Noah Horan
Professor Glushko
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Case Study – The National Wildlife Refuge System

Overview.

The National Wildlife Refuge System, as a division of the US Fish and Wildlife Service, is a collection of government-managed lands totaling over 150 million acres within 556 individually bounded refuge areas. In 1997, via the National Wildlife Refuge Improvement Act, the System was issued a legislative mandate to "monitor the status and trends of fish, wildlife, and plants in each refuge." To oversee this process, the Refuge System has established an organization called the Natural Resource Program Center, which will gather and arrange relevant decision-making information across the various geographies, expertise areas, and organizational hierarchies that are relevant to the Refuge System.

In the course of designing and implementing this system, dubbed the Inventory and Monitoring (I&M) intitiative, the Program Center's key decisions will involve tradeoffs regarding the usability of widely varying information types to widely varying stakeholders; in terms of the Discipline of Organizing, interactions and the value of knowledge management are central to this case.

The accompanying map illustrates the relevant physical resources, the digital resources that describe those physical resources, and the various internal and external stakeholders, as well as their roles in creating, manipulating, and organizing resources within the system.

What is being organized?

In the broadest sense, the Inventory and Monitoring initative seeks to organize the vast breadth of all physical resources contained within the refuges themselves – trees, plants, rivers, streams, rocks, air, and wildlife. Of course, no institution is capable of actually applying intentional arrangement directly to nature on such a large scale, but the I&M will be responsible for the information that most accurately symbolizes the scope of these physical resources. For instance, the Water Resource Inventory and Assessment (WRIA) effort is comprised of an information-gathering web application and a central database for documents, including Geographic Information Systems (GIS) data, water property rights, scientific water quality assessments, water management strategy and planning documents, and research forecasts for water quality threats from climate change or other factors.

Just as it must organize legal, scientific, geospatial, and strategic documents for water quality, the I&M also does so for its wildlife, plant, air, and geological resources. Documents may take the form of tabular/spreadsheet data models, GIS maps, narrative textual policy recommendations, transactional records of property ownership, and so on.

Finally, the I&M system encompasses metadata about information gathered in the various field offices of the Refuge System – it refers to this as the "how, why, what, when and where of refuge's inventory and monitoring surveys." This survey metadata is stored in a separate information module called PRIMR.

Why is it being organized?

We know that in part, the Refuge System has a legislative impetus to gather and arrange these resources. But what are the underlying benefits to be gained? The most compelling reasons are the

same that a business in the private sector hopes to capture by applying knowledge management systems. The I&M system supports traceability for decision-makers, which is very important for justifying strategy. If an upper-level manager in land purchasing, for instance, decides to move forward with a large scale annexation to the Blackwater National Wildlife Refuge in Cambridge, MD, she's going to need all the data she can get about the vulnerability of tributary water quality to increasing tidal variance to justify the decision internally, and she'll need all the deeds and bureaucratic documentation in order to move forward from a legal perspective.With her organization's documented planning statements to pursue science-driven acquisitions where data supports a material increase in water quality on some metric via some model, she simply matches the instances that document that increase, and her decision is now traceable to the explicit mission.

Of course, having all this data in centralized and cross-searchable databases also stands to facilitate collaboration between and within sub-organizations where otherwise there would have been none. Increased opportunities for collaboration introduce increased opportunities for value creation, and ideally, better solutions. For instance, perhaps a routine forestry survey has just been conducted at Seatuck Refuge and added to the ServCat database from the office in Shirley, NY. The scientists who created the survey discovered anomalous findings in many pine forests, but don't have anything to act on. When an entomologist from a Georgia office searching about southern pine beetles discovers the survey, he's able to link it with his own beetle geographical distribution data to conclude that Long Island faces a grave threat from the beetles' encroachment.

How much is it being organized?

Owing to the very broad, heterogeneous scope of users and contributors, the extent of granularity in resource description will be quite variable for the Inventory and Monitoring system. Although the system is guided by some top-level "principles," the organization itself occurs from the bottom up. Individual employees of the Refuge Service are responsible for uploading documents to databases. Even for a consistent resource type – say, a soil composition analysis – one team might upload monthly "snapshot" reports in the Occaquan Bay Refuge, while researchers at the Don Edwards SF Bay Refuge might upload yearlong longitudinal data that reflect weekly changes. Internal contract review lawyers might archive transactional proceedings page by page in PDF format, or in a collated report format that isn't even handled by the same database.

As discussed above, the "Whys?" of the I&M system form the principles that guide employees to make decisions about granularity when contributing. Many of these are codified as mission statements within the Fish and Wildlife program. However, these principles are abstract – they include directives for "science-driven" internal collaboration, or, the assessment of "status and trends of refuge lands, waters, plants and wildlife [to] support conservation objectives at local, regional and national levels." Abstract principles like this do not presuppose a particular implementation for individual employees or teams, and as such, granularity will be far from uniform.

When is it being organized?

Resources are added to the Refuge System's Inventory and Monitoring System as they are submitted by teams or individual employees of any participant organization within the US Fish and Wildlife Service, or by a limited number of external organizations that are granted special access. At this time, the individual or team must make decisions about what database to upload to, what file format to use, and descriptions associated with the resource. This is the primary touch point of resource organization. As discussed above, contributors are guided by mission-based principles, but are not largely subject to explicit and detailed rules. Naturally, the documents must fall within the bounds of any legal or ethical framework which might apply – employees could certainly be penalized or

prosecuted for deliberately uploading fraudulent loan documentation, or plagiarised climate research, for example.

There is a secondary touch point for resource organization, however. Databases can be accessed by any federal employees with the corresponding login information, and even members of the public can access large portions of the system. At this point, in the "information retrieval" stage, the resources can be organized again "on the way out," based on user queries.

How or by whom is it being organized?

As already discussed, the resources in the I&M system are contributed chiefly by individuals or teams employed by the US Fish and Wildlife Service. Most organization occurs as a result of their choices at the time of contribution. We can also attribute a portion of the organization to top-down processes – the system's principles were laid out by the librarians, subject matter experts, policy specialists and so on that were tasked to design the Natural Resource Program Center, in response to the 1997 National Wildlife Refuge Improvement Act. In that sense, the legislation itself was also responsible for some organizing decisions. Finally, end users are also organizers of the system via the searches they perform. Imaginable actors responsible for organizing the system therefore include Federal scientists, managers, legal professionals, financial auditors, external contractors, academics, enthusiasts, non-profit organizations, land owners, sportsmen, legislators, voters, and computational processes.

Other considerations.

Outside of the value that stands to be gained from interactions enabled by organizing this system, the Federal government has an interest in archival here – clearly, the system is intended to address issues of information resource lifespan. That is, within the Refuge System, individual field offices often have cabinets upon cabinets of original research, survey data, and legal documentation that currently exist in paper formats. These resources are vulnerable to fire, flood, or other disaster, as well as simple wear and tear, or risk of loss. For purposes of business continuity, and archival for legacy interests, then, conversion of these resources to a digital format is a valuable proposition.