The USDA's NAIP Imagery in Idaho: A Decade of Evolving Partnerships to Improve Access

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Abstract

Since 2004 the University of Idaho (UI) Library has provided access through its geospatial data repository, INSIDE Idaho, to Idaho aerial imagery produced by the USDA Farm Service Agency's National Agricultural Imagery Program (NAIP). These efforts have been successful due to partnerships and collaborations forged through state-level working groups and committees. Recently, the 2015 Idaho NAIP imagery was provided through a partnership among UI, Idaho State University, Idaho National Laboratory, and Idaho State Geospatial Office. This paper describes the evolution of Idaho's NAIP imagery partnerships, procurement, management, accessibility, and technology between 2004 and 2015. While the technologies to handle both one-time access and also ongoing connections from web and mobile applications have changed dramatically over the years, the collaboration and partnerships have endured, and the story possesses implications for other land-grant universities.

Introduction

Land-grant universities possess unique obligations to serve their states, as well as their university communities. Opportunities to engage the wide range of user groups within a state abound—from local and state governments to federal and tribal agencies, and to the private and nonprofit sectors. One of the key areas in which land-grant universities can provide service is through the application of comparative advantage: universities can leverage technical expertise and innovative capacity over time to enable local stakeholders to better accomplish their goals. In the state of Idaho, aerial photography obtained from the United States Department of Agriculture's (USDA) National Agricultural Imagery Program (NAIP)

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has provided a case study of this type of service and its power to build positive connections and beneficial interdependency throughout the state community.

NAIP imagery is used in a range of applications, but primarily within the context of agriculture, natural resources management, and state and local planning (USDA, 2008). In these applications we see parallels to the mission of a land-grant university and its library. The Morrill Act of 1862 and the Hatch Act of 1887 directed land-grant universities to provide for research and support of agriculture and the "mechanic arts" (Sternberg, 2014). The University of Idaho (UI), an 1862 land grant, describes in its vision engaging "as a dynamic land-grant institution throughout our state in partnership with and in support of Idaho's communities and major industries, in traditional areas such as agriculture, in other established and vital industries, and in nascent enterprises that contribute to economic growth and strength" (UI, 2017, n.p.).

The Interactive Numeric and Spatial Information and Data Engine for Idaho (INSIDE Idaho), a geospatial data repository maintained by UI Library, supports this research and outreach mission for the university. INSIDE Idaho was recognized as the geospatial data clearinghouse for the state in 2002. This designation was achieved through partnerships developed with the federal, state, local, tribal, higher education, and private-sector entities working within the state. When the first statewide NAIP coverage for Idaho was collected in 2004, INSIDE Idaho was determined to be the logical archive for these data. The Idaho Geospatial Committee requested that INSIDE Idaho manage, curate, and distribute the data, to which it agreed. Since that initial statewide, 2004 NAIP imagery collection, we have continued to collect during the subsequent years of 2009, 2011, 2013, 2015, and likely in 2017.

Overview of NAIP Imagery

Today's NAIP is administered by the USDA's Farm Service Agency (FSA) through its Aerial Photography Field Office (APFO) based in Salt Lake City. NAIP is the modern-day successor of the National High Altitude Photography Program (NHAP), the National Aerial Photography Program (NAPP), and the National Digital Ortho Program (NDOP). NHAP, which was operational from 1980 to 1989, and NAPP (1987–2007) were both federal interagency aerial-photography programs coordinated by the U.S. Geological Survey (USGS). NDOP was inaugurated in 1993 to begin a cyclical process of generating nationwide digital orthoimagery from existing aerial images (Mathews, 2007). The general use of aerial photography in agriculture dates back to the 1930s, when FSA began to use aerial imagery to support its efforts to assess and improve agriculture activities during the Great Depression (Monmonier, 2002).

A signature reason for the use of aerial photography is the application

of photogrammetry, which is a form of remote sensing that uses aerial photos for achieving accuracy in measuring distances on earth (Allaby, 2008). In agriculture, using these techniques introduces the means to engage in large-scale surveying and analysis of crop plantings, estimates of crop yields, division of land into measurable units, and detection of land-cover change. When combined with other forms of environmental or agricultural data, aerial imagery has become an essential part of many land-use and land-planning activities, both in government and research communities. Over the subsequent seventy years aerial imagery has improved both in resolution and complexity, thus allowing for better clarity and more accurate assessments in diverse areas, such as analyzing wildland fires, determining tree and forest mortality, and conducting disaster risk assessments (USDA, 2008).

The ongoing NAIP, which began in 2003, acquires aerial imagery for the contiguous United States during the agricultural growing season primarily to support FSA's farm programs and maintain its common land unit (CLU) boundaries. These CLUs are one of the principal reasons that NAIP is a critical resource to federal, state, and local governments. The CLUs represent individual contiguous farming parcels, which are the official estimations of farm records for the USDA (USDA, 2012). Additionally, the imagery acquired under NAIP is used by other federal, state, local, and tribal agencies, the private sector, and universities on a wide variety of projects (USDA, 2008). While the primary geographic area of interest for imagery acquisition to meet FSA's mission is on agricultural areas, it actively seeks cost-sharing partnerships to collect imagery for entire states.

Overview of Geographic Information Sharing in Idaho

Given the capability of NAIP imagery to be a core dataset for a wide range of activities in Idaho, the GIS community had to come together to offset the cost of everyone independently purchasing or establishing infrastructure to support the use of the aerial imagery. Fortunately, numerous agencies and nongovernmental groups had been working together to share geographic information for some time. Governor John Evans, in 1978, issued an executive order that established the Idaho Image Analysis Facility within the Idaho Department of Water Resources (IDWR), and designated IDWR as the lead state agency for remote-sensing and geographic information systems. Subsequent executive orders modernized the role and duties of the Idaho Image Analysis Facility and renamed it the Idaho Geographic Information Center (IGIC) (IGO, 2009). IGIC was established to address geospatial issues, including training, technical assistance, coordination and support, development of technology, and the establishment and development of a clearinghouse. However, with the expiration of the executive order (no. 96-12) in 2000, the IGIC dissolved.

Curiously, while some states maintain a single comprehensive geospa-

tial office, in Idaho the custom was that each department developed its own GIS capacities. With little surprise then, in 2000 the first State GIS Coordinator was hired at the Idaho Department of Administration (IDA) to develop a vision and plan for the use of spatial technologies across the state and across agencies. The coordinator drafted Executive Order 2001-07, signed by Governor Dirk Kempthorne in May 2001, which established the Idaho Geospatial Committee and, among other duties, directed it to "identify and promote a State geospatial information clearinghouse as a vehicle for sharing information" (p. 14). The state's Information Technology Resource Management Council (ITRMC) also encouraged IGC's efforts to establish a clearinghouse.

INSIDE Idaho, being managed by UI Library as well as located some 300 miles north of the state capitol of Boise, was not a unanimous choice for recognition as the state geospatial data clearinghouse. Some believed that the personnel managing the repository should be physically located in Boise, where many of the GIS professionals in the state resided at the time. Additionally, it was felt that the geospatial data clearinghouse should not be managed out of an academic library, but rather be structured within a state agency. However, in April 2002, after much debate, IGC announced the selection of UI's INSIDE Idaho as the state's official geospatial data clearinghouse.

In subsequent years the momentum established during the early 2000s continued with little abatement. Executive Order 2006-05, which continued the existence of IGC, reaffirmed the importance of the clearinghouse as a vehicle for sharing geographic information. The GIS coordinator position was elevated to Geospatial Information Officer (GIO) within a newly created Idaho Geospatial Office at IDA. The geospatial community, led by IGC, developed strategic and business plans for development and deployment of Idaho's spatial data infrastructure in March 2009 (IGO, 2009). Executive Order 2010-07 established the Idaho Geospatial Council, which formed a decision-making and steering body called the IGC-Executive Council (IGC-EC). Standing members include the INSIDE Idaho manager.

To structure the coordination of Idaho's geographic information systems and resources, further organization takes place under the Framework Leadership Team. This system is part of a larger national effort to standardize geospatial information infrastructures throughout the nation. The Federal Geospatial Data Committee (FGDC) is the primary author of this thematic structure (FDGC, 2012). In Idaho, the Framework Leadership Team is composed of the chair of each Technical Working Group (TWG), which provide technical and substantive expertise and focused effort in specific areas of interest. For example, a TWG exists for each framework layer—that is, themes of data that almost all geospatial applications require on a recurring basis, such as transportation, elevation, hydrogra-

phy, aerial imagery, and others. Specifically, the Imagery TWG coordinates activities related to the imagery framework theme, where discussions surrounding the NAIP imagery for Idaho have taken place (IGO, 2009) (see fig. 1).

Even though a plethora of changes have taken place, the community within the state has grown and integrated around logical and necessary structures. The state GIO provides political and organizational leadership to bring the varying groups together. The technical expertise in various areas is separated among working groups that enable communication and cross-institutional information-sharing. INSIDE Idaho also has endured: it continues to be a hub for sharing geospatial information. Relationship-building requires state-wide travel for face-to-face meetings; it requires participation in abundant conference calls, as well as copious email traffic. Fortunately, UI Library leadership recognized the importance of the clearinghouse designation to solidify its role in the coming geospatial, aerial-image data deluge. Years of building partnerships and cultivating relationships across the state's GIS community were the reasons why INSIDE Idaho was in a position to be designated the state geospatial clearinghouse and subsequently play a vital role in the management, curation, and distribution of NAIP aerial imagery.

2004 NAIP Imagery Acquisition

In the early 2000s Idaho began to coordinate the acquisition and dissemination of state-wide aerial, orthorectified imagery. The newly created State GIS Coordinator position had recently been filled. State-wide orthoimagery was available for purchase from public and private vendors—meaning imagery of the entire state could be acquired at once. At the time, the only border-to-border imagery that existed for Idaho was Landsat satellite imagery at a 30-meter ground resolution. Unfortunately, many local research and planning activities require imagery at a spatial resolution greater than that. Also, at that time Landsat imagery required significant processing in order to be usable for most needs. USGS digital orthophoto quadrangles (DOQs) were available from the NHAP and NAPP programs for most of the state, excluding a large area in its heavily forested central portion.

With these limitations in mind, the first state-wide purchase of digital orthorectified imagery was a 10-meter-ground-resolution panchromatic product from the SPOT Image Corporation, which had restricted access to Idaho's state, regional, county, and local governments, K-12 public schools, and higher education institutions. These restrictions prevented the data from being truly "state-wide" and hardly possessed the characteristics of a public service. The initial SPOT purchase was followed in 2003 with a second one of a similar product, but having a 2.5-meter ground resolution. This dataset had identical license restrictions to those described above. In each case, managing and curating these data also introduced

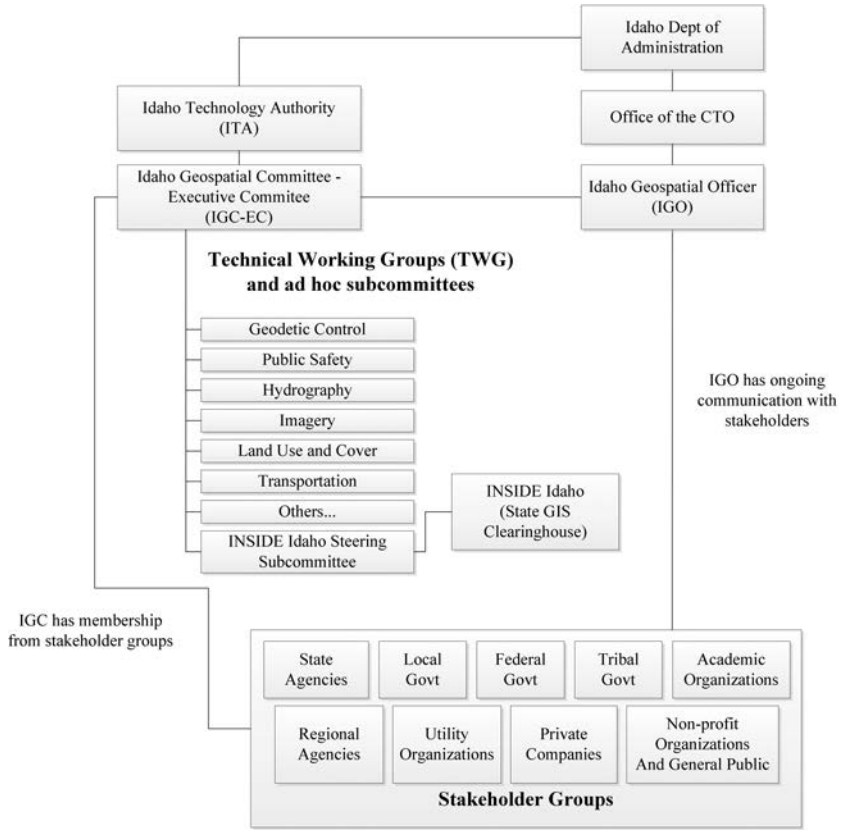

Figure 1. The organizational structure of the Idaho spatial data infrastructure.

barriers. The data were delivered offline to entities meeting the access and use constraints, and INSIDE Idaho archived a copy of each dataset to place in its repository.

In 2003 FSA informed state officials that they would be acquiring imagery in summer 2004 for all of the agricultural areas of the state. Idaho's Imagery TWG began to inform the state's GIS-user community and explore the possibility of acquiring border-to-border, 1-meter-ground-resolution, 3-band natural-color orthorectified imagery. The process of coordinating the contribution of money from federal, state, local, and tribal governments and others in the state began. The State GIS Coordinator began corresponding with representatives of these agencies in order to secure the funds needed for the purchase. Managing the commitments of multiple partners whose budget fiscal years varied proved to be no small task; aligning the fiscal requirement of FSA with the fiscal requirements of a plethora of partners across the state required a significant amount of co-

ordination. In the end the coordinator was able to assemble the funds for the border-to-border acquisition. USGS's Idaho Mapping Liaison (a position that no longer exists) made a commitment to purchase external hard drives and pay the fees to have them shipped to UI Library. It was agreed that INSIDE Idaho would make the data publically available for both downloading and as a geospatial web service over the internet.

The thought of receiving these data excited the geospatial community in Idaho. The NAIP imagery would be the first border-to-border, high-resolution imagery for the state. The data would be approximately 800GB in size, which even twelve years later persists as a substantial barrier for downloading and processing. Popular commercial products like, for example, Google Maps did not yet exist, and swiping a finger across a web-mapping application on a smart phone was not yet available, let alone taken for granted. Most internet map servers now used to make available geospatial web services were in their infancy at the time.

As can be expected, processing the data was burdensome. The data were originally collected on film and subsequently converted to digital images. Two products were to be delivered: preliminary compressed county mosaics, which are created using software that compresses many images that cover small areas into a single image covering a much larger area (such as a county); and final images spatially organized into USGS quarter-quadrangles (3.75 feet) in the TIFF format. The latter organization was important because the USGS's structure was a familiar organizational standard for reviewing sections of the state to anyone who had spent significant time working with maps and spatial data. INSIDE Idaho received the data on external hard drives, then transferred them to a file server. These data were made available for downloading; additionally, ESRI ArcIMS, a web-map server, was used to make these data available as geospatial web services. The web-map service created through ArcIMS provided pictures of these data, but did not deliver the actual values of each pixel to users. For some users a simple image was all that was needed; for others the pixel data were required. At this time these methods of delivery were sufficient for partners, because they were the only ones available.

The NAIP data proved popular. A professor at a state college noted: "The imagery is a real hit here—having to run people off that want to see trails, their house, etc. Way cool and phenomenally useful for my classes and my own research" (Bruce Godfrey, personal communication, October 13, 2004). A researcher at a state university exclaimed: "I just downloaded the compressed mosaics from INSIDE—THEY ARE GREAT! I wonder if there is an uncompressed version available? This would help for the analysis I am doing since the SID compressed images gets a little fuzzy when you zoom in. I can supply DVDs or other media for copying if you have the originals. Thanks!" (Bruce Godfrey, personal communication, December 9, 2004). Another professor at a state university asked: "I see you have the

2004 NAIP county mosaic for Latah County up on the INSIDE site. Do you have access to the individual quarter quad source data? I'd really like to get the UI Campus area and the Experimental Forest areas for some of my lab exercises for my airphoto interpretation and mapping class. Let me know if you know how I can get access" (Bruce Godfrey, personal communication, March 3, 2005). Finally, one user wrote: "I found on the internet that you are the contact for the NAIP imagery for the state of Idaho. Although I currently do not live in the state, I am considering purchasing a farm there and would appreciate your sending me, if possible, a copy of the 2004 imagery for Kootenai County on disk, in MrSID format. I currently have a farm . . . and have found the NAIP imagery very useful in my management and would hope to use the Idaho information to facilitate my search for a suitable property there. Thank you for your consideration, A User, Mississippi" (Bruce Godfrey, personal communication, September 9, 2006).

2009 and 2011 NAIP Imagery Acquisitions

FSA notified the state government that they would be collecting data in Idaho again during summer 2009. These data were to be acquired in a fashion similar to the 2004 collection; however, these would include the addition of a fourth band, a near-infrared one. This difference introduced several significant changes to the nature of the partnerships. First, the inclusion of the fourth band meant that the data would require approximately 30 percent more disk space than the 2004 collection. Therefore it was hypothesized that more partners would request the data be delivered to them offline rather than having to download such large files. Second, the near-infrared band introduced new opportunities for vegetation analysis. Thus a potentially broader user-base for delivering those data might be realized. Finally, the inclusion of the fourth band necessitated that web services be configured to allow users to select two visualizations for these data: natural color (band combination 1, 2, 3) and color infrared (band combination 4, 1, 2) (USDA, 2013).

The ability to move data around the state was still limited by bandwidth and network connectivity issues. Also, due to the popularity of these data, there was a desire to achieve redundancy in case of computer infrastructure interruptions. The need to put the data in multiple locations and under multiple auspices was significant. Therefore IDA allocated resources to INSIDE Idaho at UI, as well as to the GIS Teaching and Research Center at Idaho State University (ISU) for the dissemination of the data from 2009 onward. In some ways the two organizations represented the aggregations of GIS-related data-dissemination and data-curation expertise and infrastructure in the state. They also covered the landscape of the state well: UI in Moscow in the north and ISU in Pocatello in the east/south, approximately 500 miles from each other, and each connected to Idaho's major population centers. Notably, and per the statewide agreements,

INSIDE Idaho received a copy of the data for the clearinghouse; by this point, concerns about the ability of INSIDE Idaho to continue to serve the state's needs had lessened. Competent and consistent service over the previous five years had increased the geospatial community's trust in it.

The 2009 NAIP collections also introduced new server technology, which began to alter the ways that users accessed the imagery. ArcGIS for the server was implemented at both UI and ISU. Both institutions began to configure and test geospatial web services for these new NAIP data. Technology had progressed to the point where we could deliver to users, and as desired by some of the partners, *image* services instead of simply *map* services. It was vital for UI and ISU to keep up with the rapidly evolving technologies surrounding managing and delivering large collections of digital imagery so that the partners who used the services did so in as efficient a manner as possible to meet their business needs. If delivery methods of these data were not kept current, the partnership would likely suffer.

The 2011, data were virtually identical to those in the 2009 collection. Based on successful collaboration in the past, UI and ISU began to test and configure geospatial web services for these data (see figs. 2–3). The usage statistics on both graphs indicate two important trends. First, page views for web services show continuing increases in traffic over time. When a new NAIP dataset is released, previous datasets receive less traffic for obvious reasons. Second, the graph regarding downloads shows the pattern discussed above: downloads decreased across the board as both dataset size increased and web services became more prevalent. Together, the two graphs indicate trends that have been observed within the Idaho geospatial community, and trends that we expect are widely found in other, similar types of data and network infrastructures.

2013 NAIP Imagery Acquisition

In 2012 FSA notified the state of Idaho that again it would collect data the following year. For the first time these data were offered at a half-meter ground pixel resolution. Whereas previous concerns regarding the size resulted in multiple copies being shared in different locations, this increased ground resolution greatly increased the size of the data to approximately 4TB. Since 1999, UI and ISU had each procured and maintained its own storage for digital-data holdings, and had independently created the files necessary to produce geospatial web services. The size of these data prompted a discussion between the two about finding efficiencies for archiving and accessing the data across the two research universities, as hosting multiple terabytes was not a simple endeavor.

During the intervening years, UI had launched a separate initiative to improve research data services through the establishment of a service center, the Northwest Knowledge Network (NKN). This initiative was part of

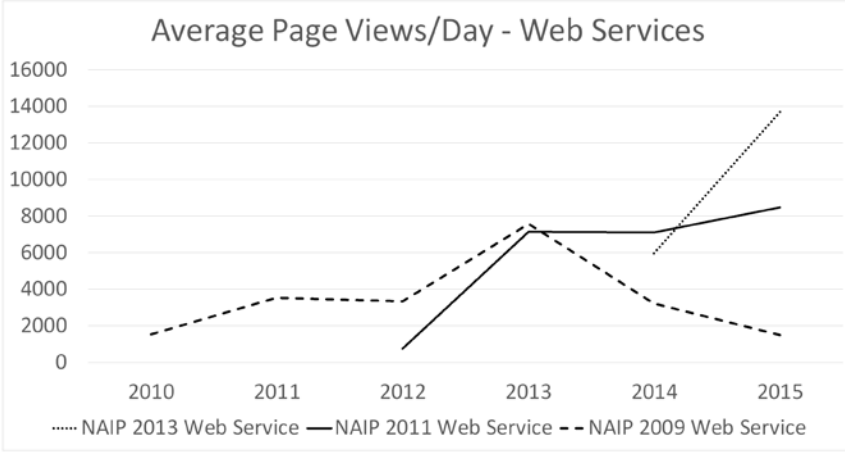

Figure 2. Page views for NAIP imagery over time.

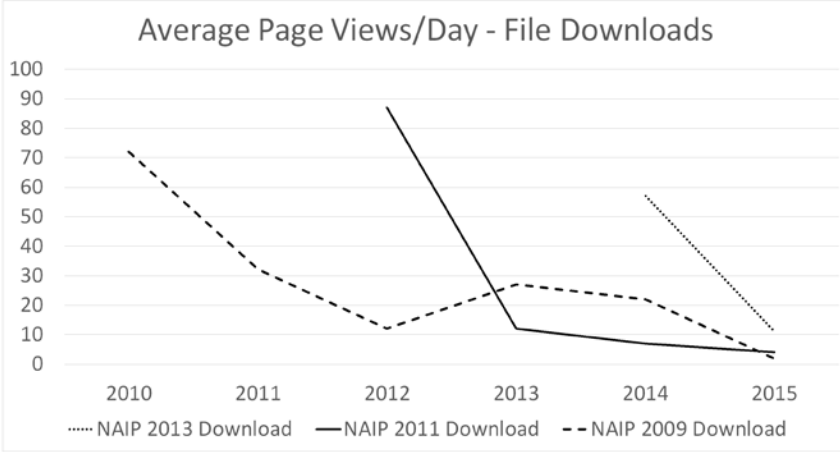

Figure 3. Downloads for NAIP imagery over time.

a larger state-wide collaboration set forth in a document titled "Cyber-infrastructure Strategic Action Plan for Idaho Universities" (IUECWG, 2012). One of the principal advantages to the architecture of NKN was a partnership with both INSIDE Idaho and the Idaho National Laboratory (INL) located in Idaho Falls. INL and ISU are only about fifty miles apart in the eastern portion of the state. Therefore, as part of the NKN network, INL was able to host a small, dedicated data center that replicated the entire INSIDE Idaho catalog, including the NAIP data from the UI Library

data center to INL's data center. The result was near seamless accessibility across the state, redundancy, and the capacity to serve all locations from a single distributed storage system. Figure 4 provides a basic idea of this infrastructure.

After receiving these data on an external drive at UI, the workflow to share the data with ISU commenced. Data were copied from the external drive to a pre-ingest storage location on the server. Checksums were generated before and after file transfers for each file in the network storage location and then compared. Read-only permissions were applied to all files, and the data were organized into a directory structure required by our repository. Geospatial metadata were created as needed; even though NAIP imagery comes with FGDC-compliant metadata, local information needs to be added. Next, the steps required to create a geospatial web service were then undertaken. Using ArcGIS Desktop, a mosaic dataset was created and published on an ArcGIS server site.

Sharing these files cut down significantly on the amount of work that ISU needed to do to publish the geospatial web service from its servers. Once testing was complete, the data, as well as the files required for the ArcGIS server service, were copied from a pre-ingest location to a produc-

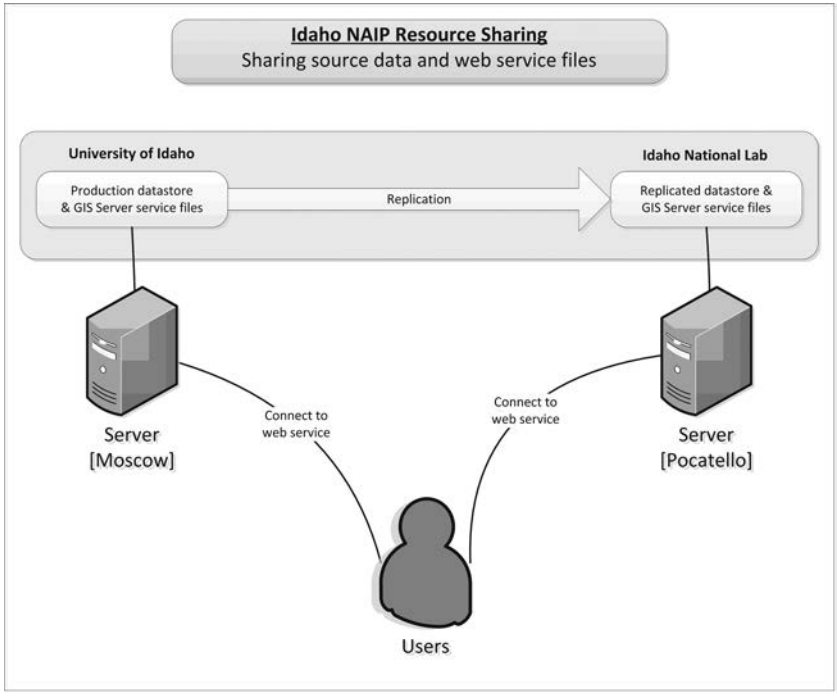

Figure 4. Method of sharing NAIP data across the state of Idaho.

tion location. Once again, checksums were created and compared. The data were then replicated to INL, and ISU was granted access to this replicated data store as well as to all the files required for the ArcGIS server service. Lastly, final versions of the geospatial web services were published at both ISU and UI, and the capabilities to access the services using Open Geospatial Consortium standards were enabled.

The emergence of new technologies, the increase in the size of geospatial data, and the adoption of the important collaborative vision have resulted in changes to the ways in which we approach geospatial web services collaboration. In partnership with the Idaho Regional Optical Network, NKN, and the Idaho Geospatial Office, UI and ISU have successfully implemented a more economical, reliable, and efficient workflow for sharing geospatial data and supporting web service files. State agencies and other stakeholders benefit from this system each time they access NAIP data stored at INSIDE Idaho, even if they do not realize it. Based on the success of this project, future collaboration could potentially involve sharing at the GIS server tier and/or web server tier to achieve a higher degree of failover and efficiency and/or enabling two-way replication between the two institutions.

Curation and Management

With the 2004, 2009, 2011, and 2013 collections in place in our repository and subsequent collections on the way, curation challenges have become evident. Curating the data has not been difficult; instead, the curation of the geospatial web services has required a significant amount of time with respect to both service maintenance and, perhaps surprisingly, the professional development of staff.

One of the major changes over the past decade is how geospatial web services for aerial imagery have become an expectation, and in many cases preferred. State-agency GIS professionals depend on these services to make many of their daily activities more efficient and effective. While some users still download individual aerial imagery tiles from these large collections to their local computer, many users prefer accessing seamless mosaics of an entire data collection using web applications, desktop applications, mobile devices, or programming and scripting code.

More recently, users not only want to be able to access aerial imagery as a seamless mosaic, but they expect to be able to retrieve more than just a picture of the imagery from the geospatial web service, including the actual pixel values of the raster (that is, an image service and not just a map service). In so doing, users are able to perform analysis, such as image classification, using these data from the web services. Users expect to be able to have control over a resampling technique of their choice, choosing the type of compression applied, selecting a spatial reference system, picking an image format, and even changing band combinations as needed.

Enabling parameters of the service that permit these types of operations increase the ability to filter, analyze, and visualize the data.

For NAIP data collections, INSIDE Idaho staff members have had to keep current on raster management and geospatial web services for raster data to support the needs of those in the partnership. We have upgraded legacy map services to image services so that partners can continue to consume these data in a manner that helps them meet their business requirements. In some cases users are performing not only visual analysis but also analytical analysis on the data available via these services. Additionally, to extend the exploratory possibilities of these data, we have enabled on-the-fly processing functions to allow for a color infrared representation, in addition to the natural color representation. This increases the value of the service to users by quickly allowing them access to a subsequent band combination. Working within the IGC-EC structure and with the different framework TWGs has enabled us to continue to receive feedback on needed infrastructural changes as well as to be responsive to the desires of our partners. Communication being key in any set of relationships, it has proven critical in supporting and growing Idaho's spatial data network.

Conclusion

NAIP imagery remains one of the most popular resources available in INSIDE Idaho's collections. It is also a mission-critical service for a land-grant university library, as the NAIP imagery collection requires expert data management and curation. Stakeholders throughout the state—from federal partners, state agencies, and local and tribal governments, to university researchers, to private companies—all utilize the Idaho NAIP services. Through these connections the sustainability of the partnerships forged over the last ten years remains strong. The Imagery TWG continues to be active, with participation from numerous stakeholders. At the time of this writing, 2015 NAIP imagery of Idaho has been procured by the IDA, and external drives with the data are on their way to UI Library to be made available for downloading and as web services. There are, however, some new pressures on the partnership.

Foremost, these NAIP data are becoming available as web services from other providers. APFO itself has recently made them available as web services. At this time the data are not available for downloading and only available as a natural color representation, but for some users this is sufficient. Additionally, Esri, through ArcGIS Online, is now making NAIP imagery available. Second, some members of the partnership have expressed interest in the Imagery TWG, exploring options for the acquisition of imagery at higher spatial resolutions than NAIP provides. Recent discussions have centered on the cost and licensing options for 6-inch-resolution orthoimagery. Unfortunately, from the perspective of librarians at a land-grant university, licensing restrictions with these data are more

restrictive. They are similar to the restrictions of the imagery that the state of Idaho purchased in the early 2000s from SPOT Image Corporation and do not allow the data to be in the public domain, as we have enjoyed with NAIP imagery over the past decade.

One of the beneficial aspects of this case study is that it describes the value that a national program dataset has brought to cementing relationships within the state geospatial community. The implication is that any other state has the opportunity to utilize local implementation of these national data for the benefit of the state. Any land-grant university might see parallels for other national data-collection programs as well. The responsiveness of local institutions to local stakeholders means that local governments—city and county—or local private-sector organizations have resources that they can rely upon without competing for attention with other states or regions. The new discussions around 6-inch-resolution imagery represent that relationship. Federal programs and companies like Esri usually need to detect significant demand before action and often leave marginal-use cases behind; we can respond much more quickly and at a smaller scale, which INSIDE Idaho staff, and that of UI Library more generally, prioritize responsiveness to these state needs above those that come from elsewhere.

Finally, as land-grant universities are compelled to attempt to transfer knowledge and apply their research and development resources to aid state communities, the type of service exemplified by the NAIP program in Idaho shows how a university might leverage its technical expertise. The program produces the data and manages part of the cost of the agricultural portion of the project. The state GIO possesses both authority and legitimacy to coordinate state-wide activities and collect funding from partners. The state agencies have specific, thematically oriented foci for using and working with geospatial data, thus creating a community of users with explicit needs. The university library, on the other hand, has the responsibility to make available information resources for the benefit of the university and, by extension, the state. Each group with different responsibilities working together has created a strong, successful, lasting partnership, one that continues to serve the state of Idaho.

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