Organization of Fish and Wildlife Information Managers

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Preparing for the future:
Adapting Technology to Support Sustainable Resource Management

ABSTRACTS

The AFWA - OFWIM Connection
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Since 2005, the Association of Fish and Wildlife Agencies (AFWA) has had a standing Technologies and Data Utilization Committee (TDUC). The TDUC was formed to replace the Automated Wildlife Data Systems Task Force. The committee serves as the center for agency technology initiatives and data management efforts. The issues addressed by the committee directly relate to the mission statement of the Organization of Fish and Wildlife Information Managers. The TDUC and its AFWA staffer, the Automated Wildlife Data Systems Program Coordinator, need to work on establishing a formal line of communication between the committee and OFWIM.

Jeff Johnston is trained as a biologist and holds a Masters degree in Biology from Arizona State University and a Bachelors degree in Mathematics and Biology from Hendrix College. He is currently the Automated Wildlife Data Systems Program Coordinator for the Association of Fish and Wildlife Agencies (AFWA). Prior to his employment with AFWA, Jeff served as the Data Management Program Coordinator for the Arkansas Game and Fish Commission for 3½ years. He has also been an Oracle database developer for a Fortune 500 company and a clinical data manager for the Arkansas Children's Hospital Nutritional Research Clinic.

Remote Sensing Systems Overview for Fish And Wildlife Managers
Brian Huberty

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So many choices; so few dollars. It used to be much simpler 30 years ago when all you had was aerial photography to map the landscape. Today, there are many more choices than just plain old aerial photography. This presentation will highlight the multitude of sensors available for fish and wildlife management applications. There are satellite, aerial, and ground sensor systems using optical, radar, thermal and hyperspectal sensors as well as traditional aerial photography.

So as information managers for fish and wildlife agencies, your job just became much more challenging in this digital imaging era. Not only are there many more choices, they are digital in nature.

Brian Huberty is the National Wetland Inventory Coordinator for U.S. Fish and Wildlife Service Region 3, and is responsible for overseeing the National Wetland Inventory program in the Great Lakes/Mississippi River region. Brian has more than 20 years experience in image acquisition, analysis, remote sensing, and GIS. He has been certified as a Mapping Scientist by the American Society of Photogrammetry and Remote Sensing. He currently serves ASPRS as the Chair of that society's Primary Data Acquisition Division, and is a member of the ASPRS Board of Directors.

<u>Open Source Web Mapping for Natural Resource Management</u>
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Open Source software provides a high-quality, cost-effected solution to many common business problems and web-based GIS is no exception. This presentation will detail applications developed at the Minnesota DNR that make use of technologies such as MapServer and PostGIS to address: 1) information dissemination, 2) GIS data sharing and distribution, and 3) web-based data collection and management.

Steve Lime manages a database and application development group for the Minnesota Department of Natural Resources. His specialty is integration of GIS and web technologies. He was the creator of the popular Open Source University of Minnesota MapServer application and still remains as lead developer for the project.

Map Server Applications for Wildlife Education:
A Case Study of 'Moose on the Loose'
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The Colorado Division of Wildlife's Education Program initiated a project for grade school children to follow the movements of two moose, equipped with satellite transceiver collars . The telemetry collars placed on the moose transmitted GPS locational information back to the ARGOS system satellites. Twice per week ARGOS would ship a file, by email, to the Colorado Division of Wildlife. Data on the collar number, date and time of point data capture, and geographic coordinates was entered into a spreadsheet for each valid locational fix from the ARGOS file. Raw geographic coordinates from the ARGOS derived spreadsheets were converted to UTM/NAD 27 locations, and imported to an ArcView shapefile format. Geo-locations in the shapefiles were reviewed spatially, and outliers dropped. Documents (PDFs) were prepared twice a week, of the locations for each moose, and posted to the 'Education' pages of the CDOW web-site (http://www.wildlife.state.co.us/Education/StudentActivities/GrandMesaMooseTracking/) for student download, and use with each weeks prepared 'lesson plan'. Students were directed to use the Division's Natural Diversity Information System 'online' MapServer (http://www.ndis.nrel.colostate.edu/maps/) [using ESRI's ArcIMS technology, http://www.esri.com/arcims/] to plot and analyze the moose locational data. Protoyping was also done, using the open source University of Minnesota MapServer (http://mapserver.gis.umn.edu/) and Apache (http://www.apache.org/) web-server software, for a 'Moose Tracking' specific MapServer. In addition to the moose telemetry data available on the 'Travelin' Moose MapServer', additional reference data layers were made available in both vector format [airports (points), streams and contours (lines) cities, lakes and townships (polygon)], and raster format [elevation, and statewide 250K digital raster graphics maps] for interactive querying and viewing.

Don is Wildlife Inventory Coordinator in the Wildlife Resources Support Section for the Colorado Division of Wildlife. Don has overseen development of the Division's GIS-based Wildlife Resource Information System (WRIS; early 1970's), the Colorado Wildlife Species Database (CWSD; early 1980's), the Scientific Collections Permit Database (SCICOLL), and initiation of the Division's Colorado Vegetation Classification Project (CVCP; early 1990's). He has served as Colorado's Principal Investigator for the Colorado Gap Analysis Project (COGAP) [http://ndis1.nrel.colostate.edu/cogap/], as well as being Principal Investigator for the Colorado Ecoregional Component of the Southwest Regional Gap Analysis Project (SW-ReGAP). Don has been a collaborator in development of the Division's Natural Diversity Information Source (NDIS) [http://www.ndis.nrel.colostate.edu/] and other database/web applications at the CDOW. Professionally, Don belongs to The Wildlife Society, The Society for Conservation Biology, The American Society of Photogrammetry and Remote Sensing, the United States Regional Association of the International Association for Landscape Ecology, and the Organization of Fish & Wildlife Information Managers. He is a past-president of OFWIM, and is currently the Southwest Regional Contact for OFWIM, in addition to being an 'unofficial OFWIM Co-WebMaster' for 2003-06. Don received his Bachelor of Science degree in Wildlife Biology (Research Option) from Colorado State University (1972) and his Master of Science degree in Wildlife Biology from Colorado State University (1989). Don lives in a seemingly abandon Victorian home in Denver, Colorado, and enjoys fishing, hunting, camping, motorcycle touring, and an occasional bluegrass festival.

Online GAP Ecosystem Data Explorer Tool: An Opensource GIS Decision Support Tool for Gap Analysis Data
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The Gap Analysis Program has previously developed a decision support tool for GAP data based on ESRI ArcView software. While the functionality of the GAP Ecosystem Data Explorer Tool remains a robust interface for manipulating GAP datasets, the software and hard disk requirements of ever increasing data extents require a transition to a web delivered tool. The next generation of the GEDE Tool is being developed on a LAPS architecture (Linux, Apache, PHP, PostgreSQL) with rCalc, PostGIS, GRASS, and MapServer. An opensource framework has provided a flexible, economical, and robust solution. This presentation will discuss the programmatic needs of an online GIS decision support tool, how they are being met with opensource solutions, and where we are headed with future development.

Steve Williams has been working with the Gap Analysis Program for the last 10 years -- first with the NC state project, and now with regional efforts in the Southeast and Northeast. His primary focus is vertebrate modeling which makes him deal with database design, spatial modeling, and web delivery of GIS data. Due to his anti-establishment temperament, he has opted for open-source solutions to web delivery and is here today to tell us about it.

Rapid GIS Application development and Interoperability at NBII

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In the role of fulfilling its mission of bringing biological information to the internet, U.S. Geological Survey's National Biological Information Infrastructure Program (USGS-NBII), works through a distributed network of NBII nodes and NBII partners. Since the technical skills and funding vary across this distributed network, NBII's Geospatial Program has focused on the development of templates and toolkits to allow for rapid application development within the network money.

NBII toolkits can be plugged-into any new or existing websites for enabling geospatial functionality such as gazetteer functions, or web mapping applications. These toolkits are platform independent, have minimum limitations and can be integrated with new or existing applications with minimum effort and little programming knowledge. Using these toolkits can reduce development time of an ArcIMS application that is complies with the Geospatial Interoperability Framework (GIF) used within NBII from several man months to few weeks.

NBII services such as the Catalog of Web Map Services, the Gazetteer service, and the bounding box service, can be used by any application without the overhead of hosting and maintaining the code or the map layers. NBII provides users with one or more clients to these services, which can be embedded into new or existing ArcIMS applications.

NBII Nodes and NBII Partners participate in the GIF by enabling their ArcIMS Applications for WMS access, then registering their application so it will be harvested into NBII Catalog of Web Map Services. This Catalog service provides a central place for discovering and visualizing published NBII web map or feature services and their associated map layers. Currently the Catalog service contains approximately 250 biologically related map services which comprise the Catalog services holdings of approximately 20,000 data layers for use by the public.

By extending the current or new applications, using these toolkits or services, NBII provides a richer user experience and exposure to its wide array of resources to users in the tools they currently use to perform their work.

Onkar Chandel is a Software Architect with masters in computer science. He experience in managing, architecting and delivering software projects related to Enterprise GIS, Enterprise Applications, and Telecommunications. Currently he is working as a technical lead for NBII's Geospatial Interoperability Framework.

The Perils of Portals:
Avoiding Pitfalls in Sharing Data via Web Portals
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Web Portals are becoming a very useful tool for locating and obtaining information over the Internet. This technology involves posting metadata through a specific portal website with links to the original data. The StreamNet project is but one of many database projects that is using this technology to share its data with a wide group of interested data users. In exploring and beginning to use this approach, however, a number of potential difficulties became evident. One is lack of "branding" for a data source. Once published, the data are available for other entities to use and re-publish under their own name. Even though the ultimate source of the data may be detailed in the new metadata, the owner of the new data set and the associated metadata is identified as the new user, not the original data source. This results in a second copy of the data, sometimes with changes, and confusion over whose data it is. A second pitfall also relates to subsequent users and re-publishers of a data set. We have encountered cases where a secondary user of data published their new data set to a portal, but did not updated the data or the metadata over time. Worse, in cases where the second source ceases to exist but the web site remains active, it becomes difficult to remove the link to the outdated data set from the portal. Lastly, updating the metadata to cover additions and changes to the data set can be tiresome and overlooked if the metadata are sent directly to the portal. In this case, it is better for the data source to publish its metadata as a web service so that the portal can periodically upload the metadata with updates as they are made.

Bruce Schmidt has over 30 year experience in fisheries management, research and administration in four states. He holds a BS in Fisheries Management and an MS in Fish and Wildlife Science. Bruce's experience includes jobs as research biologist, planner, director of research, and 10 years as a state fish chief. He is currently employed in the field of information management as Program Manager of the StreamNet Project with the Pacific States Marine Fisheries Commission.

Sharing of Data through Web Services
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If I could only get to the data that is stored in someone else's database, I could complete my project quicker and under budget. How many times have we asked ourselves this very question?

Sharing is the key to success. Today, the ability to seamlessly exchange information between internal business units, other organizations and partners is vital for success; yet most organizations employ a variety of separate applications that store and exchange data in different ways and therefore cannot "talk" to one another productively.

Web services have evolved as a practical, cost-effective solution for uniting information distributed between critical applications over operating system, platform, and language barriers that were previously impassable.

Jeff Dobson is the Senior programmer/analyst for the Fish and Wildlife Information Exchange at the Conservation Management Institute at VA Tech. He did his undergraduate studies in computer science at Virginia Tech and has worked in the Information Technology field for over 10 years. As Senior programmer at CMI, he is currently managing various natural resources database and web applications for state and federal agencies as well as a couple international organizations.

Threatened and Endangered Species Data Management System: Integrating Digital Data Collection, Oracle, and the Internet.

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The US Army Corps of Engineers has conducted monitoring and evaluation of populations of the threatened Piping Plover and endangered Interior Least Tern on the Missouri River for the past 15 years. Historically data was collected on paper datasheets and stored in multiple Access databases and excel spreadsheets. As populations increased, data requests became more frequent and real time management practices were developed, it grew apparent that a more efficient method of data collection and storage was needed. The Threatened and Endangered Species Data Management System was developed to provide a single, centralized system for entry, storage, and distribution of these data while maintaining data quality standards and providing real time information to our partners for use in decision making processes.

Through the use of Trimble GPS units we have vastly increased our efficiency in the field and our ability to update the database daily. An Oracle database has enabled us to organize and store current nesting season data as well as historic data while maintaining data integrity. The web interface provides the portal to real time reports, custom historic reports, a map interface, data entry, and tools for our field crews. This system has enabled us to avoid redundant record keeping and data entry efforts, provide for easy and timely backups of data, provide rigorous data standards through built in data validation routines, standardize record keeping, and insure the most up to date information is available for customized reports and data presentation.

Coral Huber received a BS in Zoology/Wildlife and Fisheries from North Dakota State University in 2001 and a BS in Natural Resource Conservation from the University of Montana in 2002. Her career started out as an intern with the US Army Corp of Engineers Omaha District Threatened and Endangered Species section where she worked primarily on reservoir habitat research and GIS. She is currently working as a wildlife biologist for the section on data management for tern and plover issues on the Missouri River.

Martha Bullock is a geospatial data and application developer with the US Army Corps of Engineers Remote Sensing and GIS Center of Expertise in Hanover, NH. She has worked with customers from around the Corps and from other agencies on various projects to enhance the collection, storage, analysis, and distribution of geospatial data. Martha will be presenting two ongoing projects within the Missouri River Basin that support basin-wide species and habitat restoration efforts.

Mobile Software and Hardware Lessons Learned
Rick Lorenzen

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Anyone creating mobile offline applications should hear these pilot season results. Minnesota's Department of Natural Resources developed new mobile fisheries software and used rugged tablets in their lake survey boats this year. This pilot includes a new data structure, new online and offline screens, over 75 new validation tables, new "paper" data collection forms, new rugged tablets, gathering and validating location coordinates, data imports from old hardware devices, and dozens of new reports. You can benefit from what we learned.

Software: Java Client, Java Web Start, and Open Source Hibernate
Databases: Oracle for online and Open Source HSQLDB for offline
Hardware: Xplore X104C2 rugged tablets and Corvallis Micro Technology handhelds

Attendees will learn: Problems encountered creating offline software and how to avoid or mitigate them; Problems encountered using hardware outside and how to mitigate them; Three critical recommendations for those who are creating mobile applications; A workable approach to bridging tabular and spatial data.

Rick Lorenzen is the Systems Analyst Unit Supervisor for the Minnesota Department of Natural Resources (DNR) Fish and Wildlife Division. His team develops and maintains Natural Resource Management software and Geographical Information System data layers and maps. Rick attended Carleton College for liberal arts education, Brown Institute for computer programming, and Metropolitan State University for a business/management degree. He worked in Information Technology since 1980 for Brown Institute Service Bureau, Hennepin County, PACE Laboratories, Analysts International Corporation, Pillsbury, and 3M. Rick joined the Minnesota Department of Natural Resources in 2001 as an Information Technology Supervisor and Software Development Project Manager. He is currently managing a Fisheries Lake Survey software development project and supervising software development and Geographic Information System development teams.

Efficient Creation of Large Scale Spatial Depictions of Suitable Habitat

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When problems become larger, the importance of reliable and efficient techniques becomes more crucial. This presentation will review the environment used by SWReGAP to compute raster habitat maps of over 800 terrestrial vertebrates across the southwest region of the United States drawing from up to 12 baseline spatial layers. At 30m resolution, each habitat map is over 2 1/2 gigabytes in pixel size. The process relies on a generic habitat modeling database whose purpose is to unambiguously describe the relation between habitat suitability and a predefined set of baseline layers such as land cover, elevation, and distance to water bodies. Map computation was conceptualized into two segments: the compiler which translates the database description of habitat suitability into software dependent executable code and a GIS engine which controls the process of requesting a map, creating code, its execution, and noting its final disposition. The compiler successfully created over 800 graphically based models representing each habitat relation needed for GAP assessments. Among the numerous variations of possible models, most relations tended to follow only a few specific combinations of baseline layers. Most models could produce output within an hour except for models that stipulated a minimum polygon size as that requires the added complexity of identifying polygons of the acceptable size. The GIS engine handles user requests and execution status by means of a data table located in the underlying database. This enables multiple computers to process pending requests and provides an audit trail of model executions. This methodology as it was applied to SWReGAP can serve as a case study as to how tremendous efficiencies can be gained by using a data centric, systems based perspective in project design and implementation and is ideally suited for large scale operations present in management agencies and other large research institutions.

Robert Deitner (Bob) was born in St Paul, MN and obtained a Bachelor of Science degree in Mathematics from the University of Minnesota, Duluth. He has over 20 years experience as a research specialist in the department of Fishery and Wildlife Sciences at New Mexico State University, the last 7 being with the New Mexico Cooperative Research Unit. His interests are in the quantitative aspects of natural resource systems especially large problems such as reservoir ecosystem models, recreational economic models, automating of density estimation. His talk today will be about his last role, developing animal habitat models for SWReGAP.

BOLFOR II:
Leveraging Web and Database Technologies to Help Manage Bolivia's
Forest Resources
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The Bolivian Forestry Research Institute (Instituto Boliviano de Investigación Forestal - IBIF) uses a forest management system that involves installing permanent monitoring plots in different types of forest, in order to identify suitable management practices for each type of forest and guarantee that forest resources are used in the most sustainable fashion.

At the Conservation Management Institute (CMI) we worked with IBIF to develop a Web-based application to support their resource management efforts. The Web application supports IBIF's established processes from beginning to end: printing datasheets for recording data during field surveys; providing efficient Web-based data entry forms including validation of data (required fields, data type constraints, etc.); and exporting data for analysis.

This presentation will discuss the Web application's architecture and provide an overview of the workflow implemented in the system.

Bill Herrington is a Web/database programmer/designer at the Conservation Management Institute (CMI) in Blacksburg, VA. He began working at CMI in February of 2006 and has already contributed to multiple projects including the BISON-M wildlife system for The New Mexico Department of Game and Fish, the E-FISH electronic dichotomous key website, and Bolivia's BOLFOR II forestry system. Mr. Herrington holds a Bachelor of Arts degree in English and Philosophy from Virginia Tech. His interests include watching basketball and playing fetch with Charlie (the cat that he and his wife adopted earlier this year).

Leveraging the Internet for Information Dissemination and Mapping:
From Conception to Deployment

Dean K. Jue[1] and Georgianna Strode[2]

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The general public expects the Internet to provide timely, up-to-date, and relevant information. Consequently, many public agencies have increased their presence their use of the Internet for providing such information to the general public. If properly implemented, Internet-based solutions can improve the effectiveness and efficiency of information dissemination by an agency. It may also become possible for citizens to provide relevant data to an agency over the Internet that will eventually be incorporated into mission-critical databases. The Florida Natural Areas Inventory (FNAI) has been developing such Internet-based solutions over the past three years, with many of these solutions being map-based.

During this discussion, software system designers and programmers for FNAI's Internet applications will share their knowledge and experience both in designing Internet applications (both map- and non-map-based) from the ground up as well as in discussing alternative software solutions that have also been suitable for disseminating natural heritage-type data.

The topics that will be covered during this panel discussion include: Florida Natural Areas Inventory: Statewide role in decision-making; Information dissemination over the Internet: pros and cons; Internet mapping issues; Demonstration of FNAI web applications: Conservation Lands map, Biodiversity map, Invasive Exotics map, Other maps; Lessons learned; Information Dissemination over the Internet: Getting Started

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Dean Jue has degrees in the biological sciences from the University of California at Berkeley as well as from University of California at Davis. He has been working with geographic information systems for 19 years at Florida State University. He is currently helping the Florida Natural Areas Inventory in developing their invertebrates database as well as in the development of their Internet mapping applications.

Georgianna Strode has over 20 years of GIS programming experience. Recent projects are web-based and cover a range of topics, such as biodiversity, demographics, libraries & museums, and land information.

<u>Facilitating Data Synthesis: Biodiversity in Grasslands Revisited</u>

Inigo San Gil[1] and Stephanie Pimm Lyon[2]

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We reproduced some of the results from a paper published in Nature (Productivity and sustainability influenced by biodiversity in grasslands ecosystems, vol 379, pp 718-20) using a prototype software model for data discovery and synthesis. For these synthesis tools to work, compliance with a robust metadata standard such as the Ecological Metadata Language (EML) is necessary. Using published data from the Cedar Creek Natural History Area LTER, we demonstrate the feasibility of data analysis with relatively little human intervention. We hope to motivate scientists to document their datasets with the same rigor used to collect them, allowing the broader scientific community to benefit from these datasets through the use of open source technology.

Inigo San Gil moved to the US from (San Sebastian,) Spain over a decade ago. Inigo earned his Ph.D in Mechanical Engineering at Yale, and he moved on to lead the Yale core facility for Bioinformatics. He and his family left for New Mexico, where he is currently working at the LTER Network Office in partnership with the NBII.

Stephanie Lyon has a BA in biology from Carleton College. She has worked at Cedar Creek Natural History Area since June 2005, and became Cedar Creek's Information Manager this past spring.

GIS and Wildlife Disease Surveillance in Virginia
Kendell J. Ryan

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The Virginia Department of Game and Inland Fisheries (DGIF) has been conducting surveillance for Chronic Wasting Disease (CWD) since 2002. CWD was found in West Virginia a few miles from Virginia's border in 2005. Using the locations of the nearby West Virginia cases and locations of high risk captive facilities, the state was divided into tiers representing risk levels. An active surveillance area was defined and mapped in the northwestern part of the state, the highest risk area. Through road-killed and hunter-killed deer sampling, the goal was to collect 500-550 samples throughout this area. An important part of this effort was being able to assign locations to these samples. This was necessary to ensure thorough and widespread sampling and to collect critical information should samples test positive. As with mapping locations for any wild animals, recording accurate spatial information is challenging. Working in rural areas where assigning addresses or intersections is not possible or in cases where Global Positioning Systems (GPS) may not be available, increases this challenge. Additionally, having data recorded by various field staff, the public or partner agencies, introduces potential issues with data quality and management. Some of these issues were addressed using a well designed grid system and detailed data cards for the active surveillance area. DGIF with the help of others collected the necessary samples and in most cases was able to record point locations. This information was used to map and display the collected samples, and was entered into an internal database. This database had a web front end with which the public could confidentially view the results of the disease analysis. Luckily, all samples in 2006 tested negative for CWD. The surveillance and tracking process is being modified for the 2006 season. Also in 2006, the DGIF is conducting surveillance for Avian Influenza (AI). Using lessons learned from CWD sampling, data cards have been created to include detailed location information. The primary means for data collection will be Trimble Recon units loaded with ESRI ArcPad 7.0. These units have an electronic version of the datacards in which the field staff can enter data. After evaluating the use of the Recon units in the AI surveillance, the units may be incorporated in CWD surveillance in 2007, where possible.

Kendell Ryan has been in the Fish and Wildlife Information Services section in the Wildlife Diversity Division at the VA. Dept. of Game and Inland Fisheries for about 3 years. Kendell works in the Geographic Information Systems (GIS) group mostly on natural resource related projects. Her background is in biology with an undergraduate degree from James Madison University and a Masters from the College of William and Mary.

Collaborative Approaches to Monitoring and Data Sharing in the Pacific Northwest
Bruce Schmidt

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The Pacific Northwest is rich in fish and wildlife resources but struggling with declining populations and ESA listings. Despite many state, tribal and federal management and regulatory agencies, there is no single entity "in charge", making coordinated restoration and management in this vast multi-state area difficult. As a result, several collaborative approaches have formed to encourage cooperation in management and monitoring. There are three key efforts: The Pacific Northwest Aquatic Monitoring Partnership is an umbrella organization for workgroups specialized on specific types of monitoring, including fish habitat, fish population, estuary condition, and habitat restoration effectiveness, with a data management workgroup to assist with tying data together across the partnership. The Collaborative Systemwide Monitoring and Evaluation Project is an effort among the PNW fisheries management entities to develop a consistent approach to evaluating fish population trends. The Northwest Environmental Data-network is a collaborative effort focused on improving the quality, quantity, and availability of regional data and related information on fish, wildlife and their aquatic and terrestrial habitats. These groups are distinct but related, and information management and data sharing is becoming a key theme uniting these efforts.

Bruce Schmidt has over 30 year experience in fisheries management, research and administration in four states. He holds a BS in Fisheries Management and an MS in Fish and Wildlife Science. Bruce's experience includes jobs as research biologist, planner, director of research, and 10 years as a state fish chief. He is currently employed in the field of information management as Program Manager of the StreamNet Project with the Pacific States Marine Fisheries Commission.

Deer and Turkey Telecheck
Mark Brunner

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Deer and turkey harvest information is used to determine population age and density which in turn helps determine seasons and limits and allows effective management of the populations. Missouri has a law requiring all deer and turkey hunters to report (check) animals harvested on the day they were taken. This presentation details the implementation and results of a program implemented by the Missouri Department of Conservation for hunters to check their harvested deer and turkey using the telephone rather than taking the animals to manned check stations. The project incorporated several different aspects of technology including telephone speech recognition, touch tone IVR technology, and Web development using .Net as well as standard ASP. It outlines a case study in educating the public about using new methods for performing familiar tasks through technology.

Mark Brunner is the IT Supervisor in charge of application development at the Missouri Department of Conservation. He has a BS in Forest Management and an MS in Computer Science, both from the University of Missouri at Columbia. Mr. Brunner spent 16 years in Denver developing software for aerospace applications before returning home to Missouri to work with conservation. He leads a team tasked with developing technology solutions to assist in the management of Missouri's forest, fish, and wildlife resources. Mr. Brunner was recently involved in the automation of deer and turkey harvest reporting using a combination of internet technology and automated speech recognition.

Geographically Based Visualization Tools
Shelaine Curd-Hetrick

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The National Biological Information Infrastructure -- Southern Appalachian Information Node (NBII-SAIN) is working with regional partners to develop visualization tools that enable decision making by providing accessibility to accurate downloadable information. Many organizations are moving to standard driven geographically based systems to gather and analyze and share information. The interfaces for this information can be cumbersome or user-friendly. NBII-SAIN has partnered with federal, state and non-profit organizations to share geographically based information about aquatic, botanical and mollusk species and strive to provide a user-friendly interface that allows the user to determine the level of interactive detail provided through the internet. Within this interface, we can provide visual context data layers of interest including topography, government and managed land holdings, streams, and watersheds. To learn more please visit our web site at http://sain.nbii.org/

Shelaine Curd-Hetrick is the Partnership and Outreach Coordinator for the Southern Appalachian Information Node of the National Biological Information Infrastructure (NBII-SAIN).   She has worked with state, federal, profit and non-profit agencies to develop geographically based visualization tools. She received her master's degree in Applied Ecology and Conservation Biology from Frostburg State University (1996) and a bachelor's in Computer Science and Statistics with a second major in Biology from Roanoke College (1991).

The Natural Resources Monitoring Partnership
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Monitoring is essential to making effective management decisions and evaluating the outcomes of those decisions. Unfortunately, limited resources, incomplete information, and jurisdictional boundaries can compromise the ability of resource managers to design and implement effective monitoring programs. Too often, monitoring is the last thing to get done and the first thing to be cut. Most monitoring and evaluation is driven by specific projects and short term information needs, limiting our ability to take advantage of economies of scale and make the most of scarce resources.

The Natural Resource Monitoring Partnership (NRMP) is a collaborative effort by the natural resource management community to improve monitoring efforts in order to support effective evaluation and decision-making. Current participants include state and federal natural resource management agencies, non-governmental organizations, and academic institutions. The initial focus of the Natural Resource Monitoring Partnership is on developing two open-access, internet-based tools to foster coordination of and collaboration among monitoring efforts. This NRMP system will be developed and hosted by the National Biological Information Infrastructure (NBII), a collaborative, multi-sector partnership, managed by the U.S. Geological Survey.

Monitoring Protocol Library - An internet accessible, searchable database of protocols that provides information on monitoring protocols and resource assessment methodologies, organized to facilitate reference and use.

Monitoring "Locator" - An internet-based, GIS application that allows users to identify what natural resource monitoring is being conducted within a particular area (e.g., State, county, or other selected geographic area). Users of this system will have search tools to find out about ongoing and historic monitoring according to the scales, targets, and objectives that are of interest to them.

For the last 7 years, Lisa Zolly has worked for the U.S. Geological Survey's National Biological Information Infrastructure (NBII) Program as the Knowledge Manager. Her projects include designing and integrating biological data and information systems; leading content management efforts; developing programmatic information architecture; designing standards, tools and services for the discovery, characterization, and retrieval of biological data and information; guiding user interface design; and managing thesaurus development. She holds a BA and MA in English from Virginia Tech and an MS in Information Science from the University of Tennessee; additionally, she hopes (!) to complete her MS in Natural Resources from Virginia Tech in 2007.

The National Biological Information Infrastructure's Digital Image Library

Annette Olson[1] and Gene Morris[1]

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The NBII Digital Image Library <http://images.nbii.gov> is a web resource that makes available a diverse range of images related to nature and the environment, with images contributed by the NBII and other partners. Our mission is to make documented biological images easily accessible to scientists, resource managers, decision-makers, students, and the general public, and thus images are in the public domain or allow nonprofit and educational use.

Our library seeks and makes available images associated with plant and animal species, habitats, wildlife management, and more. Each image is dynamically linked to relevant and validated information, such as scientific and common names, a description, and geographic location, as well as photographer and contributing partner names. The Library organizes images within biological and regional categories, and by special collections - such as those for a particular organization. Additionally, the library is fully searchable and most images can be downloaded in three file sizes: thumbnail, medium, and high-resolutions.

The NBII's nodes, collaborative partners, and contributors can benefit both as users and as providers to this online resource. The library provides a secure repository in which images can be organized, easily accessed, and shared. With an anticipated 10,000 images being added within the next year alone, the Digital Image Library is rapidly growing, and new tools are being developed to support that growth.

Dr. Annette Olson is a biodiversity scientist working with the National Biological Information Infrastructure, housed at the U.S. Geological Survey in Reston, VA. She shares responsibility for building species and biodiversity content, ensuring the high-quality of that content, promoting collaboration among biologists within the biodiversity informatics field, and ensuring the usability of disseminated information. Two projects that she works closely on are the NBII Digital Image Library, and the Species Knowledge Management Working Group. She is also a Research Associate with the National Museum of Natural History, Smithsonian Institution.

Collaborative Approaches to Science-Based Natural Resource Management: Promise and Challenge of Cooperative Conservation

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Basing natural resource management decisions on sound science began at the end of the nineteenth century in the belief that science would provide a means of objective and rational management. Unfortunately, the highly contentious debates that surround complex natural resource issues often marginalize the contribution of science to decisions that get made. This is in large part due to adversarial processes that are created by and often dominate regulatory disputes. In an attempt to reduce the conflict surrounding policy decisions and to increase the effective use of science in these decisions, government agencies have been exploring collaborative—cooperative conservation—approaches to natural resource management. While experience is growing and collaborative approaches can be effective, there are many challenges to overcome to implement these approaches in the agencies and to test the effectiveness of a collaborative process on the ground. The panel will moderate an interactive discussion with the audience exploring these challenges in the context of cases of successful cooperative conservation strategies.

Herman Karl is a U.S. Geological Survey scientist. He holds an appointment as a Visiting Lecturer in the Department of Urban Studies and Planning at MIT, and co-directs the MIT-USGS Science Impact Collaborative (MUSIC). His research focuses on how better to incorporate scientific information into collaborative processes and democratic deliberations for more effective natural resources decisions and durable environmental policy. He conducts integrative research at the nature-society interface to bridge the gap between science, policy, and management to harmonize the build and natural environments.

Ric Richardson is Professor and Acting Dean of the School of Architecture and Planning at the University of New Mexico. Prior to joining the faculty, Ric was the Commissioner of Planning for the State of South Dakota, and also served as the Assistant Director of Planning for the Rosebud Sioux Tribe. Ric works as a mediator to resolve environmental and community disputes and specializes in instituting collaborative planning strategies for natural resource and environmental planning. Ric is a senior associate with the Consensus Building Institute in Cambridge, Massachusetts, and the Public Disputes Program at the Harvard Law School. He also teaches an advanced course in mediating land use disputes at the Lincoln Institute for Land Policy.

Fire Research and Management Exchange System (FRAMES): Partnering to Effectively Disseminate Fire Resources

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The Fire Research And Management Exchange System (FRAMES) is being developed in order to help facilitate science delivery and technology transfer for federal and state fire and natural resource managers, researchers, county and city planners, landowners, special interest groups and the general public. The sheer volume of wildland fire and fire-related research including data, documents, tools, and websites makes the two-step process of identifying and synthesizing the best available fire science into policy and decision making challenging and sometimes impossible. Research deliverables are widely distributed, difficult to find and compare, and oftentimes poorly documented. The goal of FRAMES is to make wildland fire related content resources and technologies easy to find, access, distribute, compare, and use.

FRAMES is a distributed network of partners who are working together to connect tools, information, and people at local, regional, and national scales. One example of an effective FRAMES partnership involves the University of Idaho, NOAA's Paleoclimatology Program, USGS National Biological Information Infrastructure (NBII), and international researchers in the fire history community. This partnership is providing fire history products, and is represented in the FRAMES portal through the Fire History Subject area. The FRAMES portal technologies enhance collaboration among partners, and this collaboration enhances the sharing and transfer of fire management related technologies. The Fire History Subject area is a case in point.

Greg Gollberg is the project manager for the Fire Research And Management Exchange System (FRAMES) at the University of Idaho. BS in Ecology and Conservation Biology; MS in Fire Ecology from the University of Idaho.

Wendy Gross is a Software Engineer and Technical Project Lead with the National Oceanic and Atmospheric Administration (NOAA) Paleoclimatology Program. In collaboration with colleagues at NOAA Paleoclimatology, and the Fire Research and Management Exchange System (FRAMES), Ms. Gross manages the content of the FRAMES Portal Fire History Subject Area. Ms. Gross's research interests are in the area of portal technologies, and the design and development of analysis and visualization software tools, especially geospatial, which facilitate the transformation of scientific data into knowledge in the field of climate science. Furthermore, she is currently pursuing studies as a graduate student in the Masters of Geographic Information Systems Program at the Pennsylvania State University, Department of Geography.

High Pathogenic Avian Influenza Early Detection Data System (HEDDS): Partnering Technology and Collaboration for Improved Disease Surveillance
F. Joshua Dein

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At the request of the White House Policy Coordinating Committee for Pandemic Influenza Preparedness, the U.S. Departments of Agriculture and Interior, along with other partners, developed an early detection plan for HPAI in the United States. The plan calls for the establishment of a national database for use by all agencies, organizations and policy makers. The NBII Wildlife Disease Information Node (WDIN) has created the HPAI Early Detection Data System (HEDDS) to meet this goal. Partners formed the Interagency Steering Committee (ISC) to direct the operation and content of the system. Working with the input from the ISC, WDIN developed HEDDS to manage animal and specimen collection data taken by many groups and individuals, and analyzed by multiple laboratories.

Designing the HEDDS system involved identifying and addressing user needs. The result is a secure, accessible system platform for the generation of reports, graphs, and maps and can be used for spatial modeling. The system development also included determining the core set of data fields partners would agree to share for the mutual purpose of gaining a comprehensive view of national sampling efforts. Contributing members of the system can not only view their own surveillance sampling initiatives, but also those occurring outside their agency geographical boundaries. Through the work of WDIN and its partners, HEDDS is an example of how technology and collaborative ventures can be brought together to improve disease identification and response.

F. Joshua Dein (VMD, MS) is the Project Leader for the NBII Wildlife Disease Information Node; a biologist and veterinarian with 25 years experience with wildlife disease management in both field and laboratory environments. He has been active in other informatics collaborations aimed at integrating multidisciplinary health data and information, such as the Canary Database <http://canarydatabase.org/> and WildPro Multimedia <http://www.wildlifeinformation.org/>

Passage Assessment Database: a California Tool for Stream Habitat Connectivity Restoration

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In recognition of the importance of restoring California's once-abundant salmon and steelhead populations, an inter-agency cooperative project was initiated by the State Coastal Conservancy, Department of Fish and Game, Pacific States Marine Fisheries Commission and others to inventory barriers to fish passage throughout the coastal watersheds of California.

The Passage Assessment Database (PAD) is an ongoing map-based inventory of known and potential barriers to anadromous fish in California. The PAD has compiled data from more than one hundred agencies, organizations, groups and landowners throughout California. These data allow past and future barrier assessments to be standardized, stored in one place and made easily accessible.

The PAD can be used to analyze the cumulative impacts of barriers on salmonid migration in the context of overall watershed health, as well as to identify barriers suitable for removal or modification. It is an important tool for determining and tracking the outcomes of passage improvement projects. The PAD is publicly available via the CalFish website (www.calfish.org).

Robin Carlson has worked for the Pacific States Marine Fisheries Commission since 2000, first as a Data Analyst/Programmer and since 2003 as a Project Leader. During her tenure at PSMFC, she has worked primarily on the California Habitat Restoration Project Database and the California Passage Assessment Database. Robin received a BA in Molecular, Cellular and Developmental Biology from the University of California, Santa Cruz in 1997, and an MA in Evolutionary Biology from the University of Chicago in 2000.

Geospatial Decision Support System for the Missouri River Ecological System

Martha F Bullock[1] and Bryan E Baker

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The US Army Corps of Engineers is developing a comprehensive geospatial database framework and suite of software applications to support system-wide management and restoration of the Missouri River ecological system. The databases and applications will provide mechanisms for data collection, evaluation, storage, analysis, modeling, and distribution among Corps Districts and public and private stakeholders. Having system-wide data and analyses available through a consistent basin-wide framework will foster communication and enable efficient interoperability between Corps Districts, other federal, state, and local agencies, and the public, as well as minimize costs for collection of new data and promote continuity of data over time. The world-wide-web accessible geospatial data and decision support applications will provide users with tools to formulate system management approaches, visualize and access spatial datasets and model results, generate reports, and share documentation, methodologies, and scientific data. The database structure and decision support applications are consistent with Federal and Corps Enterprise Architecture guidance with support for both service-oriented and database driven geo-spatial and geo-temporal data access and analysis. This support system will easily interface with other Corps databases and information systems, including the Omaha District Threatened and Endangered Species Data Management System.

Martha Bullock is a geospatial data and application developer with the US Army Corps of Engineers Remote Sensing and GIS Center of Expertise in Hanover, NH. She has worked with customers from around the Corps and from other agencies on various projects to enhance the collection, storage, analysis, and distribution of geospatial data. Martha will be presenting two ongoing projects within the Missouri River Basin that support basin-wide species and habitat restoration efforts.

<u>Automated License Systems – Where Do We Go From Here?</u>
Jeff Johnston

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Automated licensing systems are now a well established part of the way state fish and wildlife agencies do business. Agencies are now looking beyond basic license sales to explore the further benefits of such systems. Demographic analysis, automated harvest reporting, and e-duck stamp are just a few examples of the additional functionality that automated license systems allow.

Jeff Johnston is trained as a biologist and holds a Masters degree in Biology from Arizona State University and a Bachelors degree in Mathematics and Biology from Hendrix College. He is currently the Automated Wildlife Data Systems Program Coordinator for the Association of Fish and Wildlife Agencies (AFWA). Prior to his employment with AFWA, Jeff served as the Data Management Program Coordinator for the Arkansas Game and Fish Commission for 3½ years. He has also been an Oracle database developer for a Fortune 500 company and a clinical data manager for the Arkansas Children's Hospital Nutritional Research Clinic.

Fishing License Sales Data: Analysis Through a Value-added Approach
American Sport Fishing Association
Presented by: Jeff Johnston

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A project to learn more about who fishes and who is more likely to drop out is progressing well. This project, a joint effort between the American Sportfishing Association (ASA) and the Association of Fish and Wildlife Agencies, is examining state fishing license data to help state fishery agencies and companies learn more about their customers.

Jeff Johnston is trained as a biologist and holds a Masters degree in Biology from Arizona State University and a Bachelors degree in Mathematics and Biology from Hendrix College. He is currently the Automated Wildlife Data Systems Program Coordinator for the Association of Fish and Wildlife Agencies (AFWA). Prior to his employment with AFWA, Jeff served as the Data Management Program Coordinator for the Arkansas Game and Fish Commission for 3½ years. He has also been an Oracle database developer for a Fortune 500 company and a clinical data manager for the Arkansas Children's Hospital Nutritional Research Clinic.

The Information is Often as Sensitive as the Species: Considerations, Approaches, and Tools

Daren J. Carlson

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Collaboration among many partners is a key component for implementing state wildlife action plans. Successful collaboration requires sharing information between organizations and across boundaries, and brings the added challenge of how to ensure sensitive information is disseminated and used appropriately. This presentation will give an overview on how information can be sensitive, how other organizations have dealt with and are dealing with sensitive information, and explore some tools and ideas for making information available while still protecting its sensitivity. This talk will hopefully set the stage for a discussion amongst participants about information sharing for State Wildlife Action Plans, addressing questions such as: What are the common data elements across State Wildlife Action Plans? What are the common data needs across state and organizational boundaries necessary for implementing State Wildlife Action Plans? How is this data currently available? What approaches can we take to protect sensitive information?

Daren Carlson has worked for the Minnesota Department of Natural Resources since 2000 after receiving his Master's in Conservation Biology from the University of Minnesota. He began his work at the MN DNR in the Science Policy Unit where he helped coordinate implementation of the state's old-growth forest guidelines, and also assisted with a forest spatial analysis project. After a 1 year Fulbright research expedition to Slovakia in 2002/2003, Daren returned to the MN DNR in the Division of Ecological Services in Fall 2003 as the ecologist and analyst for the MN State Wildlife Action Plan. He is now continuing on to coordinate the monitoring portion of SWAP implementation. His research background is in fire ecology and landscape ecology, and his lifelong interests include birds, herps, biking, and hiking.

NatureServe Web Services:
Delivering Biodiversity Data for Conservation Action
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Sustainable resource management requires detailed information about the distribution, abundance, and condition of the species in greatest need of conservation and their habitats. As fish and wildlife information managers prepare to implement their state wildlife action plans, NatureServe Web Services is emerging as an important information resource. NatureServe Web Services deliver detailed spatial and tabular data on at-risk plants, animals, and natural communities directly to end users' applications. The service-oriented architecture deployed by NatureServe makes effective use of open source technology and emerging XML-based Web Services standards to improve online access to the biodiversity information developed and managed by its distributed network of member programs. By providing direct access to comprehensive information on the status and distribution of species populations and ecological communities, NatureServe Web Services will play an important role in helping states conserve the natural lands and clean waters that provide habitat for wildlife.

Kristin Snow is Assistant Ecologist/Ecological Information Manager with NatureServe. NatureServe, which includes the international network of natural heritage programs, is a non-profit organization that provides scientific information and tools to guide conservation action. Kristin is based out of The Nature Conservancy offices here in Minneapolis. She works as a liaison between science and technical staff and on tasks such as database design, data exchange, reporting, web services, and ecological classification.

Development of Regional Terrestrial and Aquatic Habitat Classification Systems: A Foundation for Implementation of Wildlife Action Plans

Sam Hall[1] and David D. Morton

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Nearly all conservation planning for fish and wildlife populations and landscapes would be virtually impossible without a reasonably detailed assessment of habitat, ideally accomplished through digital mapping. The need for habitat maps has been recognized through the development of State Wildlife Action Plans (SWAPs). During a meeting of Northeastern states SWAP coordinators, the development of consistent regional habitat classification systems, land cover map, aquatic habitat map, and related products was considered the most important regional conservation initiative. A project to accomplish these objectives was recently initiated through a National Fish and Wildlife Foundation (NFWF)/Doris Duke Charitable Foundation grant. While state-level habitat assessments were integral to the development of the SWAPs, each state completed these tasks with different objectives, scopes, classification systems, and utilization of digital maps. The challenge of this project will be combine these efforts into a consistent regional approach. To this end, the project steering committee surveyed each state as to their habitat mapping resources, classification systems, and approach. This presentation will discuss the results of this survey as well as plans and progress toward developing regional habitat classification systems. The adoption of these classification systems should facilitate interstate coordination by providing a common foundation of habitat location and status, as well as improving the success of state-level actions by assisting jurisdictions that have not yet developed such tools.

Sam Hall has served as the Fish and Wildlife Information Services Manager for the Virginia Department of Game and Inland Fisheries since August 2005. He worked for the U.S. Department of Transportation for seven years before coming to the VDGIF. He holds a bachelors in Environmental Science from the University of Virginia and a masters in Geography from George Mason University.

Combining the efforts of Southwest Regional Gap Analysis Project and CWCS in New Mexico and Colorado

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Recently states had to complete individual Comprehensive Wildlife Conservation Strategies (CWCS) to remain eligible for State and Tribal Wildlife Grants (SWG). These efforts focused on meeting 8 essential elements of the CWCS effort and using current spatially explicit information for these elements. In New Mexico we used data from the Southwest Regional Gap Analysis Project (SWREGAP) extensively throughout the effort. Species of Greatest Conservation Need (SGCN) were associated with SWReGAP land cover types. This provided expert review for SWReGAP habitat models while providing the CWCS effort a method to identify key habitats. Fish species and invertebrates had to be handled differently because of the lack of similar data. Key habitats were identified through analysis of species indicative of New Mexico's biodiversity and known conservation needs within these communities. Similar SWReGAP land cover types were grouped to establish the spatial framework for all CWCS analyses. The stewardship layer provided current spatial information regarding ownership and management in New Mexico. A combination of SGCN by HUC, key habitats, gap status, and factors influencing SWReGAP land cover types were used to provide a statewide assessment of areas for conservation prioritization.   In Colorado, the Division of Wildlife (and Colorado SWReGAP associated Colorado State University/Natural Resources Ecology Lab personnel) utilized the SWReGAP Wildlife Habitat Relationships (WHR) habitat associations, in their efforts to identify key habitats for those species on Colorado's 'SGCN' list, while also comparing such referenced associations with those identified through the previous CO-GAP (State of Colorado) effort. In the mammals session of the Colorado CWCS Science Forum, the 'online' SWReGAP vertebrate modeling review outputs (PDFs) were also accessed during the workshop [http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/], to provide regional landscape perspectives in the identification of key habitats and species distributions. These two projects have been completed and we describe the current effort to further these efforts to application in deploying the Comprehensive Wildlife Conservation Strategies.

Ken Boykin has worked the last 12 years in the Southwest with the New Mexico Cooperative Fish and Wildlife Research Unit. His research has focused on riparian ecosystems, species at risk, fire ecology, habitat modeling, and conservation.

<u>Cooperative Registry of Conservation Actions</u>
Matthew Lawhead

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A review of the State Wildlife Action Plans has revealed a pressing need for a way to monitor conservation activities taking place on the ground. While some organizations and agencies track their own actions and projects using in-house databases, there is currently no state or national picture of all conservation activities occurring across the landscape. Consequently, there is no way to assess the scope of investment in conservation actions or the long term effect they have on the landscape.

Partners in Oregon, Washington, and Idaho are currently developing a Registry of Conservation Actions to meet these needs. The pilot is being developed regionally with the potential to be used in other states after testing. This dynamic, web-based application features intuitive interfaces targeted toward both private landowners and agencies, interactive maps utilizing the Google Maps API, and extensive use of open source software.

Matthew Lawhead is a GIS Analyst and web programmer for the Oregon Dept. of Fish and Wildlife, where he has been working for about 2 1/2 years. He was hired to work on Oregon's State Conservation Strategy, and was responsible for the development of their Conservation Opportunity Areas. He has a degree in Wildlife Biology from Oregon State University, where he also minored in Computer Science.

Getting More Out of ALS Data – A Minnesota Perspective
Tom Keefe

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This presentation will provide an overview of the history of electronic license systems from paper to electronic point of sale terminals, telephone, and Internet. It will outline new functionality and potential future changes in hardware, communications, and data collection with an electronic licensing system. Data management opportunities, constraints and collection concerns will also be addressed.

Tom graduated in 1976 from the University of Minnesota with a BS degree in Wildlife Management. He worked three years with the US Fish and Wildlife Service and 27 years with the Minnesota Department of Natural Resources in a variety of positions. In 1996 he was assigned to coordinate the development and implementation of an Electronic Licensing System for the MN DNR's fishing, hunting and recreational licenses. He coordinated that effort and continued to supervise the ongoing system, before returning to a wildlife program coordination position. Then in July he resigned from state service and joined Automated License System (ALS) a national vendor supporting recreational license systems, as a project manager. He currently works for ALS from his home in Cottage Grove, MN.