Scoping Document: High Elevation 5-Needle Pine Database in the Crown of the Continent Ecosystem

Prepared for: The Crown Managers Partnership & Crown Adaptation Partnership as requested at "We Need the Needles: Coordinating Action to Conserve 5-Needle Pine Forests in the Crown of the Continent" March 2016 Crown Managers Partnership Annual Forum

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Crown of the Continent 5-Needle Pine Database

The Crown Managers Partnership Landscape Analysis team was asked to prepare a scoping document regarding the future development of a high elevation 5-Needle Pine (5NP) database in the Crown of the Continent Ecosystem (CCE). This document outlines the justification, required setting factors, and suggestions on initial project scope.

In order to come up with a realistic plan for this database project, we consulted with three other 5NP database projects for information on their projects and their thoughts on building a CCE-wide database:

- The National Park Service: Rocky Mountain Inventory and Monitoring Network
- US Forest Service: Hi5 Database (WLIS)
- Greater Yellowstone Coordinating Committee: Whitebark Pine Subcommittee

Summaries of these conversations are included at the end of this document, and we sincerely thank Erin Borgman, Gregg DeNitto, and Ellen Jungck for taking the time to speak with us.

Justification:

At the March 2016 Crown Managers Partnership Annual Forum: "We Need the Needles: Coordinating Action to Conserve 5-Needle Pine Forests in the Crown of the Continent" there was strong consensus that centralized data was a key component in the development, implementation, and long term success in a multi-jurisdictional Crown-wide 5-Needle Pine (5NP) program.

Outcome #3 from this meeting's final report outlines the importance of why such a database is critical:

> "A clear and detailed understanding of where whitebark pine and limber pine occur across the Crown, as well as their condition (tracked through time), is crucial to inform an effective landscape-scale restoration action plan. Currently, this knowledge is fragmented: some jurisdictions have good occurrence and condition data, and some, including private lands, have nearly none at all. Data are better for whitebark, but very limited for low-elevation limber pine. Workshop participants agreed that a CCE-wide common database of stand-level occurrence and condition was necessary to inform a CCE-wide restoration strategy. Participants also expressed a desire for an information hub that could house the following types of information: case studies of restoration successes, failures, effectiveness levels and lessons learned; best management practices for operating in 5NP; standard inventory and mapping protocols; and results of CCE-wide mapping products. Participants also discussed the importance of expanding the footprint of long-term monitoring across the landscape, and to focus on the collection of absence data. "
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> (Nelson, 2016 p. 30 - See full report: http://crownmanagers.org/2016-forum/)

Required Setting Factors:

There are a number of different ways to undertake this project. After speaking with the other 5NP database projects, and considering the magnitude of this project, we have outlined five setting factors that should be in place before any work on actual database building can occur. These setting factors will ultimately determine how the project should proceed, and beginning without any one of these factors in place would likely lead to wasted time, effort, and resources.

1. **Leadership:** A central leader is required for this project to champion the work and facilitate cooperation among the vast number of collaborators. Someone from one of the partner agencies who has permanent position and capacity to do the work would be the most ideal in this position. An additional consideration here is having the leadership position be one of the major data-holding entities with management mandates specific to the 5 needle or WBP. Examples of some of the partner agencies in the CMP which may have individuals that could provide leadership to this project are:
    - Parks Canada
    - National Parks Service
    - Alberta Environment and Parks
    - US Forest Service
    - British Columbia Ministry of Forests, Lands and Natural Resources
    - Montana Department of Natural Resources and Conservations
    - Confederated Salish and Kootenai Tribes
    - Blackfeet Nation
    - Ktunaxa Nation
    - Kainai Nation
    - British Columbia Parks

2. **Data sharing agreements or Memorandum of Understanding:** A DSA or MOU between all the collaborators is needed to ensure that data sharing can be seamless. An MOU or DSA should explicitly outline how agency information can be collected, stored, shared, what can be done with the data, and who has permission to do all of these things. All agencies should strive to be at the same level so that the database can operate seamlessly without holes due to permission levels.

3. **Users' Needs Assessment:** Explicit understanding of the type of data, attributes of the data, and the type of questions that this database should be able to answer is needed. Without a clear understanding of the "job" of the database we risk setting it up in ways that limit our ability to query it in the future. A thorough user needs assessment should be conducted to ensure that all users, collaborators, and stakeholders are in agreement about the project's purpose, goals, and outcomes.

4. **Funding**:
    - **Funding for Staff:** This project is likely to take at least two years. The Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee undertook a similar exercise in their landscape and it took 2 years to gather, cross-walk, and develop their database. The collaborators in this CCE-wide project should anticipate that this effort will take at least the same amount of time especially given the transboundary nature of the project.

- **Funding for Technology:** There will likely be both one time and ongoing costs associated with this project. Those costs may be associated with software, data storage, and long term maintenance. These costs will depend on which agency takes on this database project in the short and long term.

  Other database efforts such as the Forest Service Hi-5 Database have hit major roadblocks or stalled when funding for the project was not in place. Before embarking on the database creation, funding for a minimum of two years should be guaranteed to give this project a strong chance of success.

5. **Long-term maintenance and storage:** The long term home and plan for storage and maintenance needs to be decided before the actual creation of the database begins. Conservation and restoration of 5NP in the CCE is a long term program, and the work done in this database project is designed to support that program, and a plan for the long term success of this database project needs to be developed.

When these setting factors are in place, the scope, methods, and timeframe for the actual construction and implementation of the database will be clearer.

Initial Recommendations and Scope

Based on discussions at the CMP's March 2016 Fernie conference, feedback from similar projects the following is an initial description of a possible multi-phased approach to a crown-wide database. It is critical to note, however, that completing the setting factors (especially the users' needs assessment) may drastically alter this initial plan.

Current Users' Stated Desires:

Based on the conversations at the CMP's annual forum in Fernie, there is a desire for a Crown-Wide database to be able to house the following types of information:

- Existing and future inventory data
- Existing and future monitoring data
- Restoration project information (location, success/failure, lessons learned)
- Management plans (ex: fire management) and any reports on these plans
- Standard inventory and mapping protocols
- Standard monitoring protocols
- CCE-wide mapping products (web mapping)
- Citizen science (citizen data collection and input)

There was also a lot of discussion about being able to access the database easily so that information could be uploaded or downloaded as required.

Project Phase Recommendations

Meeting the current users' needs and desires as outlined above is a massive undertaking. As such, we suggest that a phased approach would be the best option, starting with meeting the most critical needs, but setting up systems in such a way that does not limit future phases.

Phase 1 recommendations:

The outcome of the first phase of this project is to produce a seamless transboundary spatially explicit database with the following types of data:

- Current inventory and monitoring data describing the location and condition of 5NP trees and stands
- Information about current restoration projects: successes, failures, lessons learned
- Information about current management plans (ex: fire management) and any reports on these plans

Phase 2 Recommendations

The outcomes of the second phase are easy data accesses and sharing procedures that enable the collaborative functions of the database:

- Develop user input functionality for the input and updating of inventory and monitoring data, management, and restoration plans
- Develop a web-mapping interface
- Develop a web querying functionality so that users can access the data types they need
- Develop or adopt standard inventory, monitoring, and mapping protocols for the ongoing collection of data which meets the needs to all involved agencies.

Phase 3 Recommendations:

The outcomes of phase 3 are to engage the public in the CCE in the conservation and restoration of 5NP by:

- Develop public input functionality (citizen science) and engage the public in the ongoing efforts

Information from similar projects:

A number of organizations have undertaken they task of building 5NP databases from multiple datasets. To get a realistic understanding of the process, hurdles and recommendations, we spoke to individuals from three different groups to get their thoughts on building multijurisdictional 5NP databases.

The National Park Service Rocky Mountain Inventory and Monitoring Network

The Rocky Mountain Inventory and Monitoring Network (ROMN) recently completed a database of existing 5NP data in their network. They contracted out the building of their database as they did not have expertise in house. Thank you to Erin Borgman for sharing her thoughts on this project.

Geographic Scope	National Parks and some Forest Service areas within ROMN (Montana and Colorado) with 5NP
Time Frame:	January 2015 to June 2016 (not completed as a full time project)
Staff:	Contracted the database creation out as there was no capacity and expertise in-house
Number of input data sets or data structures:	5 different data structures
Final Database format:	SQL database
Intention for database:	share the information with their network and be able to update the database over time
Final database: strengths and weaknesses	**Strengths:** • The project is complete. • They are able to query the database through pre-made SQL scripts. • They have developed a common data collection structure for future data collection. **Weaknesses:** • The database is not user friendly as it was built in SQL. • It difficult to share data, and data will likely be shared as summary spreadsheets. • There is no user interface. • Updating the database will likely be something they need to continue to contact out for.
Recommendations for a Crown-wide database:	Keep it as simple as possible to meet the needs of the group to avoid increasing time and expense.

Hi5 Database (US Forest Service)

The Hi5 database is an ongoing project by the USFS. The Hi5DB started in the early 2000 with the creation of WLIS (Whitebark-Limber Pine Information System). The initial database was created in approximately 2 years. The current Hi5DB efforts began in 2010 or 2011 when the technological limitations of the WLIS database were beginning to render it unusable (for example, it was not compatible with Windows 7, nor was it online). Thank you to Gregg DeNitto for sharing his thoughts on this project.

Geographic Scope	Full range of high elevation 5NP
Time Frame:	The initial estimated time for completion of the new Hi5DB was 12 to 18 months because it was to be based off of the WLIS database. However to date, the Hi5DB is incomplete. A number of different road blocks including funding, and personnel changes has stopped the project. There is hope that work will be picked up in 2017.
Staff:	Done through USFS contractors in Fort Collins. Not done as full time work.
Number of input data sets or data structures:	Datasets for the new Hi5DB will initially be from the WLIS database. No crosswalking has to be done as it was completed previously (or user inputted into WLIS). All new data will be crosswalked by the users to match Hi5 database as they are inputted.
Final Database format:	Will likely be excel
Intention for database:	• The HI5DB is designed to be a range wide database on the presence and health of all high elevation 5NP trees. • Understand distribution of high elevation 5NP range wide • Provide Fish and Wildlife with information on overall occurrence for petitioning for listing • Trend monitoring: WPBR, other agents such as MPB, mortality • Regeneration data • Ability to Query the database • Ability to do web mapping
Final database: strengths and weaknesses	**Strengths:** • General acceptance – at the time WLIS was the only centralized database • Broadly based – covers the full range of high elevation 5NP • Relatively easy to use (WLIS was, and the intention is that the new Hi5DB will also be) **Weaknesses:** • Users need to manipulate their data to input it – they have created an interface to try to make it easier, but acknowledge that if it is too hard for the user to use they won't do it. • Getting the data: getting people to share their data can be very difficult. Will have to do a lot of marketing when complete

	• Some organizations or individuals did not want to share their exact location data, so the locations were fuzzed randomly within 1mile of their original location. No sensitivity testing has been done on the impacts to different types of analysis.
Recommendations for a Crown-wide database:	• It would be a good idea to see what other projects have done and find out what we can borrow from (ex: GYCC). • There may be an opportunity to collaborate with the Hi5DB moving forward. • Some individuals or organizations may not want to share their exact location data. Need to have a plan for these datasets. • Need to minimize the impact to the audience for inputting data. They may start, but if they find that the process will take a long time they may abandon their efforts.

Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee

The database developed by the Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee has been a central component to the creation of their strategic and adaptive action plan. Thank you to Ellen Jungck for taking the time to walk me through her thoughts on their process and product.

Geographic Scope	National Park Service , US Forest Service, and Bureau of Land management partners in the Greater Yellowstone area: Yellowstone, Grand Teton, Beaverhead-Deerlodge, Bridger-Teton, Caribou-Targhee, Custer, Gallatin, Shoshone
Time Frame:	The initial GYCC database took 1.5-2 years to assemble. The most time consuming part of the job was to crosswalk the datasets provided by the various agencies.
Staff:	One GIS person in Grand Teton National Park
Number of input data sets or data structures:	The database was built from data from five different US federal agencies: 3 regions of the Forest Service and 2 National Parks. The BLM data in the region still needs to be formatted for inclusion. These datasets were not specific presence/absence locations, but rather vegetation maps created by those agencies which needed to be converted into a standard format. Mortality detection data was also included from three different sources: Forest health protection data (aerial detection), R-SAC satellite imagery (trained on ground trothed data), and GYA low level flights. Ecological data (e.g. Grizzly Bear critical habitat) and land status (e.g. wilderness areas) were also included.
Final Database format:	Geodatabase

Intention for database:	• Developing a prioritization system for restoration and management. • Information to be used in the development of high-level strategic plans and mid-level management plans for restoration and management
Final database: strengths and weaknesses	**Strengths:** • Has helped to prioritize where they needed to be on the ground • Big driver of both the strategic and mid-level plans • Aids in petitioning for funding **Weaknesses:** • Not much of the database is built from ground-truthed data, instead it was built from vegetation models developed by the collaborating agencies.
Recommendations for a Crown-wide database:	Setting up the criteria for the database was a lot of work (the attributes for the input data), but was vital to the success of the project. The GYCC focused on the simplest data possible to look at ecological viability: Pure or dominant stands (different ecological value), tree diameter (cone production), and a measure of crown density. *Recommendation*: carefully consider what data and data attributes are needed in the database. A second round of database development is now underway: updating inventory data (current data is 10 years old) and adding monitoring data and information on how management is going. *Recommendation*: consider how the database will be used in the future and set it up initially to support these future uses. Sharing data between agencies is very tough. Even just sharing documents can be difficult, never mind an actual database. *Recommendation:* Determining how data can be shared among partners is one of the most important factors. Users need to be able to access and input data easily with some measure of data security.

Potential for Collaboration or Partnership:

One thing that the planning committee should consider is whether it would be appropriate to partner with another similar effort (i.e. the Hi5DB) either by pooling resources, following similar methods, or using the same contractors or staff to build the database. This could potentially reduce the amount of resources the Crown-wide effort needs to get the project started, and would allow for additional collaboration outside of the Crown boundaries. The biggest caveat to a potential partnership, of course, to ensure that we are still able to meet the needs discovered in the users' needs assessment.

Conclusions:

A Crown-wide 5NP database could be an important cornerstone in the collaborative restoration and management efforts of 5NP in the CCE. However, it is important that we do not underestimate the amount of effort and forethought needed to build a useful end product. Based on conversations with similar efforts, we strongly recommend that these five setting factors be in place before any work on a database commences:

1. **Leadership** for the project.
2. **Data sharing agreements** or **Memorandums of Understanding** for the sharing of 5NP data between partner organizations.
3. **Users' needs assessment** to ensure that the database will be able to answer the types of questions and provide the type of information required by managers.
4. **Funding:** for staff to build and implement the database, and for technology to develop and maintain the project long term.
5. **A long term maintenance and storage plan**, because the conservation and restoration of threatened high elevation 5NP is a long term project, and the database should be set up to support it.

Having these factors in place will go a long way to ensuring the long term success of this database.