The Pacific Northwest Conservation GIS User Assessment

A study of the use of Geographic Information Systems (GIS) by Environmental Organizations in the Pacific Northwest
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INTRODUCTION

The Pacific Northwest Conservation GIS User Assessment was initiated by the Brainerd Foundation in an effort to better understand the needs of the burgeoning number of non-profit environmental organizations using geographic information systems (GIS) in the region. GIS is a powerful combination of computer hardware and software, data and people that can help users to analyze data, represent their landscapes through maps and create new knowledge about the environment. Growing interest in GIS use is part of a broader trend among members of the environmental community – funders and activists alike – to better harness information technologies for conservation. Yet in spite of this trend, GIS use by non-profit organizations and environmental groups is poorly understood as are the particular issues confronting this GIS user community. This research effort employs survey data and interviews to develop a better understanding of how conservation groups of various sizes are using this particular technology, where they need help and what trends are shaping future use.

The effort to harness GIS by the environmental community is relatively recent while its use in conservation and resource management professions is well established. The surge in adoption and implementation of GIS by environmental groups has increased dramatically thanks to advances in technology and the falling costs of software, hardware and data. Due in part to the reduced barriers to GIS acquisition, more than 40 organizations in the Northwest have received in-kind grants of hardware and software to implement GIS in house in the past five years. These grantees are joined by dozens of others who have taken the initiative on their own to purchase software, acquire data and begin the task of building their own GIS. Still more are seeking occasional support from any of a handful of GIS providers located throughout the Northwest who provide technical and mapping services on a contract basis. This broad interest in GIS extends beyond the common perception that it is merely a mapping tool, rather it is a mechanism for creating, managing, and communicating knowledge about landscapes.

Environmental groups are acquiring GIS, convinced it will enhance their conservation efforts and are expending significant resources to attain it. While environmental organizations have much wider access to data and basic mapping capabilities, significant barriers stand in the way of efficient and effective use of this important technology. This research investigates how respondents acquire, use and manage GIS on behalf of their environmental initiatives. The following report outlines the methods used in the research process, presents the results gleaned from the evaluation of both quantitative and qualitative data, and offers conclusions and recommendations regarding the road ahead. It provides a snapshot of a very fast moving subject that we hope will contribute to a better understanding of the way conservation organizations put technology to work for the environment.

OBJECTIVE

This study evaluates the patterns of GIS use by environmental and community groups working in the Pacific Northwest. Specifically, it seeks to address three broad questions to understand how conservation groups might better access and utilize GIS technology. These include:

1. User Types and Needs: What are the most common goals and uses of GIS by conservation groups and how can they be categorized to better understand the unique needs of the non-profit community?

2. Hurdles and Sollutions: What are the primary technical and institutional challenges that stand in the way of GIS use or implementation? How are they successfully addressed?

3. Collaboration and Communication: Do opportunities exist to improve collaboration and communication among regional GIS users?

METHODS

Data collection methods consisted of an on-line, web-based survey supplemented with interviews. The survey gathered quantitative data to build a statistical snapshot of who responded and how well supported their GIS efforts were. Most questions included multiple choice options and yes/no queries. In addition, each survey solicited responses in narrative form by asking open ended questions and providing participants with as much room to respond as necessary. Finally, the survey results were supplemented with eight interviews with select representatives of the regional environmental community.

The great diversity of environmental organizations and the lack of a central and up-to-date directory suggested that a web based survey form might be appropriate to solicit input from groups utilizing GIS. A list of target organizations in the region from Alaska to Oregon and east to Montana was generated from on-line web searches and electronic databases, creating an electronic mailing list of approximately 1200 organizations. These organizations were sent a brief e-mail introducing them to CommEn Space and inviting them to visit the web site to participate. In addition, ONE Northwest, a regional non-profit organization providing Internet and networking support to the environmental community, agreed to distribute the invitation message to the moderators of dozens of list serves it hosts throughout the region. While we can not be sure how many groups received word of the survey, we assume that the use of e-mail that is easily forwarded to interested parties and the distribution support provided by ONE Northwest ensures that a major portion of the regional environmental community received notification.

Anticipating the breadth of experience and knowledge of GIS already existent in the environmental community, we developed questionnaires directed at five separate user types, categories that described the organization's current relationship to GIS. Respondents had approximately seven weeks to respond by logging onto the web site and completing one of the five surveys. Survey respondents classified themselves in response to the following descriptions:

User Type	Relationship to GIS	Number of Respondents
Type I	Groups unfamiliar but curious about GIS	21
Type II	Groups knowledgeable about GIS and seeking to utilize it	82
Type III	Groups familiar with GIS and using it to make maps	31
Type IV	Groups using GIS to conduct analysis and produce data	58
Type V	Groups who no longer use GIS	13
	TOTAL RESPONSES	205

Specific questions varied across each of the five questionnaires but were grouped into six themes. This strategy permitted the design of unique questions for each user type while at the same time producing data that could be compared and evaluated across all respondents. These themes include:

Staffing	Provides data on the staff resources and level of training.
Data	Data management questions help define the level of development and the nature of GIS use.
Community Structure	A reflection of the organization's awareness of other users, sources of data or opportunities to collaborate.
Hurdles	How organizations characterize and prioritize the challenges they face(d) in implementing their GIS;
Hurdle Response	What strategies characterize their approaches to overcoming typical problems?
Event Interest	What level of interest exists within the community for an event to address these issues and what content should be included?

Preliminary survey results were used to identify trends for further investigation and structured interview questions. Eight survey respondents were selected to represent a cross section of survey user types, to learn more about their experiences with GIS and their perceptions of difficulties and possible solutions. Each interview was tape recorded and documented with interview notes.

The quantitative results from the survey were compiled by user type and examined for strong trends and differentiation from one user type to another. Combined with the textual responses and interviews, the survey responses provide detailed insight into the variety of GIS use in the environmental community as well as opinions about the difficulties and solutions to employing this technology. Discontinuity in response between user types was interpreted as verification of the user type designations and suggested trends or patterns that could not be generalized for all users.

RESULTS AND DISCUSSION

The web-based survey proved a highly successful mechanism for facilitating participation of a geographically diverse collection of participants. We received 205 responses and representatives from eight organizations were successfully interviewed. Data collected about the mission and focus of participating organizations confirm that GIS contributes to a wide range of advocacy, educational and conservation activities. The vast majority of respondents (Type II - 82) categorized themselves as relatively new users, often just beginning the process of accessing or utilizing a GIS. The next most frequently checked category was Type IV (58) or advanced users, suggesting good representation from two ends of the user spectrum. Across all categories, most report map making is the prime function of their GIS use, although analysis and planning clearly becomes more frequent as users gain competence. Respondents described their missions by selecting from a list of topics in the following frequency:

GREENSPACE	48
JUSTICE	25
LAW	21
ADVOCACY	74
TRIBAL	21
AGRICULTURE	30
EDUCATION	115
RECREATION	20
ACADEMIC	39
DATA PRODUCER	38

TECH SUPPORT	11
BIRDING	48
FOREST	74
WILDERNESS	66
WETLAND	87
WATERSHED	92
RIVER	63
MARINE	62
HABITATS	59
LAND TRUSTS	49
RESTORATION	71

Distribution of organizational types responding to the Conservation GIS User Survey

We consider the diversity of respondents key to interpreting and evaluating the results of this research. The number of groups currently using GIS and the breadth of their activities calls into question the wisdom of any one-size-fits-all solution to the challenges such organizations face in using this technology. These challenges are detailed below along with the strategies this community of users employs to overcome them. Together, they constitute a snapshot of how this important technology is contributing to conservation efforts throughout the Pacific Northwest.

We began by asking how participants were utilizing GIS in their conservation efforts. Different uses dictate different user needs, applications and products as well as suggesting a range of competencies and skills. From the quantitative data, the research confirms that most groups are introduced to the technology via the powerful graphics and compelling maps these systems enable users to create. These products play a central role in communicating with board members, constituents and the community for all user types. However a GIS is also a powerful resource for organizing and managing data, conducting advanced analyses, and supporting strategic planning efforts.

All but beginning users were asked to comment on the hurdles they encounter in acquiring and implementing GIS. Respondents offered details on the range of technical and institutional factors that impact their GIS work and their strategies for addressing these. And to better explain the growth of this technology in the conservation community in spite of these hurdles, we looked for patterns in the strategies for overcoming them.

In defining their primary hurdles, respondents selected categories that included planning, obtaining and managing data, designing and conducting effective analysis and obtaining financial support. They were also invited to comment on additional problems via a text entry section. Type II through IV respondents were then asked to indicate how they address technical and organizational difficulties. Options included resorting to vendor provided technical support, hiring consultants, looking to volunteers or simply "muddling through".

The most predominant problems faced by users at different stages of GIS development can be grouped into four very inter-related categories: staffing, data, planning and training.

Staffing – Finding the right people to do the work:
We suspected that the presence of trained staff or the commitment of resources for assistance would be important features of organizations successfully using GIS. Accordingly, Types III, through V were queried

regarding the staff on hand to support technology and the GIS in particular. Data reveal that these groups make use of a wider variety of people resources to power their GIS initiatives: volunteers, part-time staff and outside sources of expertise were used in roughly equal proportions.
Textual responses expand on these relationships leading to the conclusion that on the whole, respondents are creative and pragmatic about acquiring and implementing GIS technology. Notably, few report that they are prioritizing GIS to the point of hiring trained, specialized staff. Even the most advanced users (Type IV respondents) indicate that only 58% support full time, GIS trained personnel.

A review of the list of responding organizations may partly explain this. While no budget information was solicited from participants, individual organizations clearly represent the widest range of size and capacity, from one or two person volunteer operations to fully staffed, national and international organizations. With such variously sized organizations pooled together it is little surprise that staff strategies vary.

The narrative responses and interviews help to draw out the implications of such ad hoc approaches to staffing. We can confirm from the data that the most significant costs associated with GIS implementation are not the software, hardware or data, although these are often the most concrete and visible at the start up phase; rather they are the costs associated with "people time". Technical resources are obviously required during GIS initiation, but successful implementation requires capable staff to accomplish the tasks. In situations where GIS is being done without full time staff, as is the case with the vast majority of respondents, added unforeseen expenses may arise, including indirect costs like lost productivity trying to get more work out of individuals tasked with other responsibilities or managing volunteers and other part-time supporters.

Stories from the interviews often illustrate how these "costs" are incurred. One respondent recounted his organization's plan to contribute the field work of their staff and volunteers to county efforts to update stream typing data for salmon recovery planning. In return, the non-profit group would get a suite of maps and data that would be used to drive restoration being supported by a separate funder. With the passage of Initiative 695, which impacted public agency budgets at virtually every jurisdiction in the state, the agency partner backed out claiming the need to "retrench and re-evaluate all partnerships." Meanwhile, the non-profit organization is caught unable to deliver on its grant commitments or perform the restoration work that it exists to do. What began as "win-win" partnership ultimately ended in failure and considerable frustration due to unforeseeable circumstances.

We asked advanced groups what new users and funders should know about staff requirements before investing in GIS for an individual group. Many suggest that while their decision to use GIS has been sound their perspectives on implementation it have evolved.

> "While we believe internal capacity is important, …many groups simply want and really only need to have ***access to*** (emphasis added) GIS technology….extensive investment in GIS hardware and software in small non-profits often goes to waste when groups do not have the financial resources to invest in the extensive person-time necessary to maintain an internal capability"

Reflecting on the practicality of smaller groups building internal capacity, another Type IV respondent wrote:

> "The next generation is conservationists who use GIS as a tool, perhaps 10-20 percent of their workplan, but whose job is advocacy or field implementation. I think in-house, full time GIS technicians are a thing of the past. The community is moving toward GIS boutiques and a few staff people who primarily do other programs, but use GIS skills to further their programs."

The message here is that most groups with experience using GIS toward conservation are happy with the results, though sobered by the efforts they require. They confirm that while the technology is becoming more accessible, it is mistaken to underestimate the resources required to truly make it work internally. Indeed, several organizations suggest that the skills required to do high quality GIS work – including knowledge of

cartography, data management, computer maintenance and possibly scientific analysis design – exceed the skill sets found among typical staff.

The next generation of GIS implementations may be more pragmatic about the staffing requirements necessary to sustain in-house GIS. 62% of Type II respondents plan to utilize outside support as they move forward with the implementation process. True to the diversity of the respondents, we expect "outside support" to take a variety of forms: more volunteers, partnerships with mentor organizations, the generosity of agencies or for profit contractors. Hopefully, organizations aspiring to acquire GIS recognize that devoting half of an administrative staff person's time to supporting the new GIS is not viable.

Data – The raw measurements upon which all GIS work depends:
Data for use in GIS relies on accurate position and attribute measurement for features in a landscape. Data developed for use in GIS is often referred to as "geospatial" data. The tasks of acquiring, evaluating, managing, editing or developing geospatial data for use in GIS pose a variety of institutional and technical issues to users at every level of competency. Access to appropriate data combined with the knowledge and skill to utilize the data is essential for organizations to produce effective information products with GIS. Consequently, survey questions inquired about the prevalent data problems facing conservation organizations and whether data access and availability are constraints for users. Advanced users were asked about their willingness to share their data and if they offer technical support or advise in the use of their shared data.

The results of interviews and the narrative information confirm that data issues present groups of all types with their most intractable challenges. Type II and III respondents expressed frustration in acquiring and evaluating data, while all user types reported significant difficulties encountered in producing data. While many groups – particularly Type IIIs – complained about the difficulty in finding useful data, statistics from other respondents suggest availability is improving. A large number of participants – between 75 and 90% in the three principal categories (II, III, & IV) indicate that their conservation work involves the production and analysis of data, geospatial or otherwise. A majority (86%) of advanced users report their data is available, much of it via the web and when asked in narrative sections of the survey, few indicated that they were prevented by policy restrictions from sharing their data.

While participant responses suggest that data access poses difficulties, survey text responses more often relate stories of existing data failing to meet the user's needs. Geospatial data sets are always developed with a particular use in mind. And while they are often applicable and relevant to other uses and questions, this is not always the case. When users – especially new users – find themselves frustrated with the shortcomings of the data in hand, some head back out to look for more and are disappointed when their search is fruitless. This pattern points to a critical problem that many new users come to understand too late: making existing data work hinges on understanding its ***appropriate use***.

To those with limited experience spatial data is often perceived as ubiquitous and accessible. Some GIS are initiated in response to having data in hand or data resources made available through agencies or other partners. But evaluating the appropriateness of data is a skill few basic users are trained to do. And yet the lineage, intended use, and structure are critical to whether a data set can be applied to a particular issue. Stated succinctly:

> "What should anyone interested understand? The importance of good data! Maps and analysis are only as good as the data producing them."

Data is only good when it is well suited to the user's information needs and analysis requirements. Unfortunately, the survey results reveal that too many organizations only discover these issues after they've expended the effort to obtain and work with data. What they find when they rely uncritically upon readily available data, is that the story told on their new map does not meet their needs or reflect their features of interest in the landscape. There is a disconnect between the particular focus of the group and what they are

able to present with their maps which leads to a dissatisfaction with the resources at hand. Groups don't ask in advance, "Does fine enough scale data exist to accomplish this?"; "Will the resolution of this data support or undermine my efforts?"; "Is this an appropriate task for GIS?" The result is profound frustration and anger or, worse, the production of poorly done products that fall short of the organization's goals and a pervading sense that the initial investment was miguided. Recognizing this trend, one advanced user recommends:

> "support positions that provide web-based (and other strategies) information that detail how data were interpreted, what kinds of statistics were used and why…fund analysts to communicate the misconceptions and gaps so that our maps, and their implications, can be fully understood"

The link between obtaining data and understanding its suitability to the task is made again and again throughout the responses, particularly as groups advance in their understanding of GIS.

> "GIS is very expensive to do right…the key is planning to get the right data based on asking the right questions at the front of a very long process…"

> "Data sets are invariably incorrect, incomplete, or inappropriate for specific questions. The continuous gathering of more does not necessarily mean better. One important issue is the need for useful database construction and maintenance at a variety of spatial scales"

In many cases, the frustration with the quality and relevance of available data leads to groups attempting to produce their own geospatial data . More than half of the Type II users reported holding data they wanted to get into their GIS and a slightly smaller figure (43%) indicated their intent to develop it in the future. 85% of Type 4 organizations do so now.

Custom data development – a hallmark of more advanced skills - is a logical and appropriate direction for an experienced organization to take. This research underscores the theory that data production increases steadily as organizations progress. Type III and IV groups produce incrementally more data on their own. However when an organization commits to developing custom data, particularly if it intends to make that data widely available, it ushers in an entirely new set of important questions:

> "Data collection and understanding are an often neglected consideration. It can take a great deal of time to become familiar with datasets and learn to use them effectively, and a great deal of time to collect them."

Data development is perhaps the most time consuming, labor intensive and potentially controversial dimension of GIS implementation. It requires significant resources: time for staff to do field work; expertise to efficiently manage data capture and digitizing; familiarity with data structures and significant computer resources. Nevertheless, it is a critical step in customizing analysis and mapping products to the very particular needs and interests of an organization and to producing new knowledge about the landscape. But it is a step that requires planning and coordination – among staff, partner organizations and other stakeholders. And though the research confirms most participants are interested in using their own data, many recognize the difficulties this poses:

> "Use of GIS is highly technical - especially management of data and analysis. Smaller organizations … can greatly benefit from in-house GIS but do not have the staff resources to manage the data and do the analysis over the long term. Groups need back-up support which would help keep up-to-date databases and would also help make data from different sources compatible"

Generally, data pose the most significant challenges to organizations developing or accessing GIS. But where groups in the early stages of implementation often perceive this as a crisis of accessibility, a more studied look

at these research results suggests that the problem more often involves accessing and using appropriate data. Increasingly, this includes custom produced data that reflects the conservation activity of a particular organization.

Strategic Planning – Visions for where we're going and how to get there:
These results suggest that a large number of groups from all user types regularly fail to adequately plan for the challenges and costs associated with GIS implementation. We asked participants if effective planning for GIS implementation was a hurdle. Responses to this particular question suggest the answer is no since no user type answered more than 16% affirmative. But written responses and interviews confirm that a failure to anticipate hidden costs, foresee technical hurdles, or anticipate the time required to do GIS well are all at the heart of people's frustration with using the technology. Each of these issues is an essential question that would typically be addressed as part of a rigorous strategic planning process. Such hindsight was particularly evident in the interviews when we asked about how organizations conducted planning.

> "More effort should be made to encourage collaboration on technology work with groups that have local or technical expertise. Too much discovery on the part of small organizations that their funding support doesn't begin to cover unexpected implementation costs"

By encouraging better planning, the funding community and the advanced users who are so often approached by less advanced groups for support, data or maps, can help interested organizations better understand their options. As numerous respondents point out, many organizations seeking help in developing GIS are doing so without an understanding of the full costs and don't need their own system as much as key products.

> "We want to see a concept of a mother ship with a bunch of satellites. One organization with technical ability and equipment works to mentor other organizations. Let's not re-invent the Wilderness Society lab in every operation…many folks have basic skills to map and do minimal analysis. But most of us quickly get to a place where we're beyond our limits and then the fear of ruining our data takes over"

This last quote – taken during an interview with a Type IV participant – also points to another issue that more effective planning could address: appropriate and effective training and support.

Training – The skills to participate in a data community
Access to appropriate training opportunities emerged as an issue of great concern to a majority of survey respondents across all user types. Indeed while a fifth to half of the respondents utilize paid consultants, 77% of the advanced users report they simply "muddle through" on their own without an effective strategy in place. Interviews confirm that few organizations have access to the people skills required to solve unforeseen problems. They suggest that most in-house operations receive staff training infrequently and what is available is often not formatted in a way that is sensitive to the realities of non-profit organizations.

> "There is a need for commitments of staged and longer term support, given the significant time commitments needed to develop expertise"

And:

> "This community includes a very wide variety of GIS skill levels and reaching them requires many different approaches. These approaches include training sessions, web-based map presentations for the non-GIS savvy, and easy access to sophisticated GIS technology and expertise for those that have GIS needs but no GIS tools."

Interviews added additional insight to this trend revealing that software provided tech support in ineffective and existing training is generally expensive, software focused and often requires several days out of the office.

Furthermore, participants may receive instruction on general techniques but return to their specific organizational projects without the skills to implement them locally or a source of assistance for doing so. The evidence suggests that access to specific tailored training that includes skill building/skill maintenance beyond GIS software is crucial yet lacking. The breadth of user interests may preclude a strictly defined "conservation GIS" user training that attempts to account for the diverse needs and interests of the present community of users.

An Environmental/Conservation GIS Community?

Recognizing that cooperation and collaboration were important sources for guidance, assistance, data sharing and partnerships, the surveys included questions intended to assess respondents' awareness of and interactions with other GIS initiatives in the community. Cooperation and awareness levels among this community of GIS users are higher than we expected. An overwhelming number of respondents in Types II, III and IV report they are aware of other initiatives and a vast majority, including Type Vs, report that they have collaborated with other groups. Equally high numbers in all three categories report that they are largely aware of other groups using GIS in the community. Further characterizing this interaction, 88% of Type IV participants indicate they are regularly approached by other organizations to provide some kind of technical support to other efforts.

While the incidence of collaboration is high, there is diversity in its forms. Maps get shared among groups working on forest protection in the same region of the Cascades; one group provides another with the statistical data on land use change in rural Oregon and the recipient takes the data into the field where its volunteers "ground truth" the results. Occasionally a Type II or III organization will be fortunate enough to work with a more advanced user, acquiring data, maps or some other form of statistical information that it can use for its own work. Some "sweet talk an agency into using that GIS to produce what we want" while others "beg, borrow, or trade at every turn."

While it would be useful to have more data describing these cooperative efforts, interviews suggest these relationships have generally been limited to data sharing and map making. There is little evidence of collaboration on the critical question of data development or system implementation where far larger cost savings potential exists.

In spite of an apparent widespread awareness of GIS work, respondents complain of a lack of effective communication across the community. Very few of the responding organizations expressed the feeling that sufficient communication exists among conservation GIS users to facilitate useful cooperation. Interviews confirm that what collaboration does exist, often stems from personal relationships among agencies and partner organizations working on similar issues. What is lacking appears to be any mechanism for more regular sharing of projects, questions and issues in a systematic way that informs groups of the efforts of others working on related issues. Linking the data problems outlined above with recognition for the institutional obstacles, one respondent wrote:

> "The greatest cost of a GIS is gathering quality data. Once data is in place there are many things you can do quickly and easily of great value. But we need more incentives and means to share data and reduce redundancy in data creation"

Trying to facilitate greater cooperation is an important challenge among resource poor organizations and is difficult if groups do not recognize the benefits available to them from the start. The quote above and others like it suggests that groups may require some greater level of education regarding the activities of other organizations before they will recognize the opportunities available via more collaboration. They may need a vehicle to meet and discuss their work and to learn what others may have to offer their efforts.

Event Interest – Strengthening the community

There has been some discussion among conservation groups and funders alike that an event designed to bring together conservation GIS users in the Pacific Northwest might be a worthwhile undertaking to address the issues raised by this survey. Respondents were asked to comment on their interest in an event and the type of speakers and topics they would like to see on the agenda.

Most user types expressed a high level of interest in participating in such an event (Types II-IV were between 85 and 90% positively inclined to participate). Even 75% of those no longer utilizing GIS expressed interest. Newer and moderately experienced users indicated that the presence of funders at such a program would be critical as would the participation of more advanced users demonstrating their applications of GIS toward conservation. 60% of Type IIIs reported the importance of data provider participation as did a lesser number of Type IIs, supporting the idea that Type II groups lack the experience wrestling with data issues. Interest in case studies was moderate (56% in Type IIs and 61% in Type IIIs) although several interviewees went into detail regarding the need to actually see powerful applications demonstrated for new users.

Based on these data, we surmise that interest in an event is high although many smaller groups express a limited willingness to pay and the range of competencies suggests the need for a carefully designed agenda.

Several participants expressed skepticism about how such an undertaking would overcome "turf issues" and engender greater communication. Also, few seemed enthusiastic about paying for such an event and several smaller organizations indicated that such a program would be a lower priority if other issues precluded participation.

Groups with a particular conservation focus – marine protection or stream restoration – often want to see example of GIS working effectively in their area of concern. Likewise the survey responses include numerous requests for particular case studies aimed at demonstrating GIS applied to specific conservation questions. For some, the opportunity to present their work and to identify others who have data to contribute to its further development was most crucial. Many were clear that the participation of data providers including agencies and non-profit organizations producing their own data for conservation activity was also important.

Conclusions

The results of this investigation suggest that there is an identifiable community of environmental organizations in the Pacific Northwest that is acquiring GIS technology resources, but is struggling with a common set of difficulties in applying this technology. Despite the diversity in mission and objectives of the responding organizations, a majority expressed frustrations or shortcomings related to data acquisition and development, staff management, access to effective and relevant training, system design and inability to utilize the technology to its fullest extent. Efforts to address these challenges must take place at both the levels of the individual organization and across the environmental GIS community as a whole. Taken individually, each organization will seek to customize and tailor its GIS effort to meet its mission needs, yet all need to be aware of and engage with the larger body of environmental organizations making use of GIS. Efforts aimed at the level of the organization should include strategic planning for GIS implementation and management, training opportunities that reinforce both the fundamental concepts underlying GIS as well as institution-specific data analysis and operational requirements. Across the Northwest environmental GIS community as a whole, efforts should be made to improve communication and awareness of the wide spectrum of GIS applications being implemented by individual organizations. Specific initiatives should seek to provide a common set of data resources on the environment and encourage the availability and exchange of specific data sets developed by community members. Finally, the funding community that seeks to support environmental activism in the Pacific Northwest needs to be attuned to the difficulties and great potential presented in the application of GIS technology to environmental issues. Support for initiatives that encourage development of base data sets, access to training and strategic planning and cooperation among conservation GIS community members will improve both the success and effectiveness of GIS use.

Access to Strategic Planning

Not every environmental organization is well suited to implement GIS, yet demand for access to environmental spatial data resources managed and produced with the aid of GIS is on the rise and will continue to grow. Groups seeking access to GIS resources – and the organizations that support their efforts - must understand the need to plan. Good strategic planning in the development and use of GIS resources will help to insure a group

- accounts for the necessary resources and time to implement
- evaluates the impacts of GIS acquisition on the organization's resource budget and operation
- considers alternative scenarios that may be more appropriate or effective
- defines measurable benchmarks for evaluation
- establishes attainable, practical products as goals of their work

By strongly encouraging interested organizations to participate in a structured planning process facilitated by an organization with expertise in design and implementation, funders can help guide organizations whose needs and resources warrant in-house systems. Good planning should also lead to an understanding of the alternatives available to those groups who determine they may not need internal GIS. If establishing an in-house system isn't appropriate, where do organizations go and what do they ask for? A web-based clearinghouse that could direct organizations to other users, agencies, and support groups that may be able to provide assistance is a realistic and appropriately scaled response to the highly varied needs and interests of the many groups expressing interest in future GIS use.

Effective strategic planning leads to the development of documents including a technology assessment and implementation plan that will serve the funding community as well. A strategic plan provides potential funding and partnership organizations with a tool to evaluate the capacity of an organization even as it helps that group think through its own objectives.

Develop Appropriate Training Opportunities
Providing Northwest environmental organizations with the type of GIS training that meets their specific needs within limited budget constraints and in a timely manner is indeed a challenge. Existing training programs are largely software driven and focus on the mastery of basic functions and operations of GIS. This investigation indicates that what is essential – and missing – is a mechanism for training staff on several larger issues relating to GIS: planning implementation, management, data evaluation, data development, and the creation and communication of effective products that affect people's vision of the environment. Periodical short-term training events are poorly suited to meet these particular needs. Instead, groups need opportunities to address context specific needs that are best met through long term, low intensity access to qualified responsive support. Respondents to the survey expressed an interest in this form of less intensive, customized type of training. A program that functions more like a regularly meeting user group would permit participants to adjust their level of involvement according to their immediate needs. Facilitated and managed by an organization with experience and expertise in GIS design and implementation and familiar with regional data, such a "community user program" would be flexible in meeting the needs of participants.

A community user program could consist of meetings, web based interaction and individualized or small group workshops. Its direct objective would be to better equip organizations at various stages of development to plan and implement more efficiently. It would provide tools and strategies for solving the problems GIS development poses, rather than trying to build a single, one-size-fits-all training solution. Indirect benefits include a tighter, more informed network of conservation users and more opportunity to coordinate data and analysis efforts.

Unlike standard one or two day classes, the user program supports its participants over time, providing a resource for technical support and more essentially, strategic planning and growth. It would involve active, defined mentoring of smaller organizations by those more advanced or knowledgeable in a particular issue area. Since participation in such a network of users would ensure some collaboration and secure a limited amount of ongoing technical support, funders and other supporters could be more assured that resources invested in technology development would be well utilized if the recipients were participants. Indeed the encouragement of such a network by the funding community would be a non-coercive way to support more structured collaboration among GIS users.

Data Review and Distribution Mechanisms.
The most common difficulty among survey respondents involved difficulties pertaining to data: access, evaluation, management, documentation and development. Efforts to address these challenges will require a combination of effective training and improvement in data accessibility. Data problems can be addressed at two ends of the spectrum: on the production or supply side where standards, formats and data structures pose a range of arcane and daunting problems. And on the user or demand side, where most conservation groups express frustration at trying to obtain and manage data for their purposes.

A frequently voiced suggestion put forward by users with limited experience working with data involves the establishment of a common distribution center where users can check availability and obtain what they need. Unfortunately the experience of similar initiatives in various areas of the United States suggests the futility of a strictly "supply side" approach. GIS use among conservation groups is extremely dynamic. New data appears, someone uses it to in turn produce more data, and all the while more and more organizations are customizing and updating these resources to meet their needs. Creating a singular clearinghouse to track, review and distribute data – as several respondents suggested – would be a tempting but futile and in some instances, redundant response.

However, despite the deployment of federally sponsored data clearinghouse initiatives, local environmental groups are still struggling to acquire and make effective use of data that is freely available. Although some data needs are specific to organizations, the environmental GIS community needs a broad-based initiative to support the development, review and availability of common data resources. Information on the availability,

suitability, and procedures for use of data resources could be developed and delivered via the Internet to environmental organizations employing GIS. Updates in existing data resources and availability of new data could be communicated through web and email forums. These would be useful mechanisms for better organizing access to data, but countering the difficulty groups have ***finding*** data doesn't promise them any assistance in learning how to better ***use*** the data. Data related initiatives must also link back to training programs and should go hand in hand with the development of community user groups.

Strengthening the North West Environmental GIS Community

Survey respondents across all types strongly indicated that communication among regional conservation GIS users is weak. Most expressed support for an event that would create exposure and networking opportunities involving funders, GIS support resources and demonstrations of region specific case studies. While a short term event, such as a conference or symposium, would not
resolve the specific problems that each organization faces, it would bring them together to discuss and inform on common difficulties and shared solutions. This could be best accomplished informally by inviting advanced users to demonstrate and discuss their work and methods in an open "trade show" setting where interested users could gravitate to the issue areas, data sets or groups most relevant to their work. But the agenda should also provide some opportunity to review the principal ideas put forward here: the need to address planning, training and data management for conservation groups seeking GIS and the mechanisms for doing so. It could explore how to initiate community user groups in pilot locations with interested participants at different levels of development.