while maintaining a spatial correlation with the original DEM streams. Per the CMP's request, Tom also uses this concept to overlay NOAA IP (salmon habitat intrinsic potential, which contain flow volume information) events on top of the gradient so they can analyze the gradient and stream flow together. Along with known barriers from the PAD (Passage Assessment Database), which have already been indexed to NHD, CMP now has the three overlays they need to determine their first-cut sampling universe. Granted, a lot of the limits to anadromy are already known by these area scientists, but there are many more that can be flagged by the overlays for the scientists to field verify later.

Tom continues to process gradient and IP for CMP project areas as needed, and he'll also be giving a non-technical talk about the modeling as part of a larger CMP presentation at the Salmon Restoration Federation conference next month. If interested, or want more information on the modeling, contact Tom at Tom.Christy@wildlife.ca.gov. The attached graphic illustrates the model's ability to find gradient breaks (the red >20% gradient reach between two 0-4% gradient reaches). This modeled reach happens to correspond to an already known PAD barrier to anadromy. See ftp://nhdftp.usgs.gov/Hydro_Images/Smithbasinwaterfall.JPG

U.S. Forest Service Receiving NHD Update Training by Bill Smith

The US Geological Survey has presented two webinar NHD training sessions to US Forest Service personnel detailing the NHD Update Toolbar v6.0.1.19 and the entire NHD editing process. The first session was conducted on February 12, and the second session on February 13, 2014. In both sessions the NHD Stewardship Websites (Production and Development) were discussed. The process used to 'Check Out' NHD for editing was demonstrated, the NHD Update toolbar was detailed, as was the difference between 'Get Job from USGS' and 'Open Job'. A basic NHD overview was presented and important concepts in the NHD (Permanent IDs, ReachCodes, and Flow Network) were discussed. The importance of using the Initial Quality Control (QC) process was discussed as was the Final QC process.

A sample NHD job was loaded, and attendees were given instruction on use of the NHD Update Tool to complete sample edits. Attendees followed along as edits were completed, the 'Apply Rules' and 'Save' functions in the tool were discussed. The Edit History function of the tool was discussed and why it is critical for editors to verify all edits appeared in the Edit History file.

Each attendee was asked to 'Check Out' NHD from the Development (Training) website, use the 'Get job from USGS' function to load the data into an ArcMap 10.1 session, and practice sample edits. A follow up session will be conducted the week of 24-28 February 2014 to answer any questions attendees may have concerning the entire editing process.

For several years, USFS has expressed interest in the NHD, and potential sub-stewardship of the NHD within US Forest boundaries. Using the NHD in the USFS mapping process, and densifying the stream network for mapping and modeling are goals of the USFS.

If you have questions, please contact BJ Smith at 303-202-4493 or via email at wjsmith@usgs.gov.

If interested in setting up a Web Ex NHD Training session for your agency, please contact your USGS NHD Point of Contact:

NHD Region 1: Hank Nelson	hpnelson@usgs.gov	303-202-4448
NHD Region 2: BJ Smith	wjsmith@usgs.gov	303-202-4493
NHD Region 3: Joel Skalet	jjskalet@usgs.gov	608-238-9333 x152
NHD Region 4: Dave Arnold	darnold@usgs.gov	573-308-3533

Network Improvement Project Status by David Kraemer

The Network Improvement Project is to insure that the complete high resolution NHD for all 50 states and U.S. territories is ready for running the NHDPlus Value Added Attributes (VAA). The Initial phase of the Network Improvement Project is to update the NHD based on errors found by the NHDPlus QA/QC checks that were run at the Region (HUC 02) level on a late 2011 snapshot of the NHD. Currently the Double Check phase of the Network Improvement Project is running the NHDPlus QA/QC checks on a late 2013 snapshot of the NHD at the Sub-Region (HUC 04) level. The Double Check phase will correct any additional errors that would prevent the creation of the NHDPlus VAA.
During this month Region 03 (southern Atlantic and eastern Gulf coasts) was completed for the Initial phase of the Network Improvement Project.
The current status for the three Network Improvement Project components is:

1. Initial Network Improvement: Charles Bowker is editing the remaining sub-basins within Louisiana (Region 08) and David Kraemer is editing a sub-basin within Indiana (Region 05). Dave is also editing the sub-basins within Regions 01 and 04 along the Canadian border (Maine coast to Lake Superior).
2. Network Improvement Double Check: Charles Bowker is editing Region 18, Allen Karsh is editing Region 02, and David Kraemer is editing Regions 07 & 10. He is also preparing additional Regions for editing.
3. Alaska Initial Network Improvement: Network Improvement is dormant in Alaska, while the Double Check edits are completed in the other states.

Uncompleted Initial Network Improvement Sub-Basins Checked-Out by States (sans Alaska):
Indiana (05120111, 05120113, 05120201, 05120202, 05120206)
Mississippi (08030202 and 08030207)
As States check-in their jobs we will edit these uncompleted Initial Network Improvement Sub-Basins.

Initial Network Improvement Regions Completed: 02, 03, 06, 07, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, and 22.
Network Improvement Double Check Regions Completed: 06 and 20.

Hydrography Overlay Service to be Updated

In order to fulfill a requirement from the WBD Community, the USGS is updating the Hydrography Overlay Service to include 6-digit Hydrologic Units. This will affect the number of layers in the service. Any applications that consume this service will be impacted due to a change in configuration. Please make the changes necessary to accommodate this update. To access NHD Services, go to http://basemap.nationalmap.gov/arcgis/rest/services/USGSHydroNHD/MapServer

Suspension of HEM Checkouts

In preparation for NHD Model 2.2 release, all HEM checkouts from the stewardship website will be suspended until further notice. Please check HDC announcements and Twitter for updates.

Border Harmonization Work Cited in Newspaper

The Missoulian, a newspaper serving Western Montana, has run an article on the harmonization of NHD and WBD across the border with Canada. The article cites how this will improve ecosystem research. See: http://missoulian.com/lifestyles/recreation/usgs-releases-watershed-maps-that-cross-u-s--canada/article_39b0c1d0-9f72-11e3-b291-0019bb2963f4.html

The Value Added Attribute of the Month

Do you know your VAA's? This NHD Newsletter starts a monthly feature to describe each one of the Value Added Attributes. The flow network embedded in the NHD is what gives it its analytic power. The VAA's boost this power by pre-calculating a number of network characteristics to make network analysis richer and easy to exploit. The month's VAA is the: Hydrologic Sequence Number – HydroSeq.

The segments of the network need identifiers so that the segments can be managed. There are many ways to do this. One way is to start at the top of the list (table) and just start counting off such that the first segment (record) is one, the second is two, etc. But, there is also an "intelligent" way to do this by organizing the numbers such that any larger number is upstream and any lower number is downstream for a given path. So for a given network "segment 6" will be upstream of "segment 5", and "segment 4" will be downstream of "segment 5". Using this method makes understanding upstream and downstream relationships a snap. This identifier, HydroSeq, is used by most all of the other VAA's. It is a fundamental element that the whole VAA system is based on.

This is what you need to know about HydroSeq:

- A nationally unique sequence number that places each stream flowline in hydrologic order
- A compact numbering system
- At any flowline, all upstream flowlines have higher hydrologic sequence numbers and all downstream flowlines have lower hydrologic sequence numbers
- Ascending numbers go from downstream to upstream
- Descending numbers go from upstream to downstream

If you can't wait for next month's VAA-of-the-month, you can learn the full VAA story at: http://gio.usgs.gov/egis/training/Brown_Bags/#NHDHIGH

Sensitivity of watershed attributes to spatial resolution and interpolation method of LiDAR DEMs in three distinct landscapes a review by Keven Roth

A study (accepted but not yet published) titled "Sensitivity of watershed attributes to spatial resolution and interpolation method of LiDAR DEMs in three distinct landscapes" by Goulden, T. Hopkinson, C. and Jamieson, R. compared drainage density, individual stream length and positional accuracy of "synthetic" stream networks generated from LiDAR-derived DEMs of different resolutions using different interpolation methods. This study pointed out that little analysis of scaling relationships between stream length and DEM resolution has been done, nor has the choice of interpolation method and its effect on watershed extents and stream channel delineation been well-studied. The study looked at three distinct landscape types: an alpine environment with large elevation changes, a boreal wetland environment with minimal elevation change, and a hill to valley floor site with moderate elevation change. Streams were field surveyed and(or) delineated using orthoimages to validate the results.

One hypothesis of the study was that with higher resolutions of DEMs the drainage density would increase and the streams would become more accurate. The study found that this relationship of increasing drainage density with increasing DEM resolution only occurred in the minimal-elevation change area in the boreal wetland. This area was described as having surface flow connecting several lakes with divergent topography and subtle changes in relief. The study indicated that it was hard to meet the contributing area threshold for stream initiation so headwaters weren't lengthened. The decrease in drainage density at lower DEM resolution was probably related most strongly to the loss of detail at lower resolutions.

In the high-elevation change area, the drainage density decreased as expected from the 1m DEM to the 5m DEM but drainage density actually increased at 25m and 50m, a result according to the study of an increase in total length of headwater streams. This was described as a result of convergent topography "which facilitates meeting the stream initiation area threshold at higher elevations on the hillslope." The moderate-elevation change area fell in between. Drainage density decreased between 1m and 5m but stayed the same for the 10m, 25m and 50m resolutions. The study concluded… "this research has shown that, in addition to the DEM resolution and stream initiation threshold, the topographic characteristics will also exert influence on the total length of the drainage network which prevents the determination of a generalized scaling relationship between drainage density and DEM resolution."

Spatial Accuracy was measured using a 3m wide buffer to compare locations. Only two sites could be evaluated because the third site (the boreal wetland site) did not have good surveyed stream data. Although more points fell within the 3m buffer as the DEM resolution increased, even at 1m resolution, the study found that mean spatial accuracy was 71% for the moderate elevation change area and 61% for the high elevation change area (percentage of points that fell within the 3m buffer). At 10m, the spatial accuracy was 22% for the moderate elevation area and 35% for the high elevation change area. The reduction in accuracy was attributed to meanders and the loss of fine detail at lower DEM resolution. That may also explain why the high elevation change area had a higher percentages of points within the 3m buffer at 10m. The streams are probably steeper with fewer meanders. However, this supposition was not discussed in the paper.

Aside from corroborating that resolution, initiation thresholds and topography each affect the determination of total length for drainage networks, and that small meanders account for much of the difference in spatial accuracy, two questions remain. What does this mean and are there meaningful applications of these findings for the NHD?

Downloads of NHD Data from the USGS in January

During January there were 4,066 ftp downloads. This is broken into 1,680 downloads of statewide high resolution NHD and 116 medium resolution downloads. There were 2,137 subregion-based high resolution downloads and 133 medium-resolution downloads. Usually there are an equal number of National Map Viewer downloads, but these are no longer being reported.

2014 AWRA Spring Specialty Conference GIS and Water Resources VIII – Data to Decisions

Geographic Information Systems (GIS) are an indispensable tool in providing timely and accurate information necessary for making excellent water resources decisions. Emerging technologies in data collection, information management, web and cloud services, and visualization have opened up significant new avenues for sharing solutions across local, state, federal, and international levels. Come and discover new solutions for your organization. The conference is May 12-14, 2014 at the Snowbird Resort in Snowbird, UT. See http://www.awra.org/meetings/SnowBird2014/

NHD Photo of the Month

This month's photo was submitted by Kathy Yoder of the USGS. This is Sloan's Lake, an urban lake in Denver, Colorado. The lake was accidently created one hundred years ago when a farmer digging a ditch dug into a spring that subsequently flooded the surrounding land.
See ftp://nhdftp.usgs.gov/Hydro_Images/SloansLake.JPG. Submit your photo for the NHD Photo of the Month by sending it to kyoder@usgs.gov. This will allow the program to build a library of real-world photos linked to the NHD.

January Hydrography Quiz / New February Quiz

Kitty Kolb of the USGS was the first to guess the January NHD Quiz as Grand Island, separating two channels of the Niagra River in New York/Ontario. See ftp://nhdftp.usgs.gov/Quiz/Hydrography102.pdf

Kitty has worked as a Geographer for the USGS North Carolina Water Science Center since 2010. She became intimately acquainted with the NHD while preparing data for the recent North Carolina StreamStats update. Kitty also provides GIS research support to NCWSC projects as varied as studies of coastal groundwater modelling, confined-animal-feeding operations, Albemarle Sound environmental monitoring, and regional rainfall networks. In her previous career, she was an archaeologist.

Others with the correct answer (in order received) were: Jim Seay, Roger Barlow, Steve Shivers, Barb Rosenbaum, Matt Rehwald, Daniel Button, Al Rea, David Straub, Janet Kellam, Ellen DAmico, John Griffin, David Asbury, John Kosovich, Mike Domaratz, Andy LeBaron, Edwin Abbey, Rick Campbell, Dennis Dempsey, Bernie Sroka, Evan Hammer, and Ken Koch.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography103.jpg. Where is this bend in a major American river (that has barge traffic)? Send your guess to jdsimley@usgs.gov.

Thanks to Joel Skalet, Tom Christy, Bill Smith, David Kraemer, Kathy Yoder, John Varndell, Cindy McKay, and Keven Roth.
The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.
You can view past NHD Newsletters at http://nhd.usgs.gov/newsletter_list.html
Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.