the Vector

Winter 2010

*Official Publication of **MAGIP** - Montana Association of Geographic Information Professionals*

MAGIP Hosts Intermountain GIS Conference

Bozeman, MT April 19-23, 2010

You are cordially invited to join us in Bozeman, MT, April 19-23, 2010, for the Annual Regional MAGIP Conference.

We are proud to be hosting the conference, we have lots of fun things planned and have expanded the conference to fill the entire week. We've added more workshops and even some "mini-conferences" because we are all faced with so many different "Challenges in a Changing World"!!

Public Night will open up the conference to local schools, businesses and the sportsman community. GPS/GIS projects being worked on by local schools will be presented for awards and GPS recreational will have the opportunity to learn more about navigation from professionals, geographic games, and contest activities.

Bozeman and Montana State University, home of MSU Bobcats, and the Museum of the Rockies will host an evening banquet and private museum viewing. Families are encouraged to participate with conference attendees during this event.

Please see the 2010 Intermountain GIS Conference insert for more information!!

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Just Released!
Montana Place Names Companion

Among Montana's most enduring legacies are the names assigned to its geographic features and places found on the state map. As long as humans have inhabited Montana they have named places. And Montana place names are as varied as its terrain.

If you've ever wondered who named Alzada or if you've ever pondered about the origin of Zortman, the Montana Historical Society and the Montana State Library have developed the perfect Web site for you. "The Montana Place Names Companion" is available now via the Internet at: http://mtplacenames.org

"The Place Names Companion" is the online application based on the book, Montana Place Names from Alzada to Zortman, which was recently published by the Montana Historical Society press. Thoroughly researched and written by staff of the Montana Historical Society, the book details the origin of place names for over 1,200 geographic locations in Montana and is filled with history and anecdotes for places throughout the state. Web users can search the online "Companion" application to find information about the same places that are highlighted in the book.

The "Place Names Companion" Web site is easy to use. People can explore Montana via the Web by searching for specific place names, key words, phrases or personal names that might be found in the descriptions of the actual place names. Search results display in an online mapped application. Users can view the place name location on the Montana highway map, a state topographic map, or with aerial photos.

The details that are displayed for each of the more than 1,200 place names include:

- Complete text and any images from the book
- All related geographic information
- Latitude and longitude of each location

The online "Place Names Companion" is an excellent resource for people who want ready access to

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MSDI Framework News

- All Layer Workshop February 4, 2010

Next MAGIP Meeting

- February 18, 2010

Next MLIAC Meeting

- April 22, 2010

A Message from the President

I am very happy to announce the new MAGIP logo & updated website @ www.MAGIP.org.

The MAGIP Logo was designed by Amy Randolph of Catch & Release Graphics, Bozeman, Montana (catchandreleasegraphics.com) You will see that logo graphic includes Montana topographic elements, a compass, and the state of Montana outline.

The new website is powered by Wild Apricot, a web content management system. The site is user friendly and just about everything the Board has been looking for in a new website! We will continue to add more content to the site!

As you peruse the new website you will find some of the exciting new features:

- You can now pay for your membership and MAGIP events directly through our website
- Login access to the website
- Post to online Forums
- Events Calendar – Post a GIS event to the MAGIP events calendar
- Behind the scenes; user friendly, membership management database tools, event & registration tools, online payment, multiple account levels

I would like to recognize and thank:

- Lee Macholz for all your hard work and leadership in getting the new site up and running!
- Tony Thatcher, Mindy Cochran, & Nat Carter for working with me on the Marketing Subcommittee to develop the logo!
- Catherine Love & Gerry Daumiller for their work on the old MAGIP web site this past few years and their patience with the transition to the new site.
- Thanks to all the Board Members and Janet Cornish!

The Board has had a very productive 2009! Here are just a few of the things we've been up to:

- New Website & Logo
- 2009-2010 MAGIP Work plan
- Creation of a new Committee: Business & Operations
- Research into a MAGIP Mentoring Program
- Successful Fall Tech Session held October 20-22, in Kalispell
- First ever MAGIP Board Retreat, where we started the process of creating the work plan!
- MSDI Stewardship Review
- Gearing up for the April 2010 Intermountain Conference in Bozeman

- Erin Geraghty, MAGIP President

Keeping Up With Best Practices

The MAGIP Technical Committee is excited to welcome 2010 after experiencing a productive and rewarding 2009. Throughout the spring of 2009, much of the committee's work focused on development of the spatial reference best practice. For those of you who are still unfamiliar with the NAD83 HARN recommendation, see *Page 2* for a quick recap. Following a successful transition of its chairperson in June, the committee then planned and developed a work plan to help guide its efforts for the next year. As a result, the committee has seen a renewed focus on involving the larger MAGIP community in its work. Several members of the MAGIP Technical Committee also planned and conducted the 2009 Fall Technical Session held in Kalispell last October. By all accounts, the training session was an absolute success and the committee owes a big 'THANK YOU' to the countless number of volunteers who helped to make it such a great event.

Looking forward to 2010, the Technical Committee will be taking part in a workshop with the MSDI Stewards and Theme Leads in February to develop best practices, standards and guidelines for MSDI Stewardship. We think this will be a great opportunity to discuss the interworking relationships between framework themes and any possible roadblocks to their continued development. The committee also plans to document and formalize its own method of developing best practices in the coming year so future recommendations will be as thorough and reliable as possible. Last but not least, keep your eyes peeled for announcements about the 2010 Fall Technical Session. Planning stages will be starting soon and the committee is excited to put together another great training opportunity. All in all, it looks to be another exciting and productive year ahead. If you're interested in getting involved with the Technical Committee, please contact us at magip.mt+tech@gmail.com. MAGIP is what we make of it—and we'd love to have your help!

- Nate Holm, Technical Committee Chair

Technical Committee Members

- Bob Cochran
- Jason Danielson
- Chuck Fahner
- Michael Fashoway
- Bob Holliday
- Catherine Love
- Danielle Price

Understanding Montana State Plane NAD83 HARN

The Technical Committee began discussing the spatial reference best practice at the 2008 Fall Technical Session in Great Falls. Most agreed at that time that it was a de facto standard in the state of Montana to use the NAD83 (meters) projection. Additionally, the Montana Code Annotated required use of NAD83 (although it doesn't specify feet or meters), so it was felt that the best practice was fairly straightforward and universally accepted. As the best practice was developed and submitted to MLIAC last spring, however, concerns regarding use of the HARN surfaced and it was eventually decided that NAD83 HARN should be used as the standard. The best practice was rewritten to reflect the HARN recommendation and then resubmitted at the June, 2009 MLIAC meeting.

When considering this best practice, there are three major questions that need to be answered as a basic foundation for its success and implementation:

1. What is being recommended?
2. Why should it be used?
3. How is it implemented?

Users simply aren't going to adopt a practice that affects their data if those three questions (at a minimum) aren't answered—and what good is a best practice if nobody is using it? So, in hopes of shedding some light on the NAD83 HARN projection and its use, here is a little background on the State Plane Coordinate System, HARNs, and how it all relates to GIS data being collected in the state of Montana.

Background of the Coordinate System

The State Plane Coordinate System is a set of 126 geographic zones designed for specific regions of the United States. The system uses a Cartesian coordinate system to specify locations rather than a more complex spherical coordinate system, allowing for the use of "plane surveying" methods. By thus ignoring the curvature of the Earth, complex calculations are simplified and computed at a faster rate. Most state plane zones are based on either a Transverse Mercator projection or a Lambert conformal conic projection, depending on the shape of the state and its zones. In a state like Montana, where the distance from east-to-west is longer than north-to-south, the Lambert conformal conic projection is used because it is good at maintaining accuracy along an east-west axis.

Originally, the state plane coordinate systems were based on the North American Datum of 1927 (NAD27). This datum, using the Clarke Ellipsoid of 1866 as its foundation, was computed with a single survey point in Meades Ranch, Kansas as the datum point. Many years later, the more accurate North American Datum of 1983 (NAD83), which was computed as a geocentric reference system with no datum point, became the standard. NAD83 has been officially adopted as the legal horizontal datum for the United States by the Federal government, and has been recognized as such in legislation in 44 of the 50 states, including Montana (http://data.opi.state.mt.us/bills/mca_toc/70_22_2.htm). The computation of the NAD83 removed significant local distortions from the network which had accumulated over the years, using the original observations, and made the NAD83 much more compatible with modern survey techniques.

Even more recently, there has been an effort to refine the accuracy of the NAD83 datum using Global Positioning System (GPS) observations. These efforts, beginning with Tennessee in 1986 and finishing with Indiana in 1997, are known as "High Accuracy Reference Networks" (HARNs) and were undertaken to support the use of GPS by Federal, state, and local surveyors, geodesists, and other applications. Montana's HARN, specifically, was implemented in 1992. Throughout the process, some 16,000 survey stations throughout the United States were upgraded to A-order or B-order status, with Horizontal A-order stations having a relative accuracy of 5 mm +/- 1:10,000,000 relative to other A-order stations and Horizontal B-order stations having a relative accuracy of 8 mm +/- 1:1,000,000 relative to other A-order and B-order stations.

Rationale for Recommendation

As described above, the NAD83 HARN is simply a refinement of the coordinates of the NAD83. The NAD83 HARN has the same origin, orientation, and reference ellipsoid—that is, the same definition—as the NAD83, but its accuracy has been improved through the inclusion and support of GPS observations. The coordinates of the HARN are shifted (variously, depending on location) by +/- 10 cm, but the coordinate shift is likely not an issue for most GIS data.

Depending on the software that one is using, however, the spatial reference tag could be an issue. It is important to note that any GPS derived coordinates dating since the implementation of the HARN in Montana in 1992 are, in fact, HARN-based coordinates. So, anyone tagging their GPS derived GIS data as NAD83 rather than NAD83 HARN is actually mislabeling those coordinates (assuming it was collected after 1992).

Because of these improvements to the spatial accuracy of the NAD83, and the fact that any GPS data collected in Montana after 1992 is HARN-based, it is now recommended by MAGIP that the NAD83 HARN be used as the standard Spatial Reference for GIS data in the state of Montana.

Implementing NAD83 HARN in your GIS

As to "How" this best practice should be implemented, a few issues do exist with reprojecting datasets that span the extent of Montana's geographic boundary—namely that one geographic transformation must currently be used for data located in the western portion of the state and another for data in the east. For most county and local governments, this shouldn't be a major problem as it's just a matter of using the correct geographic transformation for your locale. For those of you who do maintain datasets at a statewide level, work is underway to provide a single adjustment grid for converting between the NAD83 and NAD83 HARN projections. It is our hope that the new grid files used in the transformation will be available for use with the 'Create Custom Geographic Transformation' tool in the current release of ArcGIS or as part of the upcoming ArcGIS 9.4 release

Ultimately, the decision to reproject any existing datasets into the NAD83 HARN lies within one's own organization. This best practice is not a mandate for the use of the NAD83 HARN, nor does it imply that it is appropriate for every database or project. However, by committing to using the spatial reference best practice, one acknowledges the benefits to one's organization and to the larger user community as a whole.

- Nate Holm, Technical Committee Chair

Small Funds, Big Impact

Last spring the MAGIP Board of Directors approved the recommendation of the Education Committee to awarded two $1000 K-12 Curriculum Development Grants. Suzie Flentie of Lewistown Middle School, and Dean Thompson and Terri Noser of Libby Elementary School received grants to purchase GPS receivers. The teachers wanted to increase the number of students that could get hands-on GPS experiences and utilize the data collected in GIS. They also wanted to get other teachers in the school involved in geospatial learning.

Lewiston Uses Funds To Train Others

Suzie teamed with GeoEssentials, Inc., Montana EdPARC, and MontanaView to bring together funds to provide four days of GPS/GIS/RS training for 18 Lewistown teachers, the High School Principal, and three teachers from Winifred Schools. Three other people from the USAD Forest Service and the local emergency services participated. ESRI's Charlie Fitzpatrick, K-12 Education Coordinator, provided numerous textbooks and teaching resources which were distributed to teachers and used as examples of geospatial activities. Each teacher was provided funds to purchase a Garmin 60 Map GPS, or to upgrade to a GPS of their choice. Teachers who chose to upgrade to a different GPS paid the difference in the cost. Eleven teachers chose to purchase touch screen Garmin Oregon 300 models. MontanaView provided a USB drive containing geospatial data sets, and examples of lessons for each teacher.

From July 20-23 the participants worked with Van Shelhamer, GeoEssentials, Alan Buss and Teal Wychoff of the University of Wyoming to learn about GPS, ArcMap, Arc Catalog, Arc GIS Explorer and geospatial learning. Graduate credit was made available from the University of Wyoming and Continuing Education Credits were available from the Montana Office of Public Instruction. Teachers were required to begin planning how they would use geospatial technologies in their classes. In December, the Lewistown and Winifred School Boards allows teachers a day away from classes to work on their lessons and to learn some basic information about remote sensing. Many of the lessons are currently being finalized and tested in the classroom. In addition, each lesson required that a Jing movie be incorporated into the lesson.

How is geospatial technology impacting the curriculum in Lewistown Schools? The Lewistown teachers and administration should be commended for making an effort to incorporate geospatial learning across the school curriculum. What they are accomplishing will serve as a model for other school districts. Here are some examples of how teachers are incorporating geospatial learning into their classes. In a Head Start Program, fathers will be working with their children on spatial learning activities involving a GPS, geocaches and rockets. Fifth graders will be using GIS as they learn about Montana History and the challenges faced by the Nez Pierce Indians as they tried to escape into Canada. Eighth graders will use math skills and GPS to advance to different geocaches, and then view their travels in Google Earth. Seventh grade students will learn about the uses of GPS, coordinates and topographic maps in local search and rescue work. In Social Science students will use MAP IT to learn about society and geography as they map Montana demographic data. English students are involved in research writing and reporting as they study historical buildings and hyperlink pictures and documents to their locations in Lewistown. The cession of reservation land by Montana tribes will be learned by using ArcMap. Students will also study the demographic and economic data on the current Montana reservations. Eighth grade science students will utilize Arc Catalog and ArcMap to create water quality maps and hyperlinks. The Special Needs instructor will be working with students on using the GPS for geocaching and collection of data. Students interested in advanced and on-going GPS/GIS activities are provided the opportunity to participate in the Middle School GPS Club, led by Suzie Flentie.

Freshman Science students will use geospatial technologies to study water quality on Big Spring Creek. Others will utilize satellite and AEROCam aerial images, provided by UMAC (Upper Midwest Aerospace Consortium) to study changes in vegetation over time along Big Spring Creek. The principles of light reflection and spatial analysis are included in their studies. Whether geographic location has an effect on school performance is being studied by the High School Principal. The High School Liberian in collaboration with the Agricultural Education instructor are conducting an inventory and mapping of the damage caused by Dutch Elm disease in Lewistown.

Winifred students will learn about using cadastral data and legal land descriptions as they learn about right of ways and what land owner may be impacted as oil exploration comes to the area. GPS, ArcMap and girls basketball will be used to learn about geospatial technology and the effect that distance may have on winning and losing a basketball game. The travel bus becomes the classroom.

Libby Uses Funds To Expand Resources

Dean Thompson and Terri Noser of the Libby Elementary School used their grant to purchase more GPS receivers. As a result more students were given the opportunity to participate in an after school program for 4th graders. Both teachers were able to attend the ESRI Education Users Conference in San Diego thanks to support from the local School Board, Montana EdPARC, and GeoEssentials. Dean and Van Shelhamer presented a poster on the after school program at the conference. The enthusiasm created by the grant and ideas obtained at the ESRI conference led to more students wanting to enroll. As parental support and student interest increased, more GPS units and more help for the teachers are needed. Dean conducted a survey of local teachers to see if there was interest in duplicating what took place at Lewistown in 2009. Forty teachers responded that they were interested in participating in a 2010 geospatial summer institute. Dean, the school grant writer, GeoEssentials and Montana EdPARC are working to raise funds that would make it possible to deliver geospatial instructional training to those teachers in Libby. Dean is working with the Flathead Electric Cooperative to establish a program where students would help locate "Cluster Buster" trees around Libby.

Team Effort On The Reservation

Colleen Stein, GIS coordinator for the USDA Forest service in Bozeman, utilized her GPS knowledge and instructional ideas from the Lewistown teachers to work with a group of students on the Fort Belknap Reservation. GPS receivers from GeoEssentials were provided free of charge for the students' use.

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Work Plan Continues To Improve Professional Development

The Professional Development Committee is in the process of implementing the work plan developed at the MAGIP Board Retreat last summer. During that retreat four sub-committees were identified to focus on specific areas of the work plan:

Conferences – this subcommittee is responsible for planning the Intermountain GIS Conference and Spring Meeting on alternate years.

Mentoring – this subcommittee will be identifying needs, content and delivery methods for a mentoring program.

Professional Certification – this subcommittee will help develop and coordinate resources to assist people in applying for the GIS Professional certification (GISP).

Web delivery – this subcommittee will be working with the MAGIP Web Presence Committee to explore methods of providing continuing education subject matter on the web.

The following are the current and continuing efforts of these subcommittees:

Intermountain GIS Conference Committee

Chair; Allen Armstrong, Gallatin County GIS.

The conference planning committee has been meeting monthly since August of 2008 to plan and promote the 2010 Intermountain GIS Conference that will be held April 19-23 in Bozeman, MT. With a solid core group of individuals from all agencies and disciplines, the planning and progression of this conference has been extremely successful. Committee members have effectively spread the word around at other events throughout Montana and there has been a great deal of feedback to the group through surveys, personal calls and personal interaction. We wouldn't be nearly as successful without the seasoned knowledge from those who have planned and organized these conferences in the past, and many of these individuals are involved with this conference also.

Countless ideas have surfaced within the committee to effectively include the novice GIS users throughout our state as well as those in senior management. The mini-conference topics are outstanding and seem to be developing an energy all to themselves. I just hope we have enough room for all the sessions presented! I hope that each member of this committee, and all of the other volunteers working on various tasks for this conference, can share in the satisfaction of a truly professional event developed right here in our state. I am thankful for the opportunity I have to work with these other professionals.

Be sure to visit the conference web site at the new MAGIP website; www.magip.org/intermountain . The MAGIP Board did a great job of completing their new website and providing a spectacular look in time for hosting the 2010 Conference material!

Mark your calendars for "Challenges for a Changing World". We look forward to seeing you in April!

Please see the 2010 Intermountain GIS Conference insert for more information!!

Mentoring Subcommittee

Chair; Diane Papineau, Montana State Library (NRIS)

The mentoring subcommittee has started the visioning process to determine the needs, content, and delivery mechanisms for a MAGIP sponsored mentoring program. The subcommittee includes the following members in addition to the chair:

- Wendy Thingelstad, Lake County GIS
- Carrie Shockley, City of Bozeman GIS
- Alison Kennedy, Montana State Department of Revenue
- Gerry Daumiller, Montana State Library (NRIS)
- Jason Danielson, Lewis and Clark County GIS
- Bryant Ralston, ESRI

The subcommittee will be meeting prior to the April 2010 conference in Bozeman to develop a proposal to forward to the MAGIP Board for consideration and feedback. Watch for more information in the coming months.

Certification Subcommittee

Chair; Kris Larson, CDM

GIS Professional Certification has been endorsed statewide. A GISP is a certified Geographic Information Systems Professional who has met the minimum standards for ethical conduct and professional practice as established by the GIS Certification Institute (GISCI). GISCI certification requires achievement in three areas: educational achievement, professional experience, and contributions to the profession.

GISP certification is not required for membership or participation in the Montana Association of Geographic Information Professionals (MAGIP) yet MAGIP's Professional Development Committee as well as the Board recognizes the formal process and encourages its membership to achieve this professional development GIS certification which:

- Allows its members to be recognized by their colleagues and peers for having demonstrated exemplary professional practice and integrity in the field
- Establishes and maintains high standards of both professional practice and ethical conduct
- Encourages aspiring GIS professionals to work towards certification for the purpose of professional development and advancement
- Encourages established GIS professionals to continue to hone their professional skills and ethical performance even as GIS technology changes

MAGIP endorsed the GISP certification in April 2009 as well as the GISCI organization which offers a positive method of developing value for professionals and employers in the GIS profession.

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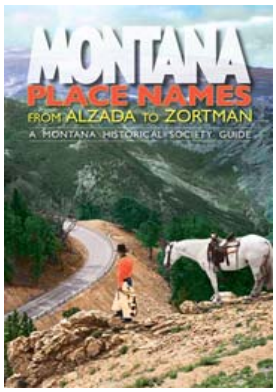
Montana Place Names Companion *Continued from Page 1*

information at their online finger tips. It also offers a means for people to provide comments and feedback to the authors as well as suggestions for place names to include in future editions of the book.

Through its statewide programs, the Montana State Library empowers Montanans; enhances learning in families and communities; builds 21st Century skills; and provides opportunities for civic participation. For more information, visit http://msl.mt.gov.

- Jennie Stapp, Montana State Library



Montana Place Names from Alzada to Zortman, published by the Montana Historical Society Press.

Available at the Montana Historical Society Museum Store for $24.95

Small Funds, Big Impact *Continued from Page 4*

Not only were teachers, students and parents impacted by the funds from the grants, at least 10 MAGIP members responded to requests for geospatial data and ideas. A lot of great ideas and suggestions were shared by MAGIP members. The teachers are very thankful for everyone's efforts. While $1000 does not seem like a lot of money, by working collaboratively with others, significant impact can be made on the incorporation of geospatial instruction in the schools.

Thank you MAGIP members. Please remember to support the educational fund raising activities at the upcoming Intermountain GIS Conference. Your dollars will be put to good use by Montana teachers.

- Van Shelhamer, Education Committee Chair

Professional Development *Continued from Page 5*

In December 2009, the Montana Land Information Act Council (MLIAC) also endorsed this professional process.

MAGIP's Professional Development Committee will, of course, assist those interested in gaining GISP certification with documentation and regular updates via the MAGIP listserve. The Professional Development Committee is very pleased to be able to offer a 4-hour GISP Certification workshop at the Intermountain GIS Conference in April. More information will be coming soon on the new GISP Support link as part of the revamped MAGIP website (http://www.magip.org/). If you have ideas about ways in which MAGIP might offer more support for this important certification, contact one of these GISP Certification Subcommittee Members:

- Lance Clampitt, USGS, lsclampitt@usgs.gov, 406-994-6919
- Stuart Challender, MSU, schallender@montana.edu, 406-994-7566
- Kris Larson, CDM, larsonka@cdm.com, 406-441-1443

For more information on professional certification go to GISCI.org

How Do You Say MAGIP?

How is one supposed pronounce the acronym "MAGIP" for our association? What is your opinion?

MAGIP with the short 'a' and soft 'g' - ma-jip

MAGIP with the short 'a' and hard 'g' - ma-gip

MAGIP with the long 'a' and soft 'g' - mā-jip

MAGIP with the long 'a' and hard 'g' - mā-gip

Add your 2 cents to the MAGIP.org Discussion Board!!

- Erin Geraghty, MAGIP President

Web Delivery Subcommittee

We currently don't have a Web Delivery Subcommittee chair. If you are interested in working on this subcommittee let Stuart know.

Get Involved!

The Professional Development committee is having a busy year, and there are lots of ways for you to become involved in YOUR professional organization. If you would like to get involved please contact myself, a subcommittee member, or another MAGIP Board member.

- Stuart Challender, Professional Development Committee Chair

Join us for a fun-filled 5 days this year

Montana Association
of Geographic Information Professionals

2010 Intermountain GIS Conference

2010

Challenges for a Changing World

April 19-23, 2010

Bozeman • Montana

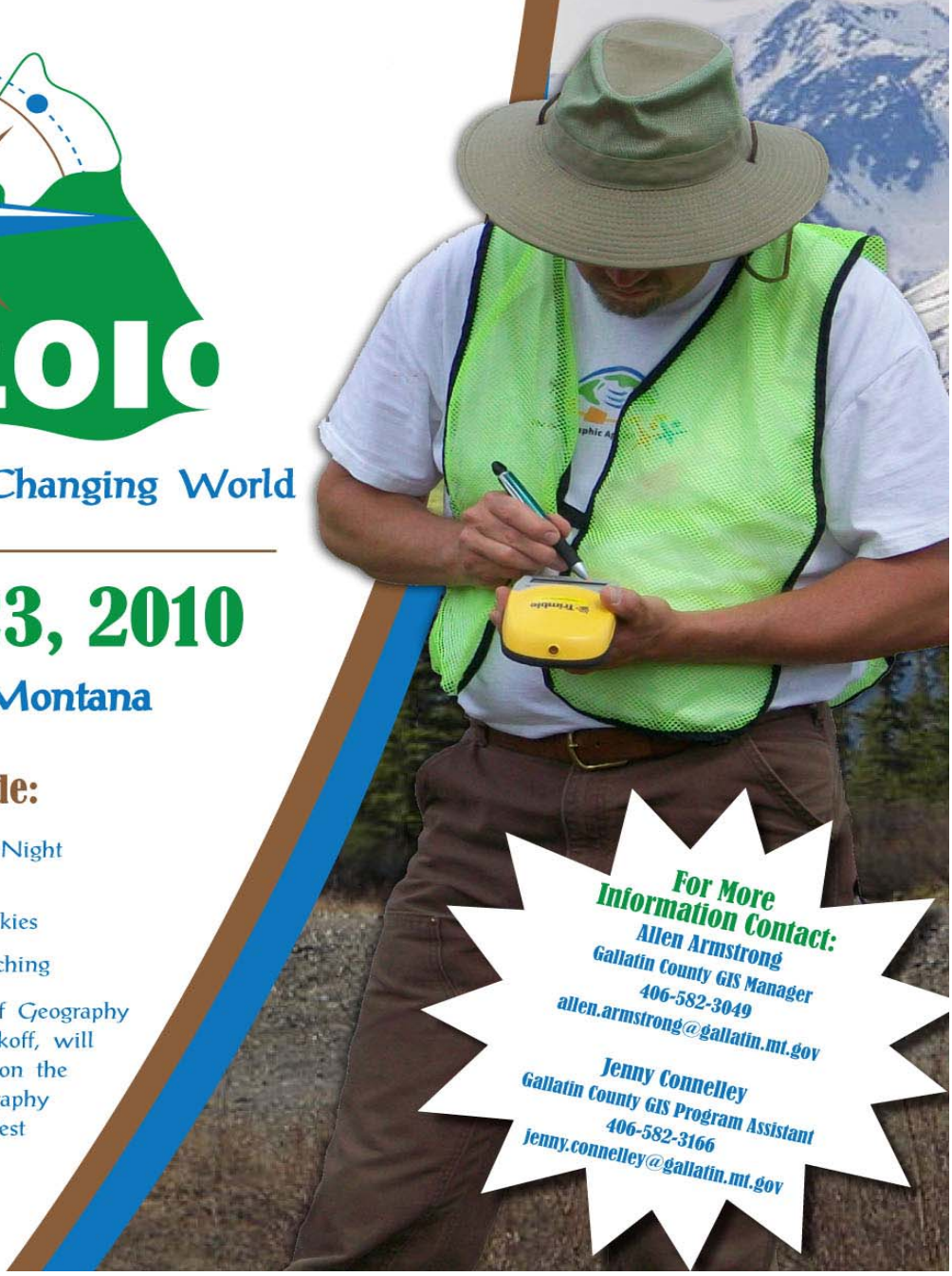
Special Features Include:

Public Education and Interaction Night

A Night of Dinner and Dinos
at the Museum of the Rockies

A new, creative take on Geo-caching

Guest Speaker: MSU Professor of Geography and Author, William Wyckoff, will give a talk with his focus on the historical and cultural geography of the Rocky Mountain West



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The Geography Of Geology

"The Rocks Don't Change, But What We Think About Them May." I first heard this provocative statement years ago as a geology student when it was spoken by Dr. Robert J. Weimer at the Colorado School of Mines. For students of sedimentary geology, the statement was, and is, a disconcerting notion, but among practicing sedimentary geologists it is an accepted premise that underpins a mobile science. The statement means that geologists are familiar with having their current understanding about a group of sedimentary rocks revised, based on new thinking. The revision may apply to one outcrop or to every occurrence of that group of rocks. Never enough data or the right data, needing to return to the field or core lab – some degree of uncertainty is common to a sedimentary geologist.

The Rocks Don't Change …

From the time that a group of sediments lithifies under the pressures and temperatures of burial, their essential aspects are preserved, even as the resulting rocks are later returned to the surface through uplift and erosion. Except for commonly recognized chemical changes related to cementation and other burial processes, the rocks' grain composition and visible features such as color, grain size, grain sorting, and stratification remain largely unchanged from the original sediment. So too, the vertical and lateral stratigraphic relationships of sedimentary features, as observed in a cliff face, road cut, or drill hole, remain unchanged from the time of sediment deposition. And because rocks at Earth's surface do not change, except for the hazards of erosion and human activity, rock outcrops look today as they have always looked to an observer, and contain the depositional features they have always contained.

… But What We Think About Them May

The sedimentary geologist's observations of a rock sequence are important because they lead to conclusions about the sedimentary processes (stream flow, wind, slow settling in water) that deposited the original sediments, which in turn lead to conclusions about the depositional environment (streambed, dune field, lake or ocean bottom) of the sediments. This determination of depositional environment is the basis for a geologist's envisioning how these same rocks will extend, either at the surface or in the subsurface: a beach deposit will be long and linear, a dune field some irregular shape, a submarine fan a fan shape. By such envisioned extension, paleogeographies of whole regions can be established for the time period when specific sediments were deposited.

Yet over decades the geologic literature on many, if not most well-known sedimentary rock sequences reflects a range of interpretations of their original depositional environment. Why? If these sedimentary rocks and rock sequences do not change, what is the source of this uncertainty? Ideas. New ideas generate uncertainty and re-evaluation. What changes, then, is how we see. What are the new questions to ask? What observations do we now understand are important to make that earlier we paid no attention to? And how do these new observations, based on new ideas, change how we think certain sediments were first deposited? In many respects, sedimentary geologists see what they are looking for, a practical premise, which, while a bit subjective and unscientific, integrates well with uncertainty, our other pitfall. Together they keep us honest and further refine the science.

Rock Reading, Past and Present

Reading field notes and sketches of a rock sequence written in the 1940s, we might learn that it is a vertical sequence of alternating sandstone, siltstone, and shale, with unit boundaries based on the relative proportions of each grain size. In the late 1950s, there began a recognition that study of modern sedimentary processes and environments could greatly assist understanding of features observed in ancient sedimentary rocks. Thus, the same rock sequence, redescribed in the 1960s and early 1970s, indicates much more detailed observation: perhaps some of the thicker sandstone layers show cross-lamination, sharp bases, and fining-upward grain size, while some of the finer-grained layers show the marks of burrowing animals; a depositional environment could be proposed. Depositional modeling of sedimentary rocks became a dynamic field of research. In the late 1970s, as the application of geophysics to sedimentary geology significantly advanced, there was a major effort to place sedimentary rocks in a regional, even global framework based on seismic-reflection data (seismic stratigraphy). Subsequently, and continuing today, sedimentary geologists have returned to direct observation of the rocks, while retaining the idea of a regional or global framework that has seismic expression. Geologists now seek to understand the rocks in the context of depositional sequences (sequence stratigraphy), with attention paid to where part of a normal sequence of associated deposits, such as a deltaic environment, is missing because of a later erosional event. Using depositional models based on modern depositional processes and environments, geologists can compare what should be present in a complete depositional sequence with what is present at a specific outcrop or well bore; what is missing becomes as significant as what is present.

Geology is a composite science, integrating the disciplines of physics, chemistry, and biology. It is further complicated by the amount of geologic time that must be accommodated though it generally cannot be duplicated in studies. Thus, geology is also in many respects an inexact science, where questions are answered as often by conceptual models as by numerical data, and numerical data are invariably expressed in ranges of values. These are the conditions that both cause and accommodate the uncertainty and periodic revision in geologic thinking. Throughout the history of the science, it has been new ideas that brought new observations leading to new conclusions about the same, unchanged rocks.

Geography of Geology – the Data Layers

Several questions can be considered toward understanding the links among interpreting sedimentary rocks, mapping these rocks, and establishing a GIS framework data layer.

1. *For all the uncertainty and revised interpretations for a group of sedimentary rocks over time, does the mapping of these rocks change?*

No, the mapping does not often change, because in accordance with the North American Stratigraphic Code we map by geologic formation (e.g.,Tensleep Sandstone, Madison Formation, Bakken Shale) with little regard for interpretation. The formation is the fundamental map unit. In Europe, geologic maps of sedimentary rocks have traditionally been constructed by geologic age (e.g., Upper Cambrian, Devonian, Lower Cretaceous), but interpretation has little bearing on the map units.

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Geology *Continued from Page 7*

However, changes to original map units do occasionally occur, resulting from new thinking. Such map-unit changes, when they do occur, are often along formation boundaries (contacts), where two widely recognized sedimentary rock units are in vertical and/or lateral contact. If a good case can be made for including some of one formation in the other formation instead, then the areal distribution of each formation (map unit) changes. Most commonly such a shift reflects honest ambiguity about where to place a formation boundary in a vertical sequence that appears transitional from one dominant sediment type to another.

An additional factor arises, as well: geologists do not always think alike; new ideas may not be accepted, or may take some time to be widely accepted. Thus, two geologic maps of the same formations in the same area may not show exactly the same formation boundaries. Further, two geologists who think alike may not have the same approach to mapping. One may split out as many units as can legitimately be mapped at the scale of the map product, including members of formations, while another maps only the formations or even lumps formations together. This divergent approach produces the well-known "splitters" and "lumpers" in the generation of data layers and resulting geologic maps.

2. How does geologic data become GIS data?

Geologic information is gathered by a geologist's systematic walking on the ground from point to point across the area of the proposed map, recording the rock types and other geologic features encountered. GPS equipment is often employed. Data points are marked on standard U.S. Geological Survey topographic base maps, commonly at the 1:24,000 scale, even if the final map will be at another scale. Additional information can be added using aerial photographs, and the geologist always consults existing geologic maps to guide new mapping. Geologic formation boundaries (contacts) are drawn on the topographic base map; mapped formations are assigned standard letter symbols based on the formation's name and age – symbols like Ksc and Mmc. These letter symbols have GIS code equivalents. Descriptions of each rock type are prepared by the geologist for the map's metadata. Other features such as faults and folds are drawn in on the base map, using standard geologic symbols that also have GIS code equivalents. These "field maps" contain the raw data. When these data are scanned, rectified, digitized, and coded they establish the GIS geology framework layer for the proposed new map.

3. Is geologic map production easier or better than with pre-GIS methods?

Preparing an initial draft of the geologic data for a chosen map area is probably equally subject to human error whether employing digitization or the earlier drafting methods. The required time for producing this initial graphic is also probably about the same. But from that point on, during rounds of editing and reviews as a map product moves toward completion, GIS methods are faster and easier to execute. Changes to the data layer, whether they are edit corrections or revisions resulting from new thinking, are easier to make. Thus, GIS methods encourage attention to detail and commitment to accuracy, on the part of both the geologist and the GIS technician. It is the ease of data-layer revision, and the ability to layer geologic data with other data sets, that has significantly increased the general awareness of and use of geologic information.

4. *How can the geology framework layer be applied?*

The intent of most geologic maps is to show, as accurately as knowledge and map scale allow, what rock formation would underlie a person's feet were he standing on the ground at a specific point on the map. Thus, when the geology framework layer is combined with cultural, political, agricultural, or other data layers at the same scale, an immediate relationship can be established among the several data layers.

Application of these related data sets is extensive. Geology underpins every project or activity we conduct on Earth's surface. Thus, the geology framework layer should underpin all planning, permitting, construction, and cost-estimate considerations. However presumptuous this statement sounds, consider these issues:

- Stability of the bedrock at a proposed bridge or waste-facility site;
- Source of mineral content delivered to streams;
- Ability of burned-over forest to regenerate;
- Quality and quantity of drinking water;
- Engineering costs related to highway construction;
- Comparative crop production related to soils (weathered bedrock);
- Potential for landslides;
- Location of potentially economic deposits such as building stone or sand and gravel.

Each of these issues is first a geologic consideration. Additionally, the geologic data layer, which reflects geologic conditions at the surface, is the basis for predicting geologic conditions beneath the surface as is routinely practiced by mining and petroleum geologists.

The availability of electronic geologic data, assembled in data layers that can be integrated with other data sets, has immeasurably assisted public agencies and private individuals in need of such data. The geology framework layer, increasingly available for wide areas of the country, allows planners and decision-makers to effectively assess local and regional management and resource-use questions.

- Karen Porter, MT Bureau of Mines & Geology (retired)

Find Data You Need: Publish Data You Have

By now, MAGIP members should be quite familiar with the Montana GIS Portal. If you are not, please visit http://gisportal.msl.mt.gov. The Montana GIS Portal enables you to discover and access spatial data and web mapping services related to Montana.

The Montana State Library released an updated Montana GIS Portal on October 1, 2009. The new portal features a redesigned interface, improved search results, and access to a wider variety of map service types. The Portal contains an online map viewer to view basic maps and air photos of any location in Montana.

"Montanans use GIS for a large number of projects," said Evan Hammer, manager of the Library's Natural Resource Information System program. "The Montana GIS Portal helps people find data to use in their GIS and mapping tools to create maps and perform analyses that drive decisions made by policy makers around the state."

"The data catalog includes 400 spatial data sets from several contributors including the Montana Base Map Service Center, the Montana State Library, Montana Fish Wildlife and Parks, and Flathead County," said Hammer. "Our staff works with state, county and local governments as well as other data providers to help them register their data & maps."

Call For Presentations...That Means YOU!

The Montana Association of Geographic Information Professionals (MAGIP) invites you to participate in the presentation of papers, electronic demonstrations, and panel discussions at the 2010 Intermountain GIS Users' Conference to be held in Bozeman, Montana, April 19-23, 2010. The conference theme, 'Challenges for a Changing World', reflects how geospatial technologies are becoming increasingly critical in a rapidly changing world.

The Intermountain GIS Conference attracts a wide variety of GIS users from federal, state, tribal and local governments and educational institutions as well as from private organizations. This year, we are also hoping to attract a wider audience, including people who come from related disciplines. Our track leaders have identified many speakers already, but we are eager to hear from anyone who might be interested in responding to this call. A preliminary list of tracks includes:

- Tribal GIS
- Data Sharing
- Snow Sciences
- Natural Resources
- GIS Policy and Management
- Public Health
- America/Montana View
- Fire
- Census and Redistricting
- Local Government
- Utilities and Services
- Energy
- Open Source GIS
- Vendors (products and ser-

If you are interested in making a presentation at the Intermountain GIS Conference please complete the submission form found on MAGIP.org and send it electronically with an abstract and short biography by February 12, 2010 to JanAllyce@aol.com. Abstracts should be single spaced and 200 words or less. They should include the title of the proposed presentation and a summary of the presentation's content. Each speaker, including each panel member, should provide their name, title, and organizational affiliation. Abstracts must be in Microsoft Word or Rich Text Format (RTF).

Notification of acceptance will be about March 1, 2010. All persons giving a presentation at the conference will be expected to register for the conference.

Check the conference web site (http://www.magip.org/intermountain) for program schedule and additional conference details as they become available. For general information about the conference contact the MAGIP Administrator, Janet Cornish, at JanAllyce@aol.com (406-723-7993) or the 2010 Intermountain GIS Conference Committee chairman, Allen Armstrong at Allen.Armstrong@gallatin.mt.gov (406-582-3049).

If you are interested in presenting a poster and entering our poster contest instead, please see our Call for Posters link on our conference website.

Save the Date!

- **URISA GIS/CAMA Conference** (March 8-11) - URISA.org
- **ESRI Developer Summit** (March 22-25) - ESRI.com
- **AAG Annual Meeting** (April 14-18) - AAG.org
- **Intermountain GIS Conference** (April 19-23) - MAGIP.org

MAGIP - *Montana Association of Geographic Information Professionals*

For more information on MAGIP please visit http://MAGIP.org,

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Have a good Winter and see you in the Spring!

Want to submit an article? Email me at magip.mt+vector@gmail.com

Nat Carter - Editor