THE SUMMIT

News From and For The Washington GIS Community

WAURISA

The Washington State Chapter of URISA – The Association for GIS Professionals

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2012 DICK THOMAS STUDENT PAPER COMPETITION WINNER

ELWHA RIVER SEDIMENTATION IMPACTS ASSESSMENT SYSTEM

By: Mark Beggs, Marshall Kosaka, Wes Lauer Ph.D., Anna Sigel, and Renee Vandermause

Two dams located on the Elwha River in northwestern Washington are currently under deconstruction. Historically, the Elwha River has been one of the most productive salmon rivers for its size in the Pacific Northwest.[1] However, following the completion of the 108 foot high Elwha Dam and 210 foot high Glines Canyon Dam, in 1913 and 1927 respectively, anadromous fish were prevented from accessing 81 miles of habitat along the main stem and major tributaries. Salmon populations in the Elwha River watershed experienced a ninety-eight percent reduction since the construction of the dams.[2]

The reservoirs above the dams have accumulated over 24 million cubic yards of sediment, a portion of which will erode as the dams are removed and then be deposited on the downstream river bed and floodplain and potentially increasing water surface elevations. Extensive numerical and physical modeling has been performed to assess the impacts of the dam removals (Randle and Bountry, 2010). However, because the Elwha restoration project represents the largest dam removal project in history, its effects are difficult to assess with precision. For this reason, the United States Bureau of Reclamation (USBR), the agency overseeing dam deconstruction, has developed an adaptive management plan to address uncertainty in system response to the dam removals. The plan relies in part upon continuous monitoring of water levels in the lower river at a set of newly installed stream gages. Seattle University's Civil Engineering Team 12.7 (the Team) was requested to perform hydraulic modeling that will allow USBR to rapidly assess the rate of downstream sedimentation using data collected at the new gages. The analysis is meant to bracket a range of possible sedimentation scenarios along the lower Elwha River and is not intended to represent a detailed prediction of geomorphic response to the sediment released from the dams.

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PRESIDENT'S COLUMN

Greetings GIS friends and colleagues. It was great fun to see so many of you at our annual 2012 Washington GIS Conference. The conference was well attended with plenty of inspiring presentations. Thank you to *everyone* who makes that event happen! Congratulations to Greg Babinski on being recognized as this year's recipient of the Summit Award, which acknowledges his long standing contributions to the Washington GIS community. Greg has a busy travel schedule as he proselytizes GIS in foreign lands while he serves as president of the national URISA, but if you can catch him between adventures, I encourage you to take a moment to thank and congratulate him on all his hard work.

Be sure to mark your calendars for next year's conference, which will be held at the Lynnwood Convention Center in Lynnwood, WA on May 6 – 8, 2013. Already our conference committee is underway with planning the next event and our thanks go to Heather Glock and Greg Babinski for taking on the task of chairing that committee. Be sure to join in if you are at all interested in participating more fully in your local GIS community. The conference committee is the busiest and has the longest task list. All hands are welcome! The theme for the next conference is *Power of Place.*

Speaking of conferences, this year's annual GIS-Pro conference, the annual event for national URISA, is being held right in our backyard. Join your colleagues in Portland, Oregon on September 30th – October 4th for that event and rub elbows with the people leading GIS efforts from all over the nation. See the www.urisa.org page for more details. Several of our board members are planning on attending and also participating in the chapter leaders discussion, where ideas from all URISA chapters get shared. If you have an idea to contribute, regarding things URISA should be focusing on, new training topics, or other GIS advocacy issues, be sure to get it to a board member so it can be added to the discussion.

We are looking forward to a great year and I hope to see you all involved in shaping GIS in our region. As always, I can be reached at president@waurisa.org and every second Tuesday at our WAURISA board meeting conference calls. See you there!

Ann Stark, President
@starkann

Save the Dates:

2013 Washington GIS Conference
May 6-8, 2013
Lynnwood Convention Center

ELWHA RIVER SEDIMENTATION IMPACTS ASSESSMENT SYSTEM

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Proposed Solution

The main work products of the project include rating curves at five locations along the lower Elwha River. A rating curve is a graph of water surface elevation (ft) plotted versus discharge (cfs). For each sedimentation scenario at a given gage, there is a single rating curve representing the relationship between the water surface elevation and discharge. Changes in the stage-discharge relationship over time along the lower river can be used to determine whether a certain percent of the channel and/or floodplain has filled with sediment. For example, Figure 1 below presents two hypothetical rating curves, one (scenario A) associated with high sediment deposition and another (scenario B) associated with low sediment deposition. In principle, stage measurements at any discharge could be used to determine whether the curve A or curve B better represented actual conditions on the river. This would then allow managers to make informed judgments regarding changes in water surface elevations prior to the occurrence of a high flow event. The Team developed rating curves using both 1-D and 2-D hydraulic models and used the results to provide recommendations for the USBR's adaptive management plan.

Methods and Design Approach

In order to support their analysis, the Team did a comprehensive literature review pertaining to existing river models, geomorphic assessment and hydraulic modeling.

The USBR installed 26 water surface gages along the Middle and Lower Elwha River that were intended to indirectly monitor sedimentation. Interpreting the discharge and water surface elevation data collected from these gages required the development of rating curves for each gage. These flood assessment tools give detailed knowledge of changing conditions and act as a warning system for potential flood risk. The following deliverables provided by the Team encompass the flood assessment tools:

1.) Creation of Sedimentation Scenarios: 4 scenarios for 1- and 2-D model
2.) 1-dimensional model (HEC-RAS) rating curves
3.) 2-dimensional model (SRH-2D) of Lower Elwha River
4.) 2-dimensional model rating curves

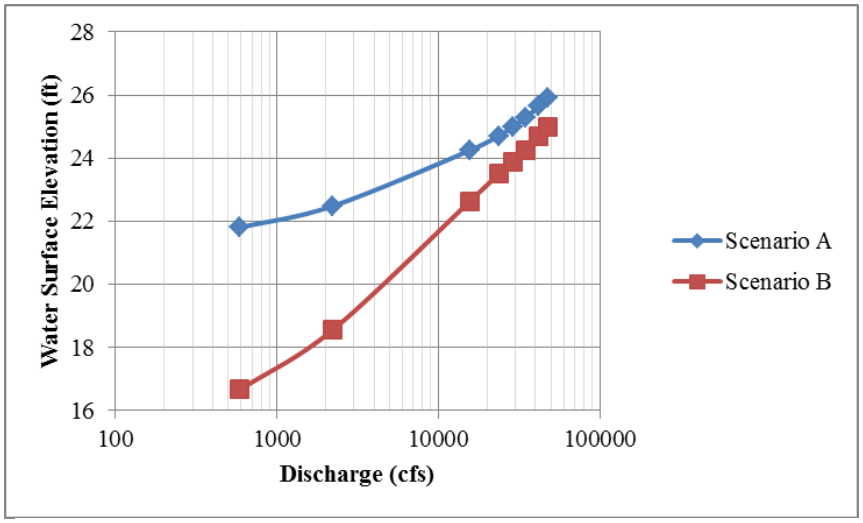

Figure 1: Rating Curve Illustration; Scenario A represents a high amount of sedimentation and Scenario B represents a low amount of sedimentation

Using Arc-GIS

Arc-GIS was crucial in the development process for the following reasons:

- Create a digital elevation model (DEM) for use in the 2D model
- Update the USACE Manning's roughness map originally developed for the HEC-RAS model to support creation of rating curves
- Create a sedimentation scenario more likely seen in natural environments

Sedimentation Scenarios

- Sedimentation patterns on the Lower Elwha could involve some combination of sedimentation in the main channel and on the floodplain. These patterns could influence the rating curves. To ensure that the analysis incorporated a full range of possibilities, the team developed four separate sedimentation scenarios for use in developing potential post dam removal rating curves.

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[1] Wunderlich et al., 1994
[2] Duda et al.2011

ELWHA RIVER SEDIMENTATION IMPACTS ASSESSMENT SYSTEM

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These scenarios include:

A) Current Conditions (without dam removal)
B) Aggradation in the main channel only.
C) Aggradation on the floodplain only.
D) Aggradation on both the floodplain and main channel

For each scenario we chose to fill each cross-section of the models a 100 % deposition value based on the amount of course and fine grained materials in the reservoirs. In order to model sediment aggradation over time we also ran our models at percentages of the maximum deposition value.

Modeling

As part of the two-dimensional analysis of the Lower Elwha River, the Team had to collect data from various sources. The data consisted of bathymetric data, data defining the left and right banks of the river developed from an aerial photograph, cross-sectional data defining the channel bed elevations, LiDAR and side channel data. When importing the data into GIS, the team defined the coordinate system based on the original coordinate system in which the files were created. At times there was difficulty lining the files in GIS up with each other due to the multiple coordinate systems used for the given datasets. To solve this problem, the Team adjusted the reference coordinate systems for each data set to the Washington State Plane System. In addition, datasets that were initially in feet were converted to meters to avoid any complications associated with units.

DEM construction involved merging LIDAR and bathymetric surveys for the main channel. Lack of data in the side channels necessitated the development of an interpolation approach that could make use of aerial photographs to augment the limited survey data.

Processing Data

After gathering the necessary data, the Team began creating the Digital Elevation Model (DEM) that would ultimately be used in the SRH-2D program simulations. The Team began this task by comparing known elevation data to that of the LiDAR data.

To do this, the ArcGIS "interpolate line" function was used to extract elevation data from the LiDAR. Once the elevation data had been extracted, the dataset was exported to MS Excel. The cross-sectional distance from the left bank was then determined using the Pythagorean Theorem and the northing and easting coordinates. Next, the LiDAR elevation data was plotted as a function of distance from the left bank in Excel.

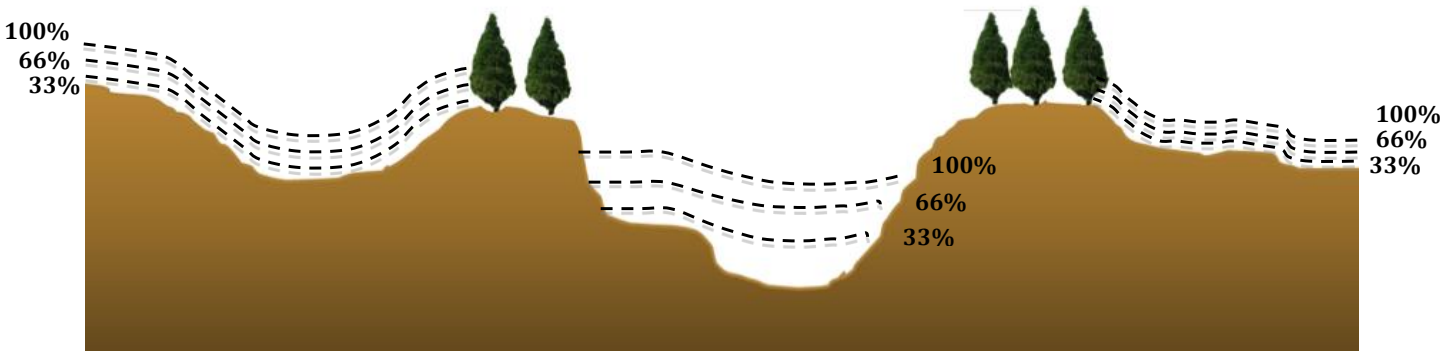

Figure 2: Scenario D, aggradation on both the floodplain and main channel at 100% maximum deposition value and percentage of maximum

See: Elwha Sedimentation Impacts System, Page 12

HOW THE WASHINGTON GIS COMMUNITY USES USCB ACS DATA

Earlier this spring the U.S. House of Representatives voted to reduce annual funding for the U.S. Census Bureau's American Community Survey (ACS) program by $100 million. In May, URISA co-signed a letter to the US Senate leadership warning about the consequences of such a reduction in funding for ACS: http://www.thecensusproject.org/letters/2012-05-16_Senate_Census_Budget_Ltr-SenateLeadership-Final-Signed.pdf.

URISA is trying to work with leadership in the House and Senate to educate them about the grassroots consequences of losing ACS funding, and we are asking your input.

To aid in this effort, a request went out via the CPS-GIS listserv for input from the Washington GIS Community, describing how GIS professionals and practitioners use ACS data. Here are the responses received:

Adriana A. Abramovich

The house bill 5326 that eliminates ACS (which gathers social and demographic info to monitor the impact of economic trends on US communities and includes statistics as age, sex, race, veteran and disability status) will affect our work from writing grants to strategic planning.

We were told not to worry about the demise of the census long form questionnaire because we could still get the detailed information from the ACS. Where I will be getting up-to-date demographic data for Community Services, Transportation, Community and Economic Development, or the Fire departments so they can apply for every state or federal grant that requires statistics at a census/neighborhood level, especially about poverty status, income, ?

The consequences of terminating ACS will be felt by more than just those who provide data for grants but also in the business community. Business relay heavily on ASC data to do such things as decide where to build new stores, hire new employees and get valuable insights on consumer spending habits. The loss of the ACS will cause chaos and inefficiency in the operations of business and municipal governments and it will definitely impact the accuracy of distribution of federal assistance for low income, highways infrastructure, etc.

The consequences of terminating ACS will be felt by more than just those who provide data for grants but also in the business community.

I just read on a Brooking Institute report that "184 federal domestic assistance programs used ACS related dataset to help guide the distribution $416 Billion / 29$=% of all federal assistance". I'm sure some of that money relates to improving our highways or building affordable housing….

If you are interested in the background of ACS, visit this link http://www.brookings.edu/research/reports/2010/07/~/media/Research/Files/Reports/2010/7/26%20acs%20reamer/0726_acs_reamer.PDF.

Adriana Abramovich
GIS ANALYST
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Renton Community & Economic Development Dept.

Nancy Grabinski-Young

The ACS data is key to helping us target our programs (some listed below) using small geography in ACS.

Example of Programs using ACS data to target program:

- Social Services
- Economic Development
- Housing
- Loans
- Home repair
- Grants
- Children
- Elderly
- Community Planning
- Business Development

Other Departments, such as Parks, Libraries, Public Works, etc. use ACS extensively.

Nancy P. Grabinski-Young
Economic Development Supervisor
Tacoma Community & Economic Development Department

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WASHINGTON GIS USES USCB ACS

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Rosemary Curran

Oh my gosh….I use the ACS data in innumerable ways – and I've been so glad to have it (despite it occasionally being difficult to get exactly what I want from American Factfinder 2).

I've used it extensively for the following documents:

- Background demographic and income information for the Countywide Planning Policies.
- KC Comp Plan Housing Technical Appendix (97 pages, including about 20 maps, at least half of which depends on the latest ACS data)
- The KC Consolidated Housing and Community Development Plan Needs Assessment. This is the planning document that we are required to submit to HUD to obtain federal funds, and which requires much of the same information that we've gathered into the Housing Technical Appendix for the KC Comp Plan.
- Ongoing monitoring of income, demographics, and housing affordability through the data that ACS provides on gross rents and home values, as well as the income and race/ethnicity data
- Forecasting housing and other needs based on age group trends (e.g. aging of the population, number of school-age children, etc.)
- Monitoring economic trends such as median income, employment, etc.
- Identifying areas with higher travel to work times and costs.

That's just a general overview. I could go on. It will be an information disaster if we do not have access to this data on a regular, ongoing basis.

Rose Curran
Affordable Housing Planner, PPMIII
King County Housing and Community Development
rosemary.curran@kingcounty.gov

Greg Lipton

I use the ACS for the following tasks:

1) To meet the Title VI requirements of the Federal Transit Administration. Without the ACS I would not have data required to show Metro does not disproportionately negatively impact
   a. Minorities
   b. Low Income People
2) FTA also requires that transit agencies meet the needs of those with Limited English Proficiency. Without the ACS we will not know what languages are needed for our outreach and advertisement literature.
3) King County's Social Justice requirements will be difficult to implement and evaluate if we do not have ACS data by Census Tract.

4) The ACS will be used to create the Census Transportation Planning Package (CTPP). The CTPP provides data by place of work and is used to create origin destination tables (O/D) for journey to work by mode. This data will be very helpful in transit and transportation planning.

Thanks for pulling this together.

Greg Lipton
Strategic Planning and Analysis
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King County Metro Transit
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Susan Kinne

I use the ACS data in the following roles and tasks in my work as an epidemiologist for the Assessment, Planning & Evaluation Unit at Public Health-Seattle & King County:

1) Updating Communities Count, the County's community indicator project supported by the city, County, United Way and other funders
2) Responding to data requests from other Public Health and County departments, hospitals, city governments, community and service organizations and citizens, which give them information on the population. Language spoken, English proficiency, income and poverty, family characteristics, ancestry, educational attainment, citizenship status and cost burden on renters/owners are the variables most requested.
3) Mapping to support grant applications

As an evaluator for the City of Seattle Human Services Department:

1) Providing population estimates by ACS variables (e.g. citizenship, ancestry, poverty, risk of homelessness) so that Human Services can determine whether it is accurately targeting its services
2) Using these estimates to support projections for service use and future need

Thanks for doing this.

Susan Kinne, Epidemiologist
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Editor's Note: URISA was founded by Dr. Edgar Horwood from the University of Washington. In advance of URISA's 50th Annual Conference in Portland this year, Judy Clark, with assistance from Chandler Felt, provided these recollections of Horwood.

RECOLLECTIONS OF DR. EDGAR HORWOOD

By Judy Clark

Once in anticipation of URISA's Fortieth Annual Conference and then again recently for the Fiftieth Anniversary, I accompanied former national Presidents of URISA to the U of W Library special collection archives and perused some of the sixty plus boxes of materials from Dr. Edgar Horwood.

I had the opportunity to meet Horwood early in my sophomore year as a recent transfer student in Urban Planning at the UW. He had full professorships in both Planning and Civil Engineering. In 1968 he showed me a monograph he wrote in 1958 describing polygon retrieval.

He told me he had been awarded a grant from the National Science Foundation and if I took FORTRAN he could hire me part time. When I began, he had just received the IBM 1130 computer that was to hold the first computerized topological map of Seattle. We had to digitize it offsite from tracings of a 200 foot to the inch map series. The 8k computer had its own operator keyboard and large insertable disks with hard plastic enclosures. Each was about 18 inches in diameter!

The project office on campus was known as the Urban Data Center. I recall having to write a routine to sort. Yes, in FORTRAN with do loops! For the Calcomp drum plotter we had to code "pen up" "go to" "pen down" and what series of letters or numbers to write. Sometimes the pen heads were ball point and sometimes we splurged on Rapidograph pens.

Dr. Horwood would travel some in the summers, probably the early short courses and URISA events. Bob Dial was completing his PhD then and I took a course from him in Critical Path Methods. Charlie Barb was also writing his dissertation and Randy Johnson was doing his Masters. When professors Jerry Schneider arrived from Penn and Dan Mandelker visited from Washington University, I was able to support both of them. Matt Rapp came over from Switzerland to study. While supporting Matt's work I got to use the first CRT which arrived in March of 1970. Usually I worked a 2-8pm shift in the summer so I could overlap with the researchers and then continue production work after they went home.

During that same period, Dr Horwood taught urban planning classes at the U of W. My friend Chandler Felt, now demographer for King County, recalls that Dr. Horwood was an imposing figure in the classroom. He was sometimes difficult to follow, and a challenge to take notes from. He would say, "There are five points you must remember about this issue: first – blah blah blah (and the expounding went on for a long time); fourth – blah blah blah; sixth – blah blah blah; third – blah blah blah blah blah." And he never covered the second and fifth points! But he made complex transportation planning topics come alive, and was highly entertaining.

Edgar Horwood was a wonderful friend and mentor. I just came across an item he and his wife gave me after a trip to Mexico. Besides enjoying the office camaraderie, the staff played volleyball at the intramural building and Edgar and Rosemary had us to their home for a holiday party.

Edgar Horwood

He also enabled me to work in his off campus venture on a contract for the National Capital Commission of Ottawa. We made a photo positive of the paper map (I reduced it with large format film and did the developing by hand). Then he had me take 1961 census tables and use a legend to color in the tracts by the values of varying parameters (aka choropleth maps). He called it "Multi-phasic Screening Analysis".

As I moved on to part time course work for my masters, I worked off campus in consulting and for regional government. We had a URISA Chapter known as Puget Sound URISA. While I was chairperson we held a conference in Portland and folks even came from Spokane. In 1975 we hosted the national URISA conference which for the first time included exhibits.

Sometime after that, the chapter went idle and by the time I got involved again it was to help host the 1984 national conference here in Seattle again. The active group in Seattle then was the Northwest Computer Aided Mapping Association. In 1988 we began to host the best of the workshops from the National URISA conference so that folk could afford to learn regionally about topics like "Geoprocessing in Local Government". The last one I set up was in 1995 and now others are done regularly. One November we held a special board meeting at the Arctic Room in downtown Seattle and determined to become The Washington URISA chapter.

Before the 1984 URISA Conference in Seattle Dr. Horwood was moved to status of Professor Emeritus. At the 1984 national URISA meeting the Horwood Prize was inaugurated and the poster "Horwood's Ten Laws" was distributed. I hope all ten laws were there, and in the right order! In 1986 he passed away and his memorial on campus was well attended. His legacy is one of careers made and impacted by his leadership and of this amazing organization we call URISA.

Judy Clark
Modeling and Forecasting Manager
City of Bellevue

(Note: When Judy did the NWCAMA and URISA Workshops she was Judy Leslie [1972-1995]; and when she studied and worked with Dr. Horwood she was Judy Fagerstrom.

Richard 'Dick' Thomas
1947 – 2006

6TH ANNUAL RICHARD 'DICK' THOMAS MEMORIAL STUDENT PRESENTATION COMPETITION & AWARD AT THE 2012 WASHINGTON GIS CONFERENCE

By Amanda Taub

WAURISA, the Washington State Chapter of the Urban and Regional Information Systems Association, held the sixth annual Richard 'Dick' Thomas Memorial Student Presentation Competition & Award on Wednesday, May 9 at this year's Washington GIS Conference (May 7 - 9, 2012) at the Greater Tacoma Convention & Trade Center in Tacoma. WAURISA established this award to honor Washington State GIS pioneer and mentor, Richard 'Dick' Thomas by continuing his work of encouraging students to excel in their studies and transition successfully into GIS careers.

WAURISA's goal with this award is to inspire students to present their original work related to GIS, geography, or geographic research in Washington State at the annual Washington GIS Conference. The competition comprised of two parts: the first was the selection of four (4) abstracts by the Competition Committee. The second part was the judging of the 4 selected presentations during the Student Presentation Session at the 2012 Washington GIS Conference. Abstracts used a maximum of 300 words to describe the proposed presentations. The presentations were limited to 20 minutes for the presentation and questions.

The competition was limited to current students enrolled at least 6 hours in a relevant curriculum at a secondary school, community college, technical school or university program. Entries were the original work by the students, which they conducted as school projects or under the supervision of a professor while enrolled in a GIS, geography, technology or related academic program. Subjects for papers were related to geography, GIS or an allied technology, as applied to natural resource, hazard mitigation, archaeology, animal habitats, energy, social, business, government or other similar issues.

Abstracts and presentations were judged on the following criteria:

- Demonstration of expertise and understanding of geographic concepts
- Demonstration of expertise and understanding of GIS, related technology, and its application
- Explanation of how the work presented relates to the topic and contributes to greater understanding or knowledge of the topic and GIS
- Demonstration of an innovative approach and/or critical thinking
- Quality of the written abstracts
- Quality of the public presentations

This year's entries:

This year's four entries presented an array of topics. Renee Vandermause and Marshall Kosaka discussed their work in assessing impacts of sedimentation along the Elwha River. Stephan Gmur presented his work on rating tropical ecosystems for biofuel potential with GIS and remote sensing. Brian Gilmore spoke about his work on analyzing marine protection area ecosystems. Chuck Neudorf discussed his project on mapping the Cove 2 dive site on Elliot Bay.

First Place: Renee Vandermause and Marshall Kosaka

Renee Vandermause and Marshall Kosaka are students at Seattle University's Department of Civil and Environmental Engineering. Their project was done under the guidance of Dr. Wes Lauer and they were part of a team with Mark Beggs and Anna Sigel. Renee and Marshall's presentation was "Elwha River Sedimentation Impacts Assessment System". Here is their abstract:

Elwha River Sedimentation Impacts Assessment System

The Elwha and Glines Canyon Dams on the Elwha River in northwestern Washington are being removed to restore the anadromous fish population and surrounding ecosystem to pre-dam conditions. In order to assess the river's sensitivity to the increased sediment load due to dam removal, Seattle University's Civil Engineering Team will combine the most recent geographic information for 2D modeling. The team intends to model different levels of aggradation below the reservoirs with a United States Bureau of Reclamation 2D model (SRH-2D) applied to the lower river. The results will supplement the larger monitoring plan and allow the USBR to assess the Lower Elwha River's potential flood risk due to changed topography.

We choose to use Arc-GIS to create a digital elevation model (DEM) for the 2D model in order to integrate multiple geographic data sets with varied spatial accuracy and interpolate missing information. Methods for interpolating channel bathymetry from survey data exist but require relatively dense data. Dense data was available for the main channel but there were large gaps in survey data for the river's primary side channel. For the main channel we interpolated a DEM using bank points from the most recent aerial Lidar (2009) and river bathymetric data (2011) in GIS. Due to the gaps in survey data for the side channel we developed our own approach to assign elevations where data was missing. This was done by using a relationship between variables measured in Arc-GIS, including radius of curvature and down channel distance. We used this relationship to create a more dense data set in order to interpolate a DEM that more closely resembles the natural topography of the river; greater depth on the outside of bends and shallower depth along the inside of bends. The DEM will then be modified for varying levels of aggradation.

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2012 DICK THOMAS AWARD

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Renee and Marshall's awards included:

- Award Plaque
- $1000 cash
- One year membership in WAURISA
- Free registration to the 2013 Washington GIS Conference
- Publication of their paper in *The Summit* (See their paper in this issue on page 1)

In addition, their professor, Dr. Wes Lauer, was awarded a cash prize of $500.

First Place Winners: Marshall Kosaka & Renee Vandermause

Second Place: Stephan Gmur

Stephan Gmur, with the University of Washington School of Environment and Forest Science, presented "Rating Tropical Ecosystems for Biofuel Potential using GIS and Remote Sensing". His advisor is Daniel Vogt. Here is his abstract:

Rating Tropical Ecosystems for Biofuel Potential using GIS and Remote Sensing

Shifting focus towards renewable energy sources has created a demand for technologies which utilize biomass in the form of forest or agricultural residuals. To meet this demand new tools and techniques are needed to quantify and understand the ability of ecosystems to remain productive and not be irreparably harmed when biomass is harvested. A national evolution of biomass potential of production forests across the country of Indonesia was conducted to quantify the area of land suitable for feedstock creation to create bioenergy. Methodology to conduct this analysis employed a weighting matrix within a vector overlay using the geospatial environment of ESRI Desktop. Using geospatial information, biophysical and terrestrial conductions such as soil order, texture, land use, net primary productivity and precipitation allowed for a uniform analysis across the country of Indonesia. The analysis was limited to the land use classification areas of production forest, limited production forest and convertible production forest where forestry practices are already in use.

These areas were evaluated by examining biophysical and terrestrial factors which influence ecosystem productivity, created a ranking system using the values of "Good", "Fair" and "Poor". These categories were assigned using threshold values from the weighting matrix which when taken in concert determine the productivity of an ecosystem.

Results from the analysis were validated through field visits and review of scientific literature reporting productivity conditions at study sites. Overall results found that close to half of all production forest lands were rated as "Good" while less than ten percent was rated as "Poor". Those areas which were rated as "Fair" can be brought to a "Good" rating using silviculture and other management methods.

His award included:

- Award Certificate
- $300 cash
- One year membership in WAURISA
- Free registration to 2013 Washington GIS Conference

Second Place Winner: Stephan Gmur

Third Place: Brian Gilmore

Brian Gilmore is a student at the Green River Community College. His advisor is Sabah Jabbouri and his presentation was on "Kailua Kona Marine Protection Area Ecosystem Analysis". Here is his abstract:

Kailua Kona Marine Protection Area Ecosystem Analysis

The purpose of this project is to analyze different criteria used in the development of Marine Park Areas (MPA's). An area of study was chosen off of the west coast of the big island of Hawaii, Kailua Kona specifically. This area was chosen for both its bio-diversity and the large amount of research data available used to drive the analysis. This project required the development of an effective geodatabase, a companion Access database and a Python script which was developed to read and print the properties of each layer in the map document. Included in the geodatabase are domains, subtypes and topologies to ensure data integrity and analysis of specific photic zones. Analysis of the marine species data and raster datasets were handled using the Marine Geospatial Ecology toolbox within the framework of the ESRI Arc Marine data model.

See: 2012 Dick Thomas Award, Page 11

2012 DICK THOMAS AWARD

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Finally surface and sub-surface characteristics were developed into a 3D ArcScene representation. By developing an ArcScene model many different factors could be evaluated concurrently, factors such as Surface Sea Temperatures (SST's), surface and below surface current direction and temperature. These two factors were evaluated on the effects changes would have on the eco-system of the reef structure in terms of animal growth and species diversity. Terrestrial systems taken into account in this analysis include soil types (for erosion effect purposes) and agricultural runoff/leeching (used to evaluate what man induced process might affect the overall health of the reef eco-system).

His award included:

- Award Certificate
- $200 cash
- One year membership in WAURISA

Third Place Winner: Brian Gilmore

Honorable Mention: Chuck Neudorf

Chuck Neudorf is a student at the Green River Community College. His advisor is Sabah Jabbouri and his presentation was on "Mapping the Cove 2 Dive Site on Elliot Bay". Here is his abstract:

Mapping the Cove 2 Dive Site on Elliot Bay

Scuba divers have unique needs for geographic information. Faced with limited instrumentation, limited visibility, limited dive time, and restrictions on vertical motion, divers need to move confidently and efficiently in a very hostile environment.

This project uses large scale lidar base maps along with collected data in order to produce maps that are germane to the needs of divers at Cove 2, on Elliot Bay in Seattle. GPS positions will be coordinated with depth soundings in order to establish points that are georeferenced and contain a z value that represents depth. The positional data will be stored on a solid state chip in the GPS/depth sounder that can be plugged into a laptop computer for downloading. The data can then be imported into a GIS where it will be used to create a surface that represents the seafloor. This surface will contain points of interest and depth contours. The final product will be a digital map that will be available to divers for information and planning, and a hardcopy map printed on a plastic slate that can be taken underwater and used during the course of a dive.

This project will produce useful maps where none are now available. Further, it will provide experience in project planning, data collection and management, and GIS mapping.

Chuck received an Honorable Mention certificate for his work.

Honorable Mention: Chuck Neudorf

Summary

Every year the students dazzle us with their projects and dedication. This year was no exception. All of the students did a professional job of presenting their work. The future seems bright for them and our profession.

I would like to send my heartfelt gratitude to everyone that made possible this year's Dick Thomas Student Presentations. I would like to thank this year's entrants, Renee Vandermause, Marshall Kosaka, Stephan Gmur, Brian Gilmore and Chuck Neudorf, for the great work they demonstrated in their abstracts and quality presentations.

I would like to thank the judges, Holly Glaser with Mappa Mundi, Lane DeLarme, Brandy Riche with Pierce County GIS and Rick Lortz with the Lakehaven Utility District for their work judging the abstracts and presentations. I would also like to thank Amanda Jobmann for her assistance with the competition, including taking the pictures of the students.

Finally, I would like to thank the professors who encouraged their students to enter the competition. These presentations would not have happened without your support.

I hope you will come to the seventh annual Richard 'Dick' Thomas Memorial Student Presentation Competition and Award at next year's Washington GIS Conference (May 6 - 8, 2013) at the Lynnwood Convention Center. Presentations will be Wednesday, May 8, 2013.

Amanda H.S. Taub, GISP
Richard 'Dick' Thomas Memorial Student Presentation Competition Coordinator
WAURISA Secretary

ELWHA RIVER SEDIMENTATION IMPACTS ASSESSMENT SYSTEM

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In order to compare the LiDAR to known data we exported the existing cross-sectional data-points from the USGS (Draut pers. Comm.) into Excel as a text file. The Team then determined the distance from the left bank for each data point and plotted. Similarly, the LiDAR elevation was plotted as a function of the distance from the left bank. An example can be seen in Figure 3. The LiDAR was compared to all cross-sectional datasets supplied by the USGS. This task was an important step in the production process because it revealed to the Team that the LiDAR data could be used in the floodplain; however, LiDAR from the channel could not be used because it did not include the channel depths.

The interpolation was done using inverse-distance-weighting (IDW) with a power of 2, carried out by a function in ArcGIS. The IDW tool has an optional functionality which allows for the area to be interpolated to be defined by barriers. The barriers confine the interpolation to inside the polylines and result in a DEM with the shape of the barriers. This is vital for the Team's DEM because it is important to only interpolate where the LiDAR is inaccurate, which we assumed to be in regions where water was present.

The tool encounters problems whenever the data from which the DEM is being interpolated is on or outside of the barriers. Therefore, the barriers were made slightly outside of where the bank points are located in order for the tool to work properly.

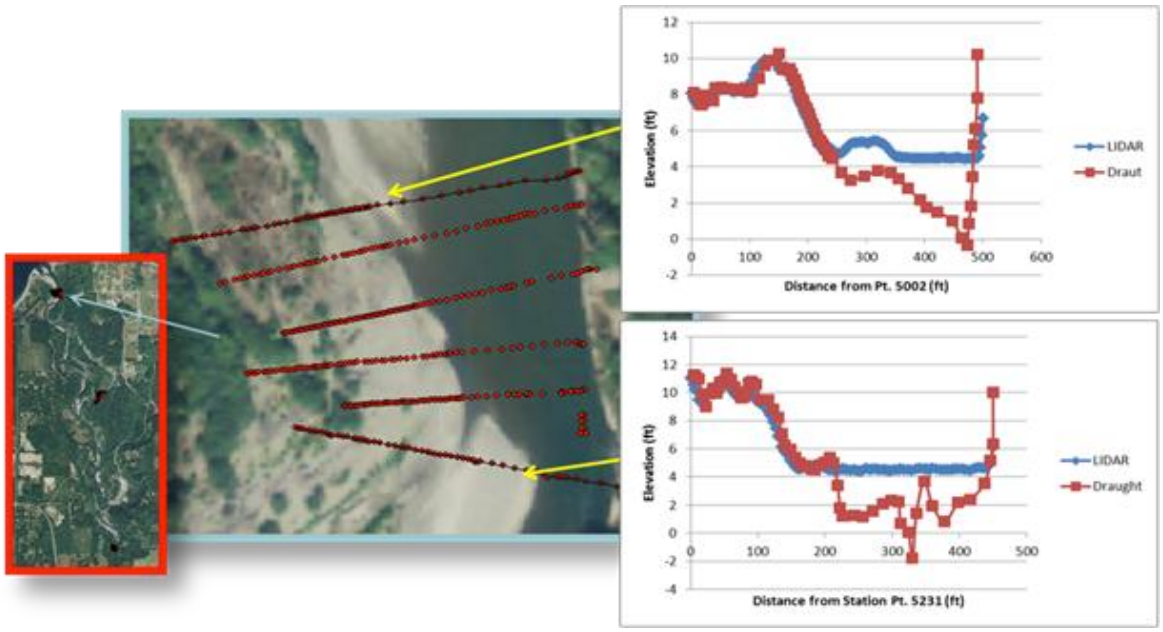

Figure 3: Elevation data as a function of distance from the left bank for LiDAR and Draut data, Located on the lower Elwha River near the delta.

Since the LiDAR did not penetrate the water surface, the topography of the channel bed was not sufficiently defined. Therefore, the Team needed to interpolate the channel bed using the USBR's 2011 bathymetric survey data in conjunction with ArcGIS's "interpolate" function. This function operates by first defining the channel boundaries and then assigning new elevation data to the LiDAR data within the boundaries. The Team defined the left and right bank channel boundaries as the point at which the water ended and land began. The Team referred to the aerial photo and defined a GIS polyline based on where water was visible within the channel on a September 2009 aerial photograph. The LiDAR was flown April 4th-6th, 2009, during which the average discharge was roughly 630 cfs, a relatively low flow that allowed the LiDAR to capture much of the channel area. Although the LiDAR is not accurate beneath the surface of the water, it can still be used to define the elevations of the bank points. Arc-GIS was used to assign elevations to the vertices of the bank lines based on the LiDAR. The bank-line elevations were then combined with the 2011 USBR bathymetric survey to create one set of x, y, z data points to be used in the interpolation. A simplified version of the changes can be seen in Figure 4.

The tool requires that the user specify a search radius for the interpolation. A radius of 200 feet was chosen to allow the tool to locate points in areas where the channel was very wide. The result of this interpolation is shown on the right in Figure 5.

This form of interpolation can be problematic because it does not take into account the way features in the bed would be longer running parallel to the flow. In theory, an interpolation technique should be used which gives a greater weight for interpolating in the downstream direction as opposed to cross stream.[3] However, the USBR survey is composed of multiple lines running up and downstream resulting in a large number points that are grouped closely in the downstream direction. Due to this, it was deemed acceptable to use the form of interpolation described above to define the channel geometry for the main stem.

[3] *Merwade, et al. 2008*

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The image on the left in figure 5, below, shows the interpolated main channel combined with the LiDAR to create a DEM. This was done using the "mosaic to new raster" function in ArcGIS.

This method of interpolation was successful for the main channel where there is sufficient data. However, in the Hunts Road side channel (a major side channel in the lower river that is rapidly becoming the main channel) there is only a sparse thalweg survey, as shown in **Error! Reference source not found.**. The lack of data in this area requires changes to the methodology with regard to our interpolation.

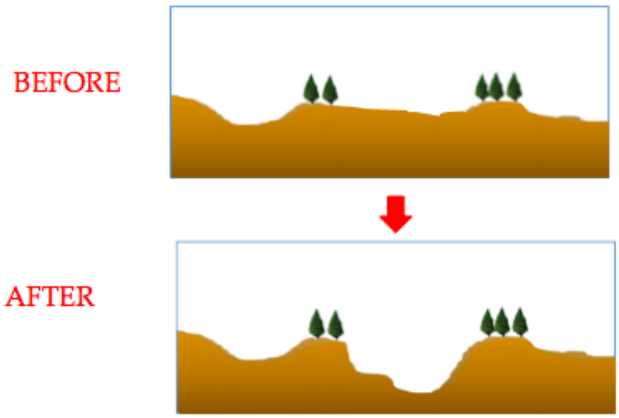

Figure 4: Simplified illustration of riverbed before and after GIS interpolation.

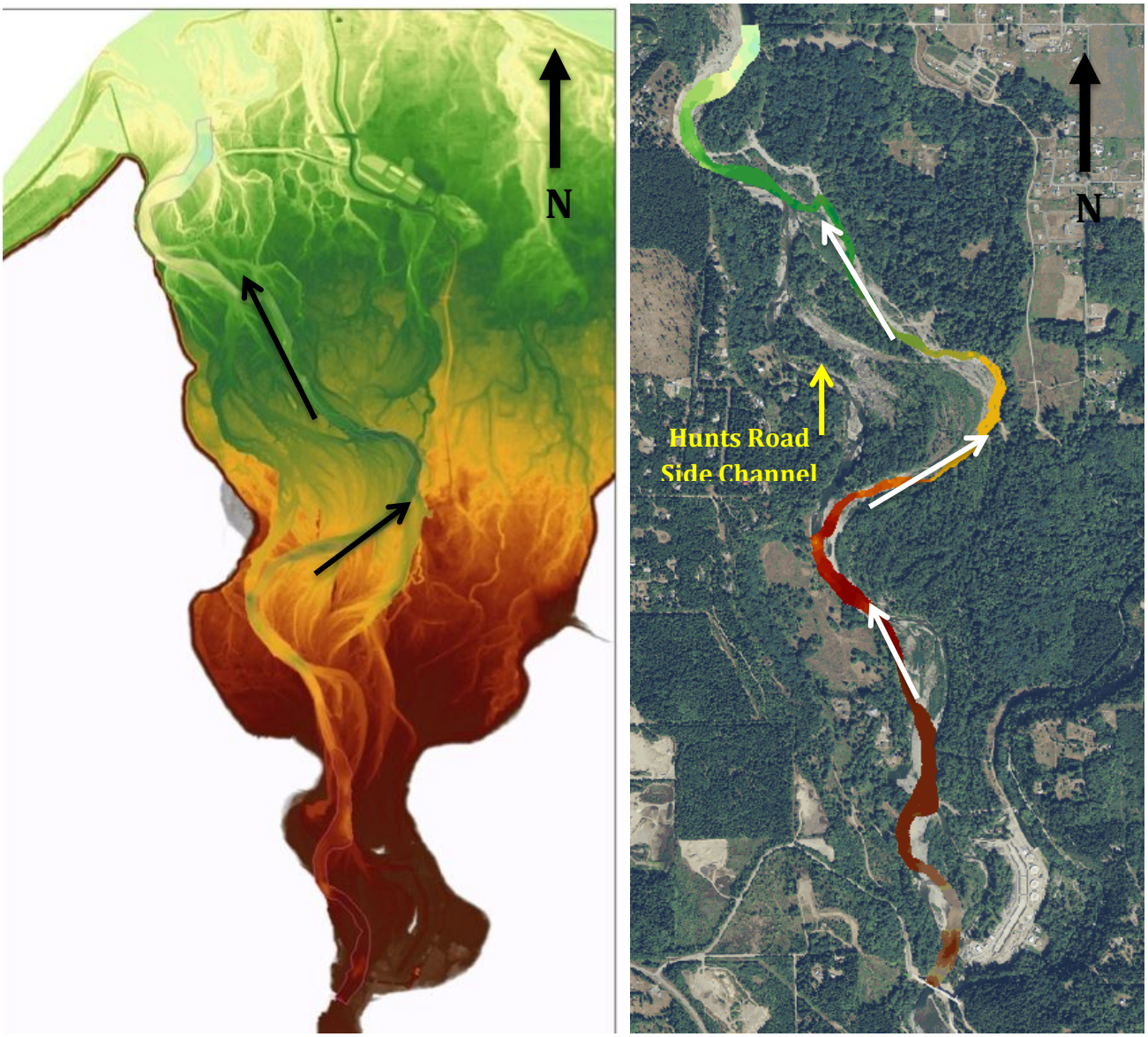

Figure 5: (Left DEM of the main channel bed interpolated from the 2011 USBR bathymetric survey with river flow directional arrows in black. (Right) Interpolated main channel and bank lines integrated with the 2009 LiDAR DEM and river flow directional arrows in white.

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For the Hunts Road channel, the Team defined the geometry based on a relationship developed between the side-slope of the bed and the centerline radius of curvature. In general, river channels are generally deeper near the outer side of sharp bends, as illustrated in Figure 7. To determine the relationship between curvature and cross-channel slope, the surveyed points were first assigned a downstream distance, *s*, and a cross channel distance from the centerline, *n*, using the "locate features along routes" function in ArcGIS. The centerline used to define *s* was created using The National Center for Earth Surface Dynamics Planform Statistics Toolbox which interpolates centerline points from right and left bank lines defined by the user.[4] The elevations of the surveyed points were plotted versus downstream distance in order to obtain an overall slope for the channel. (Several anomalously high points probably associated with engineered log jams and other debris were discarded prior to developing this slope estimate). Centerline points were then assigned elevations by multiplying *s* by the average slope and adding this to the upstream channel elevation.

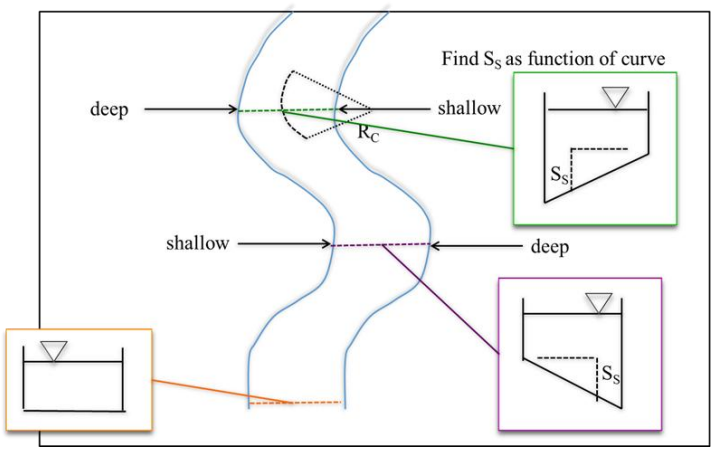

Figure 7: Simplified illustration of side channel geometry assignment

The next step in the process involved determining how cross-channel slope varied with centerline radius of curvature. The radius of curvature obtained from The Planform Statistics Toolbox (defined positive when the channel is curving to the left) was first smoothed by using a fourth order polynomial to relate the inverse of radius of curvature to downstream distance, *s*. A fourth-order polynomial was selected because the channel has four major bends. Using the fourth order polynomial, radius of curvature values were assigned to each bathymetric survey point based on its down-channel distance. In order to define a relationship between radius of curvature and side slope, the difference in elevation between the survey point and the corresponding centerline elevation, Z_s-Z_{cl}, was plotted versus the cross-channel distance divided by the radius curvature, n/R_c, as shown in Figure 14. Because *n* and R_c have different signs on the outside of a bend (*n* is negative when R_c is positive, and vise-versa), their ratio is negative at the outside of a bend and positive on point bars. (Note that points with a radius of curvature greater than 2000 were removed because a negligible side-slope is expected in reaches of the channel that are relatively straight.)

[4] *Lauer and Parker, 2008.*

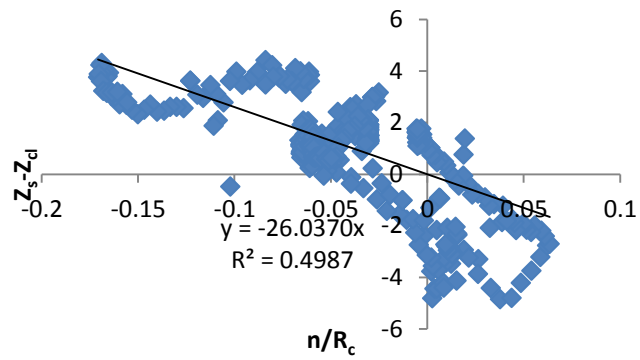

Figure 6: The difference between the surveyed elevations and the centerline elevations versus the cross-channel distance over the radius of curvature for the USBR Hunts Road channel survey points.

The regression has an R^2 value of 0.4947 which indicates a loose relationship between the slope and radius of curvature. The equation from the regression is:

$$Z_s - Z_{cl} = -26.0370\left(\frac{n}{R_c}\right) \qquad (1)$$

This can be rearranged to compute the elevation at any point on a cross-section based on its cross-channel distance, yielding:

$$Z_i = 26.0370\left(\frac{n_i}{R_{ci}}\right) + Z_{cl} \qquad (2)$$

From the centerline tool, each centerline point has a left and right bank point associated with it. A line was then drawn from the left bank point through the centerline point to the right bank point. Points were then sampled along this line at three foot spacing. These points were exported to Excel and assigned *n* values as well as a radius curvature based on the polynomial regression. Each point was then assigned an elevation using equation 2. The IDW function was then carried out as in the main channel based on this new data set. Ultimately, this procedure resulted in a DEM for the Hunts Road channel that is characterized by a lower elevation on the outside of bends and higher elevation on the point bar of the bends.

In addition to creating a DEM, the Team had to update the existing Manning's roughness map to incorporate the newly defined side channels. The original and final Manning's roughness maps can be seen below in Figure 8. In order to update the map, the Team imported polylines defining the left and right banks of each major side channel (data was for side channel position was provided by NOAA).[5] The union function was then used to "burn" the side channel left and right bank information into the Manning's roughness map.

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[5] *Pess, personal comm.*

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Next, the dissolve function was used to create new polygons within the Manning's roughness map that included the recently added side channel information. The Team then manually changed the values within these side channel polygons to more adequately simulate roughness for a channelized region. In general, this procedure resulted in localized reduction of roughness relative to the USACE values used in the HEC-RAS model, as shown in Figure 8 (left).

Using GIS to model sediment aggradation on river floodplains

GIS was particularly helpful in crafting a sedimentation scenario that is more like natural conditions for Scenario C: *Aggradation in Floodplain.* The 2-D model allows floodplain sedimentation to be represented in a more complex way than was possible for the 1-D HEC-RAS model. In general, sedimentation is expected to be highest near the channel where flow is leaving the main channel and entering the floodplain. To crudely represent this, aggradation on the floodplain was based on flow length from the main channel.

GIS was particularly helpful in crafting a sedimentation scenario that is more like natural conditions

Unfortunately, it was not possible to use the velocity vector map from SRH-2D to directly determine this length. Instead, flow direction was computed in ArcGIS using the slope of the water surface elevation DEM exported from SRH-2D for a 5-year flow event using the flow direction tool (a tool usually used for watershed delineation purposes). The tool makes a cell-by-cell determination of the flow direction into one of a given grid cells eight surrounding cells. A separate ArcGIS tool, flow length, was then used to convert flow direction into a travel distance for each cell on the floodplain.

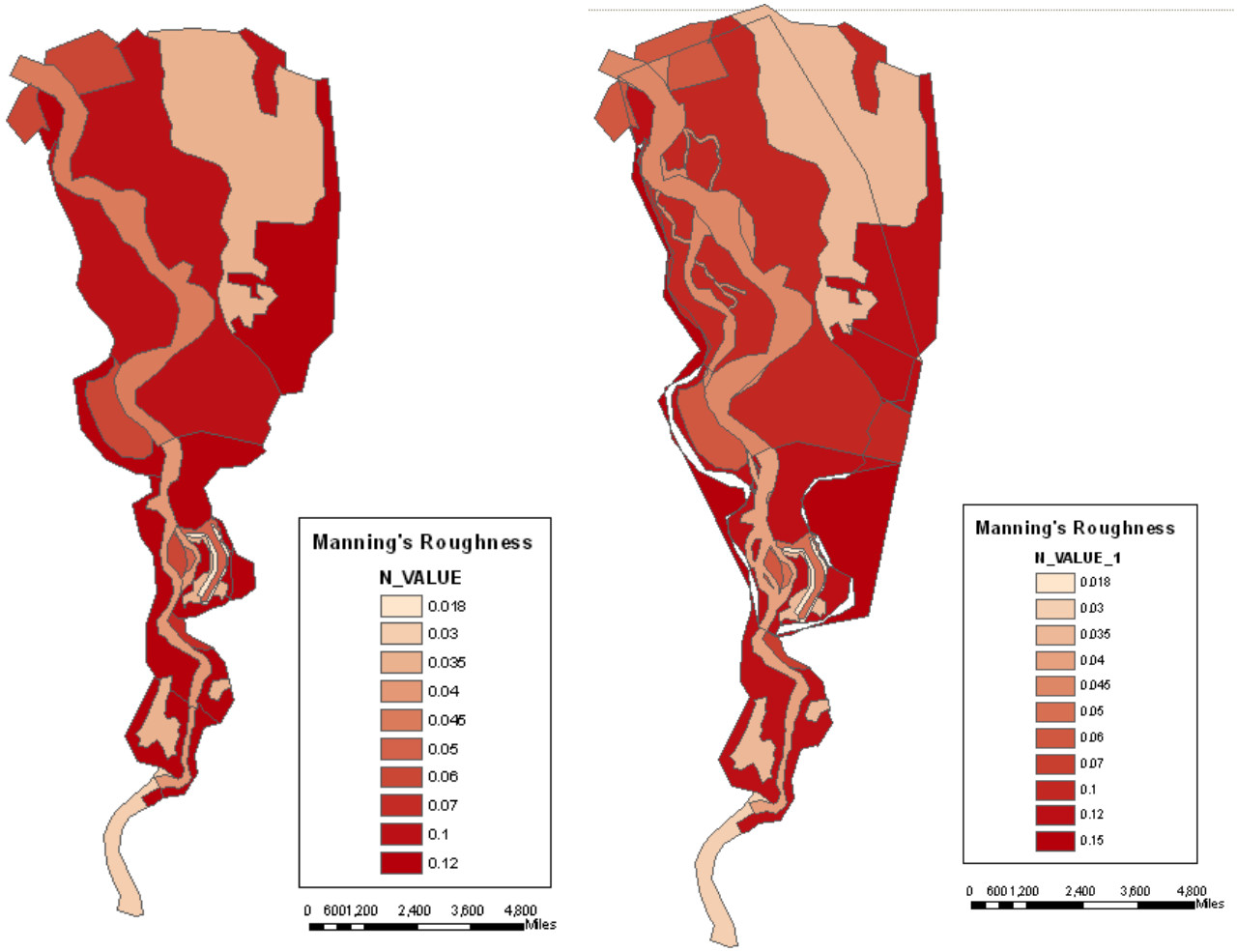

Figure 8: (Left) Original Manning's Roughness Map Created by the US Army Corps of Engineers, (Right) The New Manning's Roughness Map updated based on the interpolated DEM, side channels inserted with new roughness value

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This created a map of cells that have values for the length to the upstream channel that contributed flow (Figure 9). Since sedimentation decreases exponentially away from the channel, the Team used an exponential function to transform values of flow length into a value between zero and one. The equation used to modify the values follows the form :$D = D_0 e^{-kl}$, where *l* is the length of an individual grid cell (25 ft was used), *D* is the deposition in each cell, *k* is a variable solved for by trial and error, and D_0 is solved for using the total deposition to the lower river. Solving for *k* by trial and error was carried out until the gradual change between values near one and values near zero.

Values closer to one represent areas where flow length is short, thus more sedimentation would occur there. Values closer to zero would represent areas further away from the channel where sediment would not be able to deposit. Because the raw flow length map is very heterogeneous, with areas of large flow length directly adjacent to areas of low flow length, it was necessary to smooth the flow length map by computing the spatial average of flow length in a neighborhood of 10 cells x 10 cells. This step had the effect of smoothing out the flow length lines and making the change between areas of long and short flow lengths less abrupt. The smoothed flow length map can be seen in Figure 9.

The team then used the smoothed flow length map as input for the exponential function discussed previously. The resulting grid represents an index that was multiplied by a constant value in order to determine the amount of deposition for each cell. The constant was determined by dividing total volume of sediment to be distributed across the floodplain by the sum of the index grid. The methodology limited aggradation to areas closer to the channel where flow would most likely be spilling out of the banks. Deposition was low where flow was returning to the channel. A proportional amount of sediment (adjusted for the shorter reach length) was applied to the 2-D floodplain only sedimentation scenario.

This differs from our 1-D approach in that we are not blanketing the entire floodplain with a single depth of sediment. It additionally allows the floodplain deposition to be more concurrent with deposition in natural environments. Such deposition was simulated in the laboratory using alfalfa sprouts as vegetation and running water through a carved channel in a constructed sandbox.[6] As the channel formed, fine sediment deposits were confined to regions near the channel (Figure 10 left). Our floodplain index is broadly consistent with these results (Figure 10 right).

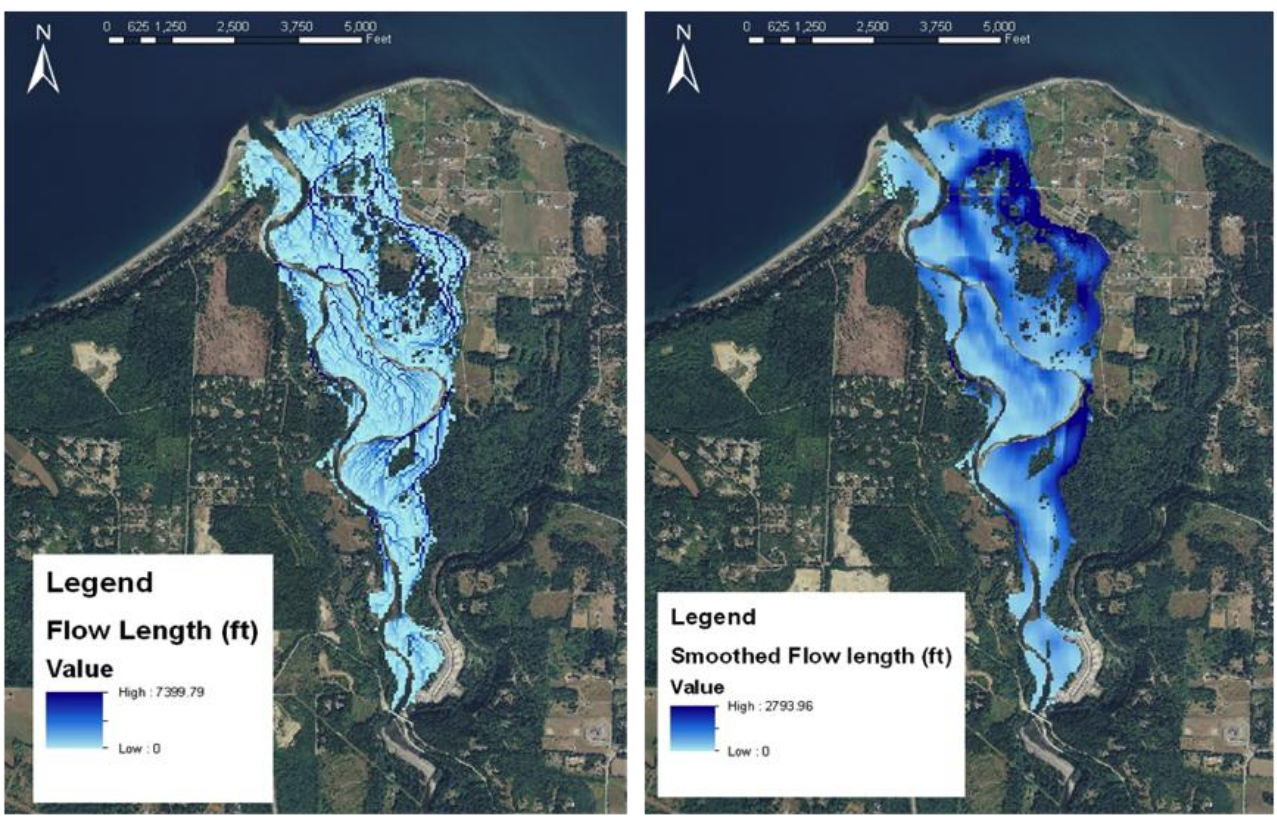

Figure 9: (a) Flow length in feet for the lower Elwha River floodplain. The dark blue regions represent areas of long flow length. (b) Smoothed flow length in feet for the lower Elwha River floodplain. Regions of dark blue represent areas of longer flow length.

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[6] *Braudrick et. al, 2009*

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GIS use Summary

The purpose of the Team's project was to develop tools for USBR to rapidly assess downstream impacts of sediment impacts due to dam deconstruction. The GIS analysis proved invaluable to the team's progress and included:

- Digital Elevation Model
  - Main Channel & Side Channel Creation through Interpolation Techniques
- Manning's Roughness
  - Updated roughness map using buffered polylines
- Sedimentation Scenarios
  - Creating a sediment aggradation scenario more congruent with that of natural conditions through Cut, Fill, and Flow Accumulation tools

Conclusion

In accordance with the adaptive management plan, the United States Bureau of Reclamation is using real-time monitoring in order to reduce uncertainty in sedimentation from the removal of the Glines Canyon and Elwha dams. The plan relies upon continuous monitoring of water levels in the lower river using a set of stream gages.

The Team was requested to develop tools to rapidly assess the rate of downstream sedimentation associated with the removal of the two dams. The tools are a series of rating curves. They bracket a range of possible sedimentation scenarios in the lower Elwha River and are based on the interpretation of one- and two-dimensional hydraulic model results. The rating curves represent potential sedimentation scenarios that may occur on the lower river.

The curves will allow easily monitored water surface information to be used to indicate the direction and magnitude of channel response to the project. The curves can also be used to assess how water surface elevation may change at higher flows. The Team made recommendations for using these curves and its 2-D modeling results to augment the existing adaptive management plan. While the Team's project reduces uncertainty, limitations in the scenarios and modeling remain. Overall, the Team found developing tools from one- and two-dimensional models to be an effective way to supplement the existing adaptive management plan and further reduce uncertainty.

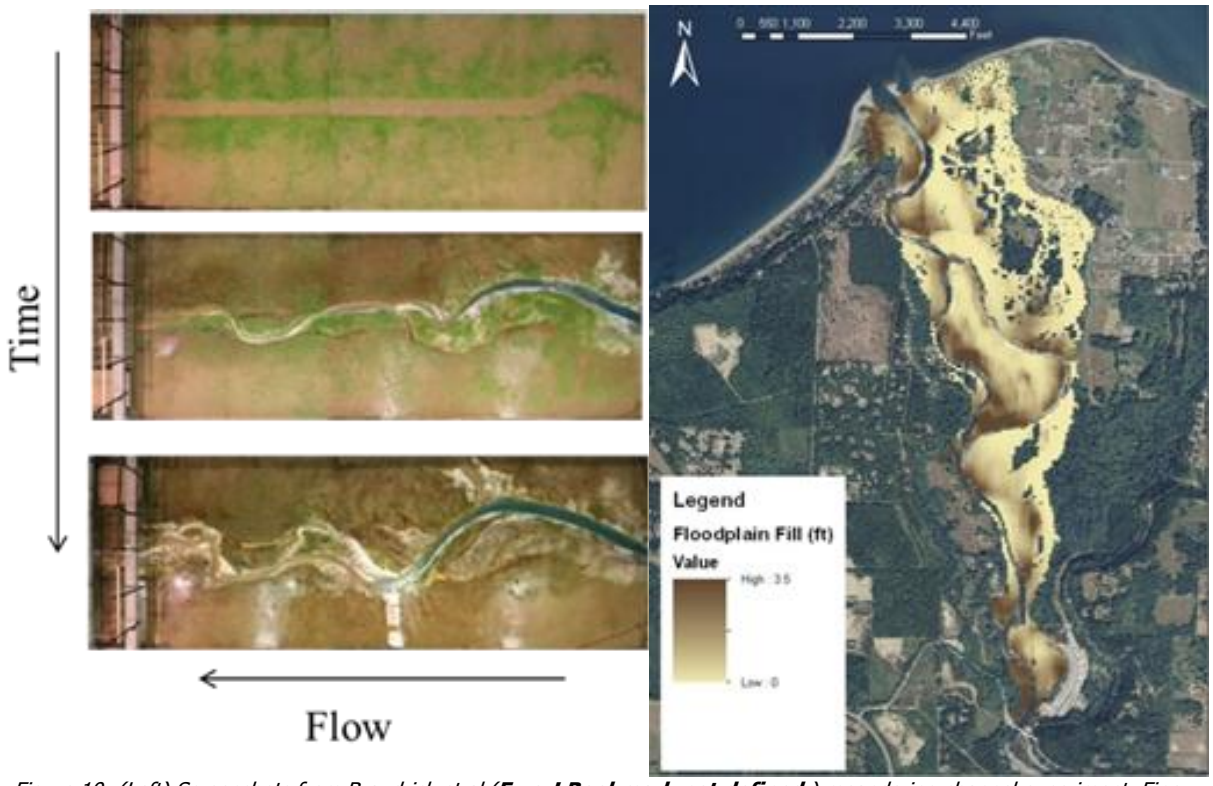

*Figure 10: (Left) Screenshots from Braudrick et al (**Error! Bookmark not defined.**) meandering channel experiment. Fine sediment deposition is concentrated to regions near the channel supporting the need to develop a deposition scenario more representative of such patterns. (Right) The amount of fill deposited on the floodplain is shown overlaid on an aerial photo. The dark brown areas represent regions of higher deposition. The maximum (100%) fill scenario ranged from zero to three feet. 33% and 66% of this range was also simulated.*

GIS-Pro 2012

URISA's 50th Annual Conference for GIS Professionals

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In case you haven't heard yet, URISA's Annual Professional Conference, GIS Pro, has teamed up with the annual Northwest GIS User's Conference for a joint educational extravaganza September 30 through October 4.

The conferences have been combined to offer, for the first time, the outstanding technical workshops you are accustom to attending the NWGIS User's Conference along with the variety of international GIS policy and visionary sessions found at the GIS Pro Conference. All for the cost of just attending one of these conferences.

Along with the workshops and educational sessions, featured speakers will include Jack Dangermond, ESRI founder, Professor Michael Goodchild, the University of California Santa Barbara, and John Sanderson, Microsoft's Cloud Evangelist.

Did I mention this will be URISA's 50th Anniversary Conference? Don't miss this opportunity!

For more information and to register please go to http://www.gis-pro.org/ and click on the GIS-Pro 2012 tab.

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THE SUMMIT - EDITORIAL

IS THERE A MORAL IMPERATIVE FOR GIS?

The Summer 2012 issue of ArcNews (http://www.esri.com/news/arcnews/summer12articles/strengthening-the-gis-profession.html) includes a thought-provoking article by David DiBiase titled 'Strengthening the GIS Profession.' DiBiase, while at Penn State was instrumental in production of the 'Geospatial Revolution' video series that provide a concise description for the lay person of what exactly it is that we do, why GIS is different, and why geospatial technology is important.

DiBiase's recent ArcNews article provides six common sense suggestions for those of us who are geospatial professionals to solidify the status of our calling. Strengthening the GIS profession has two perspectives. As we all know, what we do is often difficult to explain to our neighbors, friends, and family (my mom still thinks I make maps for the water department), not to mention to our councils, boards, executives, and elected officials. Being able to explain what we do and why it is important to others is an important part of strengthening the GIS profession.

Being able to explain why and how GIS is different is important also. All too often we try to explain why we are not like IT, or how we are not just mapping, or different than CAD or surveying. But we need to define what exactly the domain of GIS is. The recent announcement by URISA to develop the GIS Management Institute is a step in this direction.

But is GIS a profession, or just a job? If it is a profession, what makes it so? This is the question that DiBiase addresses with his seventh suggestion. A profession, DiBiase contends, is different from just a normal job. What distinguishes a profession? His contention is that, among other characteristics, a profession is based upon a 'moral imperative.' A moral imperative is a statement that describes not just what we do, but why it is important to society that we do it and why doing it provides a public benefit.

The moral imperative of the medical profession might be 'to apply medical science for the health and well-being of humanity'. The moral imperative of the legal profession might be 'to apply knowledge of the law to help people achieve justice and their due rights'. David DiBiase proposes a moral imperative for the GIS Profession, but more importantly, he challenges us to propose our own version of that moral imperative to further define our profession.

Here is my proposed moral imperative for GIS:

The GIS profession uses geographic theory, spatial analysis, and geospatial technology to help society manage the Earth's finite space, with its natural resources and communities, on a just and sustainable basis for the benefit of humanity.

What is your moral imperative for GIS? Read the article and send your moral imperative for GIS to *The Summit.*

The Summit is published by WAURISA. To encourage the discussion of issues and ideas of importance to the Washington GIS community we welcome letters to the editor or opinion essays. Letters to the editor should be a maximum of 100 words and essays should be limited to 500 words.

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PUBLIC MAPS IN WASHINGTON

In the concourse at SeaTac Airport, hurrying for a plane this summer, I passed by a shop called 'Vintage Washington – Fine Wine, Food & Spirits.' I had to stop and take a few photos of this map outside the shop, showing the State's Viticultural Areas. The map was very pleasing and includes some descriptive information about each area along the bottom and right margins of the map. Stop by, take a look, and maybe buy a bottle of Washington wine for your guests if you are picking someone up, or for your hosts, if you are on your way out of the state.

Greg Babinski Photo

Do you know of a public map display in Washington? Send it to *The Summit* and we'll include it in a future issue. *-Editor*

THE SUMMIT – LITERARY CORNER

On Exactitude in Science

In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province.

In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it.

The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness, they delivered it up to the Inclemencies of Sun and Winters.

In the Deserts of the West, inhabited by Animals and Beggars, still today, there are Tattered Ruins of that Map.

In all the Land there is no other Relic of the Disciplines of Geography.

Suarez Miranda,Viajes de varones prudentes, Libro IV,Cap. XLV, Lerida, 1658; From Jorge Luis Borges, Collected Fictions, Translated by Andrew Hurley

-Jorge Luis Borges

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Contact Karsten Venneman at: karsten@terragis.net

Central Puget Sound GIS User Group
http://waurisa.org/phpBB2/viewforum.php?f=24
Contact Nora Gierloff at: ngierloff@ci.tukwila.wa.us

Central Washington GIS User Group
Meets the 2nd Wednesday of each month.
For information contact Amanda Taub at:
ataub_gis@yahoo.com

King County GIS User Group
http://www.kingcounty.gov/operations/GIS/UserGroups.aspx
Meets 1st Wednesday every other month at 11:00am at the KCGIS Center, 201 S. Jackson Street, Seattle WA, Conf Room 7044/7045.

Northwest Washington GIS User Group
http://www.acadweb.wwu.edu/gis/nwgis_mtgs.htm

Southeast Washington/Northwest Oregon GIS User Group For more information, see:
http://web03.pocketinet.com/~sewa-neor-gis/sewa-neor-gis.org/index.html

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Contact Cathy Walker at: c.walker@mil.wa.gov

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