

## Ucross Arboretum Siting Proposal





## Table of Contents

Introduction.....	3
Project Goals and Objectives .....	4
Description of Proposed Arboretums.....	6
Coal Creek Arboretum .....	9
Coal Creek Reservoir Arboretum.....	14
Finger Lakes Arboretum .....	20
Burma Bell Arboretum.....	25
Further Considerations.....	30
Arboretum Growth and Canopy Cover .....	30
Trail Networks .....	30
Native Plant Nursery .....	32
Rangeland Education .....	33
Concluding Remarks.....	33



## *Introduction*

---



At the request of Raymond Plank, founder of Apache Corporation and the Ucross Foundation, the Ucross High Plains Stewardship Initiative (UHPSI) team has continued to evaluate possible locations and particular details for establishing an arboretum / interpretive botanical learning center on the Ucross Ranch. The team has explored various locations and logistical scenarios for embracing this new facility and would like to present four possibilities that will provide stakeholders with a sense for the broader project concept and generate preliminary responses from the Ucross community.

This description by no means represents a finalized blueprint for the project. Rather, this document seeks to highlight the underlying goals espoused by Raymond Plank as well as the UHPSI team's current recommendations on how to accomplish these goals with the greatest success ecologically, socially, and financially (i.e. the "triple bottom line" of sustainability). Maps, documentation, and budgeting should all be interpreted as working drafts to aid in the process of selecting an arboretum location. While we have paid much attention to detail on these items, our mapping and analysis is most useful for overall site selection, rather than as detailed landscape design plans or a comprehensive final budget.

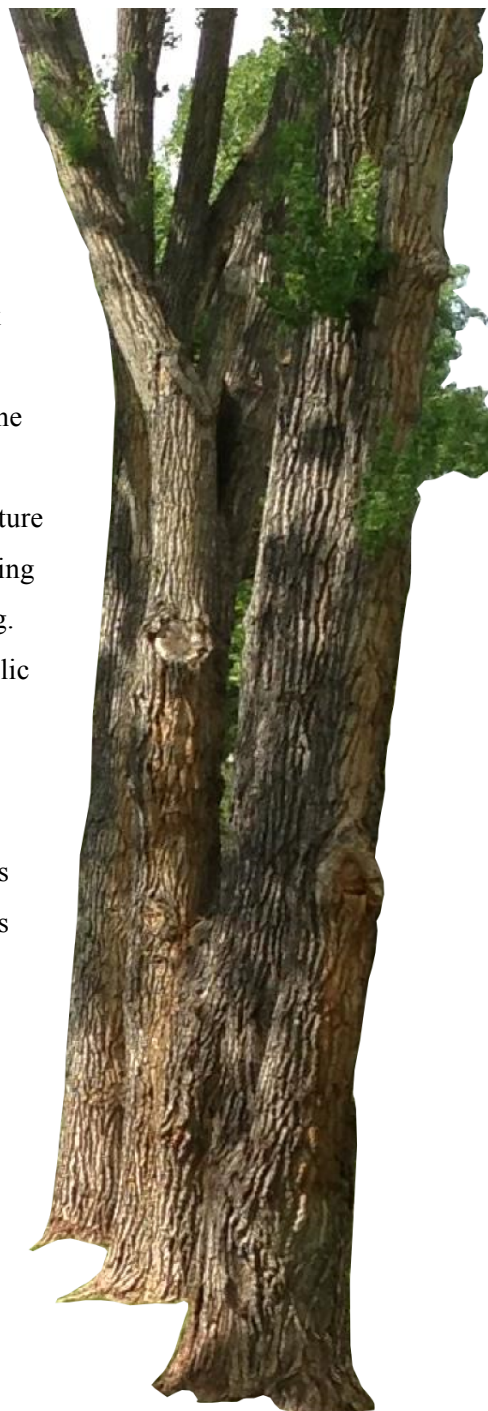
This report is broken up into the following three parts: a) the Ucross Arboretum Siting Proposal (this written document), outlining project goals and objectives, and descriptions of the four potential arboretum locations; b) a dynamic excel-based budget, allowing users to manipulate parameters and inputs for each of the four potential arboretum sites; and c) a high resolution map-book, including overview maps, arboretum plans, and rough planting outlines.

## ***Project Goals and Objectives***

---

The overarching goal per direct discussion with Raymond Plank is to construct an outdoor presentation area that showcases the natural beauty of Ucross with an emphasis on the trees and vegetation native to the High Plains of Wyoming. This area should also fulfill the following objectives:

- **Access to the arboretum - private and public**
  - Accessibility to the artists-in-residence and the Ucross Foundation staff — the arboretum should be located such that it maintains walking / “on foot” connectivity with the Big Red Art Gallery and Foundation offices, the artist residences at the Depot, and the Raymond Plank Creative Center.
  - Potential for access by visitors from outside of the Ucross community — the accessibility of the arboretum should allow for immediate and/or future enjoyment by visitors to the Ucross ranch. Parking or walking trails from existing infrastructure (e.g. Big Red) will be necessary to accommodate public use of the arboretum.
- **Connectivity with Ucross facilities**
  - The arboretum project should link the various facilities and individuals connected to the Ucross Foundation in its conceptual development and its implementation / location.
  - Access from Big Red, Raymond Plank Creative Center, Artist Residences at the Depot, and perhaps Shady Lane.
- **Education and Outreach**
  - The arboretum should maintain a pedagogical dimension (with an emphasis on ecology and land stewardship) in its construction, such that





visitors of all ages can walk away with a better knowledge of the ranch in particular, and of the High Plains more generally.

- Interpretive signage and kiosks will help illustrate important pieces of natural history and land stewardship.
- Digital applications for smart phones or tablets can be customized to provide users an interactive experience while walking through the arboretum. Users could also add their own content through the application (photos, writing, etc.)

- **Long-term Sustainability**

- The arboretum should be constructed in such a way that its “lifetime” reaches into the future.
- A planting scheme with multiple generations of trees/plants should be implemented.
- Budgeting the maintenance costs required for upkeep, e.g. re-planting, watering, arborist work, landscaping, trail maintenance, etc.
- Modelling the hydrological needs of the long-term vegetative growth.
- Designing a native plant nursery, either on-site or off-site, to support the arboretum, and to grow woody vegetation for draws and landscaping projects around the Ucross Ranch.

- **Aesthetics**

- The arboretum should maintain an attractive aesthetic that matches the artistic mission of the Ucross foundation while embracing the personality of Wyoming’s High Plains.
- Design should embrace a mixture of plentiful shade and open space.
- Siting should potentially be near water.

- **Recreation**

- The arboretum should include infrastructure / areas that allow visitors to enjoy extended periods of time for meditation, reflection, and relaxation.

- **Carbon Storage**

- The arboretum should harness the ability of trees / woody vegetation to sequester carbon.
- Infrastructure (benches, signage, etc.) should be constructed with wood wherever possible, with this sequestration objective in mind.

- **Budget**

- With a fixed budget, attempts should be made to utilize existing resources to minimize up front expenditures.
- This will also help ensure continuous funding of maintenance and upkeep.

## *Description of Proposed Arboretums*

---

Arboretums and botanical gardens are traditionally populated with trees, shrubs, and other exemplary herbaceous growth. The Ucross Foundation has maintained a longstanding planting initiative, and the arboretum project should work in synergy with this ongoing work (i.e. to utilize existing expertise and resources) rather than attempting something entirely new and disconnected. The ideas we present here are to develop a cohesive outdoor trail, planting, and grove network that is populated with exceptional examples of native vegetation. Please keep in mind that these are the first draft in an iterative, design-intensive process of planting plans, trail layout, and budgeting.

Once an arboretum location has been selected (guided by the findings of this report), we will begin the process of designing the arboretum layout itself. This will involve more detailed research, viability analyses, and budgeting for individual tree, shrub, and grass species. Additionally, we will put together a review of existing arboretums/botanical gardens in the



**Figure 1** – High Plains Arboretum at the Cheyenne Botanical Gardens. [www.botanic.org/discover/high-plains-arboretum](http://www.botanic.org/discover/high-plains-arboretum)

West and the greater continental United States – this will ideally help guide and inform our design and decision making processes. We will likely collaborate with landscape architects at Yale University and in Wyoming in an effort to make the arboretum fit the existing landscape as closely as possible.

UHPSI has identified **four** potential locations for **arboretums** on the Ucross property (Figure 2). These locations have been selected for their: a) proximity to Big Red, Raymond Plank Center, and the artist residences at the Depot, b) proximity to existing water sources, c) location on state-owned land, and d) existing vegetative cover and/or infrastructure. Additionally, we have proposed a **rangeland education area**, and a **nursery** for the propagation and growth of native plants – including grasses, shrubs, and trees.

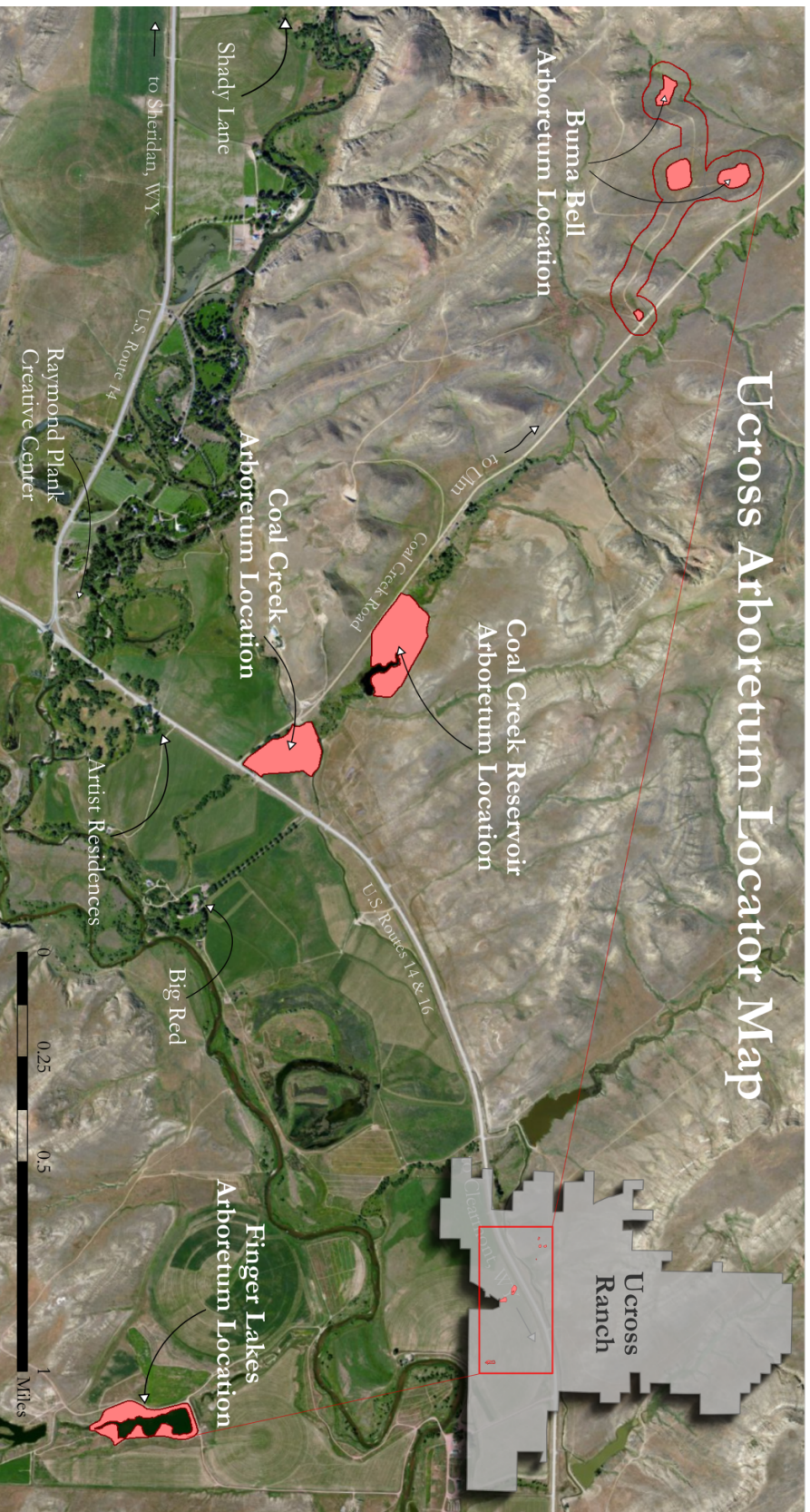
1. The proposed Burma Bell Arboretum (BBA) is on state-owned land adjacent to a set of old coal-bed methane wells, which never produced methane, yet exposed a significant water source. This



site is tucked up in the hills in a beautiful location, but is quite a good ways up Coal Creek Road from Big Red.

2. The proposed Coal Creek Reservoir Arboretum (CCRA) is also on state-owned land quite close to Big Red, and adjacent to a small reservoir on Coal Creek.
3. The proposed Finger Lakes Reservoir Arboretum (FLRA) is located around one of the large bentonite-lined ponds south of the Bird Farm. With abundant water availability, broad views of the ranch and the Bighorns, and some existing infrastructure, this is a beautiful spot. However, it is the furthest proposed arboretum location from the center of Ucross, and involves a crossing of Clear Creek.
4. The Coal Creek Arboretum (CCA) is located just across from the Big Red driveway in an existing grove of cottonwoods. An irrigation ditch flows to the north of the site, with abundant, available water. With existing vegetation and infrastructure, and close proximity to buildings of interest, the Coal Creek Arboretum seems to meet most criteria on the UHPSI checklist.
5. The proposed rangeland education area should be located adjacent to selected arboretum site. This would allow a visitor the understanding of ecological restoration/reclamation at Ucross through the arboretum, while providing the context that Ucross is a large-scale working cattle operation. This would allow Ucross to highlight its award winning holistic range management practices through yet another venue.
6. We have yet to determine the precise location of the native plant nursery, largely because it should be closely tied to the site of the arboretum. Because of the educational value of a native plant nursery in telling a story about ecological reclamation and restoration, it would be ideal to incorporate it into any potential arboretum site. Alternatively, this could be located near an existing Ucross facility (e.g. Big Red, the RPCC, or the Ucross barn near the silo) to leverage infrastructure (e.g. water, tools, manpower)

Each of these four arboretum locations have been evaluated below on how well they meet the eight objectives identified by UHPSI and Raymond Plank. The following section will focus on each potential arboretum site, walking through its success in completing project goals. Visual aids have been included below.



**Figure 2** – Locations of four proposed arboretum locations at Ucross – Clearmont, WY.



## *Coal Creek Arboretum*

---

The Coal Creek Arboretum is located just across from the Big Red driveway in an existing grove of cottonwoods. This is a prime site, with plentiful shade, a seasonal stream (Coal Creek), wetland vegetation, existing infrastructure (e.g. parking area, fencing), and close proximity to Ucross Foundation buildings and residences. As the most heavily vegetated of the four proposed locations, the Coal Creek site has a jump start on developing into a mature arboretum – it would take between 25 and 45 years for plantings at the other three locations to grow to the level of canopy cover currently seen at Coal Creek.

An irrigation ditch flows to the north of the site, with abundant, available water. Additionally, there is a pre-existing well on the western side of the proposed arboretum site, lending an alternative water source if permitting from the Clear Creek Ditch proves difficult. While the Coal Creek site is located near a major road, a densely planted row of trees would be sufficient to block the majority of vehicular noise.

---



- *Access to the arboretum - private and public:*
  - This is the closest of the four proposed locations. Big Red is 0.7 miles away, the Raymond Plank Creative Center is 0.7 miles away, and the artist residences at the Depot are 0.4 miles away.
  - An amply sized parking area already exists within the proposed arboretum area. This minimizes start-up construction costs, while allowing continuing access for visitors from the Ucross community and beyond.
- *Connectivity with Ucross facilities*
  - Simple signage or a crosswalk across State Route 14/16 would link this arboretum to Big Red facilities. Through an agreement with Mike and Lynne Latham, artists can already walk from their residences to Big Red, making this a simple linkup.
  - Since any trail-building between the RPCC and the proposed Arboretum would have to cross private land, connectivity here becomes much more difficult. Should this site be selected, any trail work will require careful collaboration with local property owners.
  - Since artists regularly ride their cruiser bikes along State Route 14/16, the parking area by this proposed arboretum would be easily accessible

- *Education and Outreach*

- The parking area within the proposed arboretum is a perfect location for an interpretive kiosk. This can inform visitors about the purposes and uses of the arboretum, in addition to placing the arboretum in the



**Figure 3** - Photo highlighting existing mature trees at the Coal Creek Arboretum Location. Source: Google Street View

context of land stewardship on the greater High Plains

- Interpretive signage will be placed at critical locations throughout the arboretum, highlighting important trees, vegetation, and other natural features
- Coal Creek, which runs through the arboretum, will help to exemplify the value of seasonal streams and wetlands in ecosystem health and function.
- *Long-term Sustainability*
  - The Coal Creek site provides an ideal location for a sustainable, ecologically sound arboretum.
  - Has clearly demonstrated its capacity for growing big, beautiful trees.

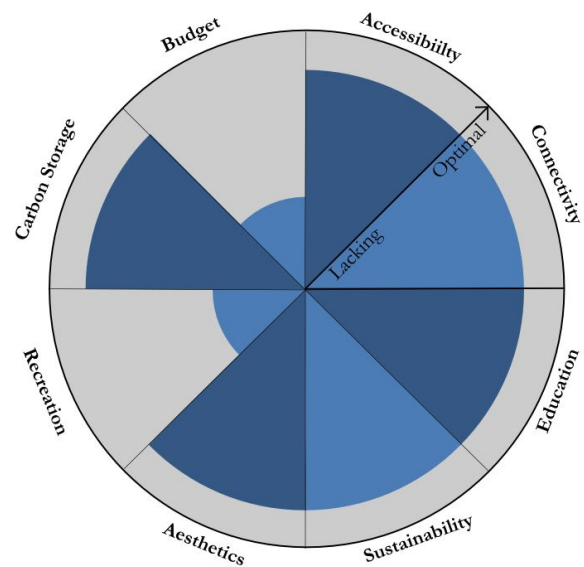


- From the start will be a mixed-age, mixed-species arboretum, with mature, young, and brand new trees.
- Well-developed soils exist, ensuring long term tree health and stability.
- *Aesthetics*
  - As is, the Coal Creek location is a beautiful spot, with lush vegetation and many mature cottonwoods. Tree canopy cover is currently at 36% of the total area.
  - Tree planting will enhance existing canopy cover, ideally raising cover to over 50%.
  - A native shrub/grass area will provide a contemplative retreat area in the north section of the arboretum.
  - The northern part of the arboretum would have northeastern views towards the rolling hills in the Lower Coal Creek pasture
- *Recreation*
  - This proposal includes walking trails, numerous benches, and picnic tables for the enjoyment of visitors.
  - Existing mature shade trees, new plantings, and the native grass/shrub garden will all present opportunities for quiet reflection, relaxation, and socialization.
- *Carbon Storage*
  - Currently, this location exhibits a high degree of carbon storage in tree, shrub, and soil realms.
  - By improving the quality and health of existing trees, and by planting hundreds of new trees, this arboretum location could sequester an average of 24.5 tons of carbon per year for the first thirty years (this estimate does not include carbon sequestered in shrubs and perennial grasses)..
- *Budget*
  - Of the four proposed locations, the budget for this project falls somewhere in the middle.
  - Although there is a large amount of existing canopy cover, there are some large costs associated with cleanup and arborist maintenance.
  - A large number of trees are needed for sound-breaks for traffic noise from 14/16.
  - However, there is an enormous intangible value in having 60 mature trees already on the parcel. If we were to purchase 60 mature trees for another arboretum site, the costs would be astronomical.
  - Three main budgeting phases of the project
    - Year one includes construction costs and one year of maintenance.
      - Total construction and maintenance costs after year 1 - \$45,561

- Cost per acre after year 1 – \$4,831
- Years one through five add on yearly maintenance costs which include an intensive watering and tree pruning operation.
  - Total construction and maintenance costs through year 5 - \$70,476
  - Cost per acre after year 5 - \$7,473
- Years five through ten will add on yearly maintenance costs less than the previous five years. As trees need less water and pruning, costs will drop.
  - Total construction and maintenance costs through year 10 - \$84,042
  - Cost per acre after year 10 - \$8,912

● **Major Benefits**

- The existing canopy of mature trees means this location will feel more forested than others.
  - It will take the other three locations between **40 and 45 years** to reach the same canopy cover **currently** seen at the Coal Creek Arboretum.
- As the closest location to existing Ucross facilities, access to this arboretum location would be simple, with little investment in new infrastructure.
- Abundant water exists in the Clear Creek ditch to the north of the arboretum and at an existing water well on the property. The choice of water sources will be dependent on permitting costs with the state/regional water bureau.



● **Major Concerns**

- Proximity to major roads
  - This will be mitigated by a dense row planting of trees to serve as a sound-break from the road noise on State Route 14/16.
- Terms of The Nature Conservancy Easement
  - Plantings will be restricted to Wyoming native plants, with stress put on native plants of the high plains.



- Careful coordination with TNC will be required to ensure the terms of the easement are met during construction and planting, and to allow ongoing monitoring on the arboretum property.
- Trail construction will be subject to TNC's easement terms, and may not be possible. Ucross/Apache have encountered issues with trail construction on TNC eased lands in the past.
- Clean up of the area in preparation for planting may be costly
  - Labor required by Ucross staff clearing brush, deconstructing old buildings, etc.
  - May require arborists to clean existing trees and make them safe for an arboretum setting.

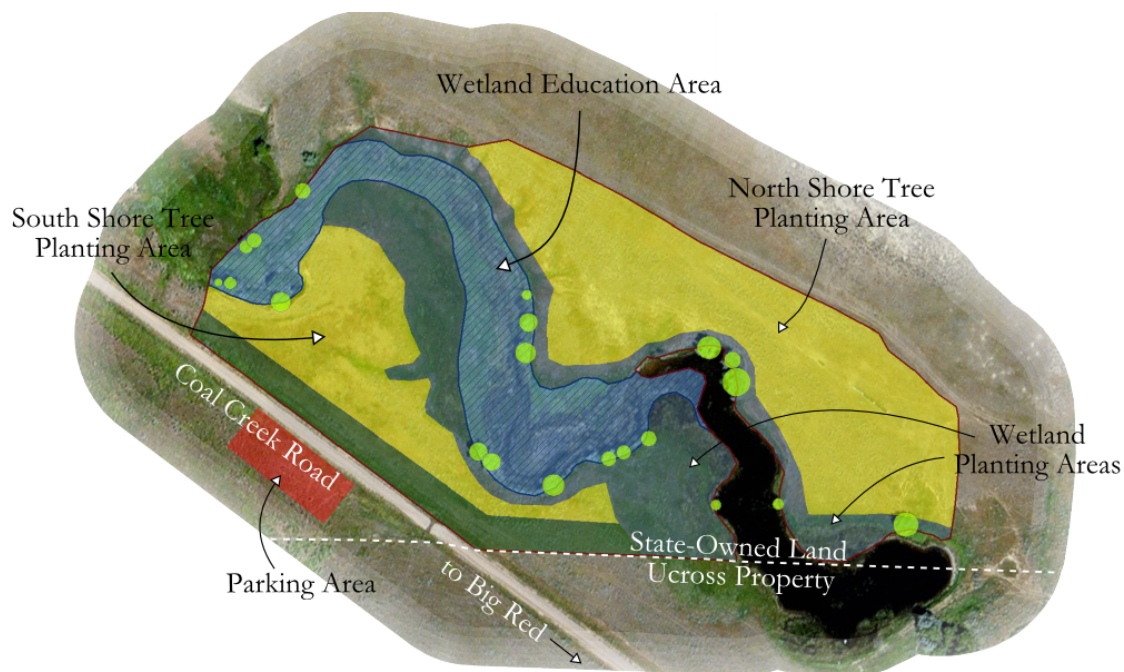
## *Coal Creek Reservoir Arboretum*

---

The Coal Creek Reservoir (CCR) proposed arboretum site lies on the border of Ucross property and state-owned land, along Coal Creek Road, roughly one kilometer from its junction with Routes 14/16. This location borders a small reservoir, with seasonally variable water levels. A handful of trees and smaller woody vegetation borders Coal Creek and the reservoir. Roughly one third of the arboretum site is currently covered with thick, wetland grasses, sedges, weeds, and small shrubs – the remaining area is currently a mixture of sagebrush, grasses, and barren ground.

Although the CCR site lacks existing infrastructure and is sparsely vegetated with shrubs and trees, it is within easy walking and biking distance of Ucross Foundation facilities, and is proximal to seasonally abundant water from Coal Creek. The siting of the CCR proposal on leased Wyoming State land opens a number of avenues for potential collaboration with various state agencies.

---



- *Access to the arboretum - private and public:*
  - This is the second closest of the four proposed locations. Big Red is 1.1 miles away, the Raymond Plank Creative Center is 1.1 miles away, and the artist residences at the Depot are 0.8 miles away.
  - There is currently no parking at this location. As this proposed arboretum is on state land, the construction of a lot would require collaboration/negotiation with the state engineers' office.
  
- *Connectivity with Ucross facilities*
  - Paired with a 0.4 mile walk down Coal Creek Road, simple signage or a crosswalk across State Route 14/16 would link this arboretum to Big Red facilities. Through an agreement with Mike and Lynne Latham, artists can already walk from their residences to Big Red, making this a long, but simple linkup.
  - Since any trail building between the RPCC and the proposed Arboretum would have to cross private land, connectivity here becomes much more difficult. Again, should this site be selected, any trail work will require careful collaboration with local property owners.
  - Since artists regularly ride their cruiser bikes along State Route 14/16 and occasionally up Coal Creek Road, this would still be an easily accessible location for artists by cycle.
  
- *Education and Outreach*
  - Just within the fenceline of this proposed arboretum would be a perfect location for an interpretive kiosk. This can inform visitors about the purposes and uses of the arboretum, in addition to placing the arboretum in the context of land stewardship on the greater high plains.
  - When visitors exit their cars, or walk/bike down Coal Creek Road, they will be greeted right away by this kiosk, with information, photos, and news.
  - Interpretive signage will be placed at critical locations throughout the arboretum, highlighting important trees, vegetation, and other natural features.
  - Coal Creek, which runs through the middle of the arboretum, will help to exemplify the value of seasonal streams and wetlands in ecosystem health and function.



- Additionally, the small reservoir adjacent to this proposed site can serve as an educational tool for discussing the importance of water availability and storage in arid landscapes.
- *Long-term Sustainability*
  - Coal Creek Reservoir provides an ideal site for a sustainable, ecologically sound arboretum location.
  - Abundant water and existing woody and herbaceous vegetation indicate that this is a fertile, wet location, capable of supporting year-round plant growth.
  - However, the seasonal nature of the reservoir may necessitate the drilling of a water well on site, or diversion of water from the Clear Creek Ditch to the south. More detailed monitoring and analysis will dictate the water requirements for the arboretum and water availability from the reservoir.
  - Without an existing canopy of mature trees, attention must be paid to ensure that the arboretum grows into a diverse area with trees of varying sizes, ages, and ecological function.
    - This can be accomplished with a careful pruning schedule, and a plan for continued plantings throughout the lifetime of the arboretum (starting at year 10)
  - There are clearly well-developed soils, ensuring long term tree health and stability.
- *Aesthetics*
  - As is, the Coal Creek Reservoir is a beautiful spot, with lush vegetation and a handful of mature trees. Tree canopy cover is currently at 2% of the total area.
  - Tree planting will enhance existing canopy cover, ideally raising cover to over 36%.
  - It is anticipated that this level of canopy cover will be reached within 42 growing seasons.
  - A native shrub/grass area will provide a contemplative retreat area in the north section of the arboretum.
  - The northern part of the arboretum would have northeastern views towards the rolling hills in the Lower Coal Creek pasture.

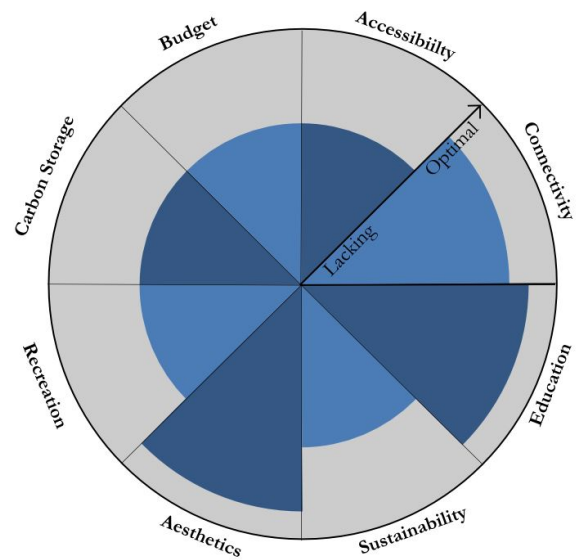


**Figure 4 - *Acer negundo* near Coal Creek Reservoir**

- *Recreation*
  - Situated on the scenic Coal Creek Road, this arboretum can be a starting point for walks, bike rides, and scenic drives through the Ucross Property and towards Ulm, WY.
- *Carbon Storage*
  - Currently, the few trees and woody vegetation on this parcel represent a small amount of above-ground carbon storage.
  - The majority of carbon currently stored in this parcel is underground – i.e. soil and root structures of grasses and wetland vegetation.
  - Tree planting has the potential to sequester and store large amounts of carbon – an average of 18.3 tons of carbon per year for the first thirty years (this estimate does not include carbon sequestered in shrubs and perennial grasses).
- *Budget*
  - Of the four proposed locations the budget for this project falls in the middle.
  - There is little existing vegetative cover (about 20 small trees/shrubs currently), and many trees would need to be planted to enhance canopy cover.
  - However, there is abundant water in the Coal Creek reservoir.
    - Affordability will vary depending on permitting costs and water leasing from the state (not included in the budgeting below).
    - Prices could rapidly skyrocket if a well or ditch diversion is needed for tree watering.
  - Three main budgeting phases of the project
    - Year one includes construction costs and one year of maintenance.
      - Total construction and maintenance costs after year 1 - \$49,578
      - Cost per acre after year 1 - \$3,645
    - Years one through five add on yearly maintenance costs which include an intensive watering and tree pruning operation.
      - Total construction and maintenance costs through year 5 - \$68,299
      - Cost per acre after year 5 - \$5,022
    - Years five through ten will add on yearly maintenance costs less than the previous five years. As trees need less water and pruning, costs will drop.
      - Total construction and maintenance costs through year 10 - \$82,222
      - Cost per acre after year 10 - \$6,045

- **Major Benefits**

- Location on state land opens the possibility for collaboration with state agencies, setting precedent for other stewardship projects in the high plains region.
- Adjacent to a relatively abundant, seasonal water source.
- Beautiful location with panoramic views of the Coal Creek valley.
- Quiet – away from the highway noise in the Clear Creek valley.



- **Major Concerns**

- Proximity to Coal Creek Road – a medium traffic county road
  - This will be mitigated by a dense row planting of trees on the south side of the arboretum to serve as a sound-break from road noise.
- Proximity to Ucross dwellings on Coal Creek Road
  - There are three existing housing units just up the road from this arboretum location.
  - Visitors would only see these dwellings while parking on Coal Creek Road – the homes would be blocked by topography and vegetative cover while in the arboretum proper.
  - Residents of the dwellings would be able to see visitors coming and going. However, residents already deal with visitors to the Teepee Circles, the access to which is significantly closer than the proposed arboretum.
  - Residents would be treated to a beautiful arboretum view as the trees and shrubs mature over the years. However, there may be some noise and visual pollution during the initial construction and planting phases.
  - Communication with residents is of the utmost importance in choosing this location for the arboretum.
- Location on State-Owned Land
  - While this is most likely a benefit due to state buy-in, financial support, and the setting of precedent, there is a chance that siting an arboretum on state land may have negative consequences.



- Potential for extra regulation on planting, construction, and maintenance.
  - Water rights issues – unclear exactly how much water we would be able to acquire from the state/water resources commission, and how much it would cost.
- The lack of existing woody vegetation means that this arboretum location will not feel like a mature wooded site for many years. It will be a number of years until there is even enough shade to really enjoy the space in the summer time.
  - The lack of a guaranteed water source is worrisome to the long-term sustainability and up-front costs associated with this arboretum site.

## *Finger Lakes Arboretum*

---

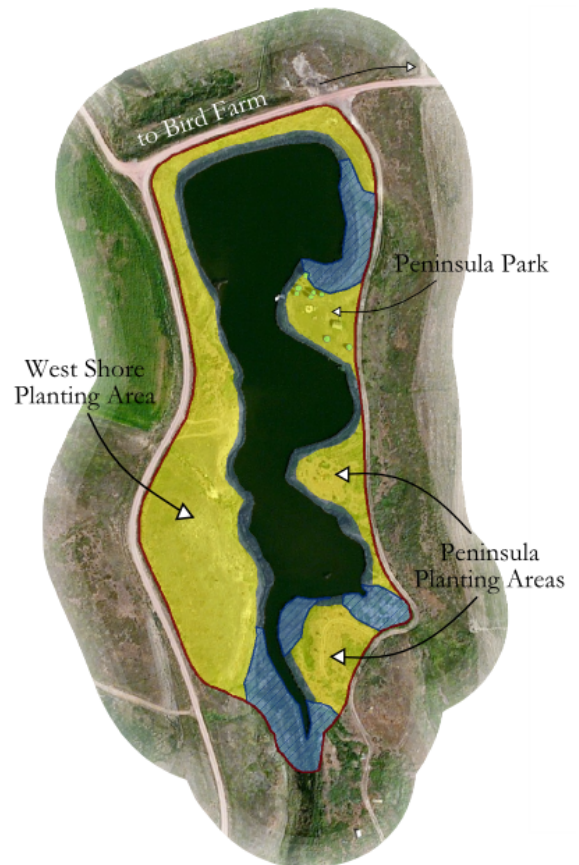
The Finger Lakes Arboretum site is located south of Clear Creek and is tucked up in the southern hills of the Ucross Ranch. This is a beautiful location, with sweeping views of the Clear Creek valley and the Bighorn Mountains to the west. The “Finger Lakes” are a set of reservoirs lined with bentonite, an impermeable mineral, allowing them to hold abundant, clear water throughout the dry summer months on the ranch.

While this area currently does not have an abundance of woody vegetation, the adjacent upper Finger Lake reservoir holds promise for the long-term viability of tree planting in the area. However, the distance from existing Ucross infrastructure, and the proximity of active hunting fields poses significant access issues, especially during the early Fall months when upland bird hunting season is in full swing.

---

- *Access to the arboretum - private and public:*

- This is the furthest away of the four proposed locations. Big Red is 3.0 miles away, the Raymond Plank Creative Center is 3.5 miles away, and the artist residences at the Depot are 3.1 miles away.
  - If visitors were to use existing Ucross two-tracks and dirt roads, the distance from Big Red is only 2.5 miles.
  - If a foot bridge were constructed over Clear Creek (an unlikely outcome), the arboretum would only be a 1.2 mile walk from Big Red.
- Parking for this facility will be logistically difficult. The closest parking is either at Big Red or the Bird Farm. It is unlikely that visitors would be permitted to drive across active Ucross rangelands or close to the bird farm hunt fields.



- *Connectivity with Ucross facilities*
  - This arboretum location would likely only be accessible by foot and bicycle.
  - Because of its distance from existing Ucross facilities, connectivity will be limited. Any visits will therefore need to be very deliberate and require a large time investment.
- *Education and Outreach*
  - The Peninsula Park area within the proposed arboretum is a perfect location for an interpretive kiosk. This can inform visitors about the purposes and uses of the arboretum, in addition to placing the arboretum in the context of land stewardship on the greater high plains.
  - Interpretive signage will be placed at critical locations throughout the arboretum, highlighting important trees, vegetation, and other natural features.
  - The wetland draw running into the southern end of the arboretum will help to exemplify the value of seasonal streams and wetlands in ecosystem health and function.
- *Long-term Sustainability*
  - The abundant, perennial, water of the finger lakes provides long-term assurance of healthy vegetation, and aesthetic beauty.
  - Without an existing canopy of mature trees, attention must be paid to ensure that the arboretum grows into a diverse, healthy stand of trees, with mixed ages and canopy heights.
    - This can be accomplished with a careful pruning schedule, and a plan for continued plantings throughout the lifetime of the arboretum (starting at year 10).
- *Aesthetics*
  - As is, the Finger Lakes are a beautiful location, with lush vegetation lining the ponds, a scattering of woody vegetation, and panoramic views of the Clear Creek valley and the Big Horn Mountains to the west.
  - However, tree canopy cover is currently less than 1% of the total area.



**Figure 5** - Sunrise near the Finger Lakes Arboretum site

- Tree planting will ideally raise tree canopy cover to over 36%.
- It is anticipated that this level of canopy cover will be reached within 46 growing seasons.
- *Recreation*
  - Access to this arboretum would be along scenic roads and paths in the lush, scenic Clear Creek valley. The process of travelling to the arboretum is itself a wonderful recreational experience.
  - However, once at the arboretum site, access further into the ranch property would be difficult.
  - The Peninsula Park provides a lovely site for relaxation and recreation, and would serve as a great picnicking spot, or location from which to launch boats into the lake.
  - During hunting season, access and recreation will be extremely limited.
- *Carbon Storage*
  - Currently, the few trees and woody vegetation on this parcel represent a small amount of above-ground carbon storage.
  - The majority of carbon currently stored in this parcel is underground – i.e. soil and root structures of grasses and wetland vegetation.
  - Tree planting has the potential to sequester and store large of amounts of carbon – an average of 13.1 tons of carbon per year for the first thirty years (this estimate does not include carbon sequestered in shrubs and perennial grasses).
- *Budget*
  - Of the four proposed locations the budget for this project is the least expensive, due largely to its small size in relation to other proposed sites, its abundant water source, and no need for sound-break tree plantings.
  - There is little existing vegetative cover (about 10 small trees/shrubs currently), and many trees will need to be planted to enhance canopy cover.
  - However, there is abundant water in the Finger Lake reservoir.
    - Affordability will vary depending on permitting costs for water withdrawal (not included in the budgeting below).
  - The budget below assumes access will be along existing Ucross roads and two-track. The construction of a footbridge across Clear Creek would significantly increase the budget.
  - Three main budgeting phases of the project.
    - Year one includes construction costs and one year of maintenance.



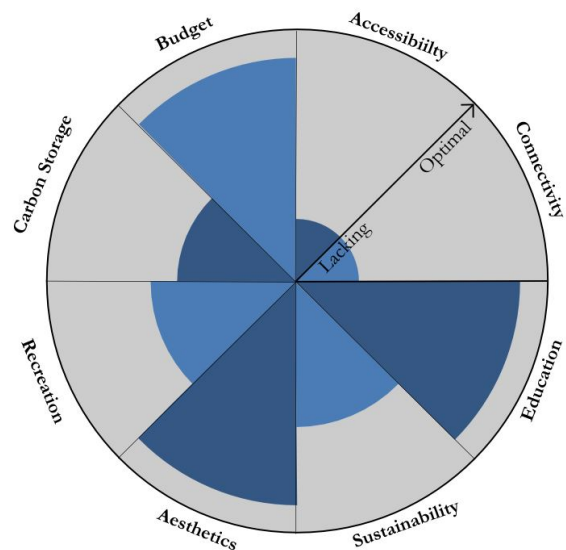
- Total construction and maintenance costs after year 1 - \$35,034
  - Cost per acre after year 1 - \$5,197
- Years one through five tack on yearly maintenance costs which include an intensive watering and tree pruning operation.
  - Total construction and maintenance costs through year 5 - \$52,144
  - Cost per acre after year 5 - \$7,736
- Years five through ten will tack on yearly maintenance costs less than the previous five years. As trees need less water and pruning, costs will drop.
  - Total construction and maintenance costs through year 10 - \$68,961
  - Cost per acre after year 10 - \$9,934

- **Major Benefits**

- Adjacent to an abundant, perennial water source.
  - Beautiful location with panoramic views of the Clear Creek valley.
  - Access would be along scenic roads and two-track.
  - Quiet – away from highway noise on the other side of the valley.

- **Major Concerns**

- The biggest concern with this location is the distance from existing Ucross facilities.
  - If our goal is to promote easy access, education, and an accessible, quiet retreat for artists, this is a major concern.
- The second biggest concern will be with actual access. As any pedestrian or vehicular traffic would cross active rangeland and bird farm hunt fields, this would require some delicate logistics, and careful coordination with ranchers and managers, especially during hunting season.
- The lack of existing woody vegetation means that this arboretum location will not feel like a mature wooded site for many years. It will be a number of years even until there is enough shade to really enjoy the space in the summer time.
- Terms of The Nature Conservancy Easement



- Plantings will be restricted to Wyoming native plants, with stress put on native plants of the high plains.
- Careful coordination with TNC will be required to ensure the terms of the easement are met during construction and planting, and to allow ongoing monitoring on the arboretum property.
- Trail construction will be subject to TNC's easement terms, and may not be possible. Ucross/Apache have encountered issues with trail construction on TNC eased lands in the past.

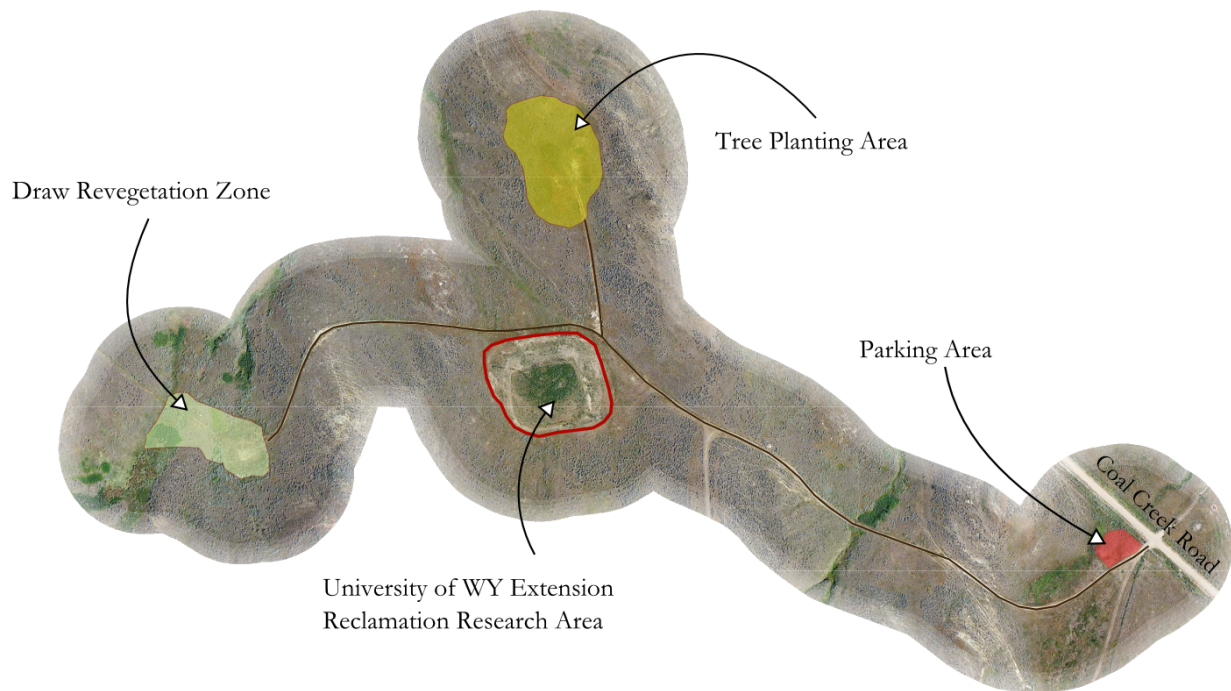
## *Burma Bell Arboretum*

---

The Burma Bell Arboretum site is located 1.4 miles up Coal Creek Road from its intersection with Routes 14/16. Situated a short 0.4 miles up a well-worn two-track road, the proposed location is tucked into a tranquil valley. Sited adjacent to a set of defunct non-producing coal bed methane wells and pads, this area has been the focus of reclamation work and research by the University of Wyoming Extension. If selected, this location could tell an interesting story about the power of ecological restoration in the high plains.

Although the Burma Bell site lacks existing infrastructure and is sparsely vegetated with shrubs and trees, with water from a reclaimed CBM site, or a freshly drilled well, land managers at Ucross could design an arboretum here from the ground up, without the constraints of existing vegetation, infrastructure, or development. Additionally, the siting of the arboretum proposal on leased Wyoming State land opens a number of avenues for potential collaboration with various state agencies.

---



- *Access to the arboretum - private and public:*
  - This is the second furthest of the four proposed locations. Big Red is 2.5 miles away, the Raymond Plank Creative Center is 2.5 miles away, and the artist residences at the Depot are 2.2 miles away.
  - There is currently no parking at this location. As this proposed arboretum is on state land, the construction of a lot would require some degree of collaboration/negotiation with the state engineers' office.
- *Connectivity with Ucross facilities*
  - The parking area for this arboretum would be a simple drive from Big Red, the RPCC, or the artist residences at the Depot.
  - By foot or bike, this would be a long, but pleasant stretch of dirt road travel down Coal Creek Road.
  - Many artists already run and bike on Coal Creek Road, so this may not be a deterrent.
  - Alternatively, this could be reached by walking over the hill from Shady Lane. Visitors to Shady Lane could also be driven up over the ridge by staff with management permission.
- *Education and Outreach*
  - The proposed parking area adjacent to Coal Creek Road would make a great location for an interpretive kiosk. This can inform visitors about the purposes and uses of the arboretum, in addition to placing the arboretum in the context of land stewardship on the greater high plains.
  - Due to the distance between the parking area and the various arboretum features, smaller kiosks should be placed at the following locations to orient and educate visitors:
    - The University of Wyoming Extension research area
    - The tree planting area
    - The draw revegetation zone
  - Interpretive signage will be placed at critical locations throughout the arboretum, highlighting important trees, vegetation, and other natural features.
  - The draw revegetation area in the southeast section of the arboretum will help to exemplify the value of seasonal streams and wetlands in ecosystem health and function.

- *Long-term Sustainability*

- As a relatively dry, isolated site free of woody vegetation, the Burma Bell Arboretum would be the least sustainable option of the four. Without a demonstrated ability to develop organic soils and grow larger vegetation, the success of the site is unclear.
- Without an existing canopy of mature trees, attention must be paid to ensure that the arboretum grows into a diverse, healthy stand of trees, with mixed ages and canopy heights.



**Figure 6** - UHPSI researchers sampling vegetation above the Burma Bell Arboretum location

- This can be accomplished with a careful pruning schedule, and a plan for continued plantings throughout the lifetime of the arboretum (starting at year 10).
- This arboretum would take significantly longer than others to develop into a shady, canopied, arboretum.
- However, by starting all of the trees/saplings/grasses in the arboretum from “scratch”, we can ensure that the final design of the arboretum is exactly suited to our goals and intentions.

- *Aesthetics*

- This arboretum is placed in a secluded, quiet location well up the Coal Creek valley.
- The landscape is a beautiful representation of the natural topography of the Ucross ranch and the greater high plains.
- There is no current tree cover at the proposed site.
- Tree planting will ideally raise tree canopy cover to over 36%.
- It is anticipated that this level of canopy cover will be reached within 25 growing seasons, largely due to the small size of the proposed planting area.

- *Recreation*

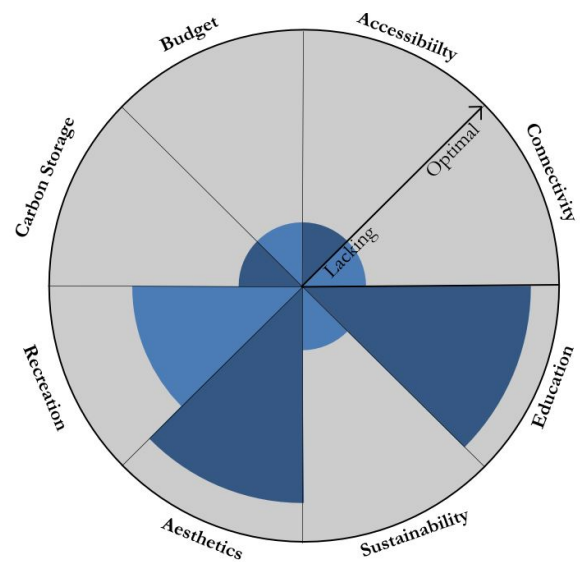
- The proposed location is sited on leased state land with a number of existing trails and two-track.



- A rigorous uphill walk on two-track would bring a visitor to the Burma Bell ridge-top cabin, with sweeping views of the ranch to the east and the Bighorn Mountains to the west.
- Continuing downhill past and to the west of Burma Bell, those visitors with permission would be able to connect to the Apache Shady Lane facilities, roughly two miles from the Burma Bell Arboretum location.

- *Carbon Storage*

- The majority of carbon currently stored in this parcel is underground – i.e. soil and root structures of grasses and wetland vegetation.
- Tree planting has the potential to sequester and store large amounts of carbon – an average of 6.3 tons of carbon per year for the first thirty years (this estimate does not include carbon sequestered in shrubs and perennial grasses).



- *Budget*

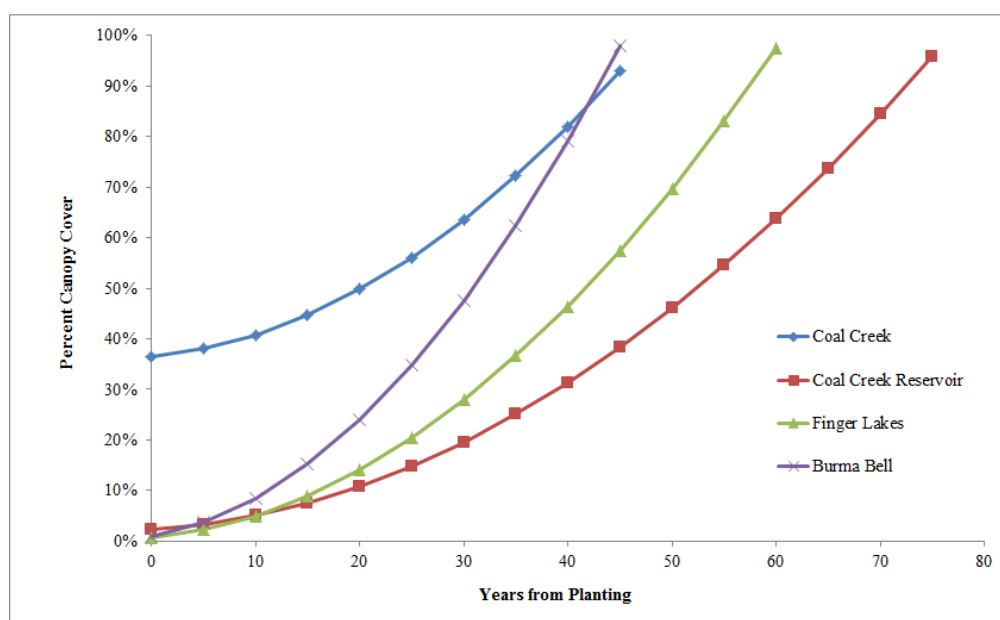
- This arboretum location is by far the most costly of the four alternatives.
- Because of its remote location, expenses increase exponentially for items like basic maintenance, trail/facilities/parking construction, and tree planting.
- Most importantly, this is the only proposed location without proximal surface water. A drilled well would be the only option for water in this location. The cost of drilling a well depends on depth (estimated at between 300 and 600 feet in this location), and could run between \$10,000 and \$24,000 (up to 25% of the total budget for the project).
- Three main budgeting phases of the project.
  - Year one includes construction costs and one year of maintenance.
    - Total construction and maintenance costs after year 1 - \$59,377
    - Cost per acre after year 1 - \$12,370
  - Years one through five tack on yearly maintenance costs which include an intensive watering and tree pruning operation.
    - Total construction and maintenance costs through year 5 - \$80,985
    - Cost per acre after year 5 – \$16,871

- Years five through ten will tack on yearly maintenance costs less than the previous five years. As trees need less water and pruning, costs will drop.
    - Total construction and maintenance costs through year 10 - \$96,816ß
    - Cost per acre after year 10 - \$20,170
- **Major Benefits**
  - Remote, quiet, serene location.
  - Potential to “start from scratch” and design an arboretum without using existing vegetation.
  - Strong educational benefits with close proximity to University of Wyoming long-term study sites and the draw re-vegetation project.
  - Location on state land opens the possibility for collaboration with state agencies, setting precedent for other stewardship projects in the high plains region.
- **Major Concerns**
  - Distance from existing Ucross Facilities. This location would be much more of a destination than an easy retreat or a quiet shady spot for the artists. This may mean more time spent during visits, but may reduce the frequency and likelihood of artists, Ucross residents, and visitors making the trek.
  - Distance from parking – access would require driving across Ucross property (an unlikely scenario given active cattle ranching) or a half-mile walk to the arboretum along two-track.
  - Location on State-Owned Land
    - While this is most likely a benefit due to state buy-in, financial support, and the setting of precedent, there is a chance that siting an arboretum on state land may have negative consequences.
    - Potential for extra regulation on planting, construction, and maintenance.
    - Water rights issues – unclear exactly how much water we would be able to acquire from the state/water resources commission, and how much it would cost.
  - The necessity to dig a new well (or re-open an existing well)
    - This will prove to be very expensive, especially since water is very deep at this site.
    - It is unclear if re-opening an existing well would produce a viable water source.
  - Potential conflicts with University of Wyoming long-term study sites.

## *Further Considerations*

### *Arboretum Growth and Canopy Cover*

In selecting an arboretum site, it is important to consider the existing infrastructure at the location – both natural and manmade. As of the summer of 2013, the four proposed locations contain between zero and sixty one trees. Those locations with minimal existing woody vegetation would need to play “catch up” in order to reach the degree of maturation seen at sites with existing canopy cover. The following graph shows canopy cover on the y-axis with time on the x-axis. Note that the Coal Creek Arboretum starts at nearly 35% canopy cover, and it takes the three other sites between 25 and 45 years to reach this level of maturation. At 25 years, the Coal Creek Arboretum has already far outpaced the other proposed sites.



**Figure 7** - Canopy maturation over time at four proposed arboretum sites. This is a simplified model that does not take into account site-specific conditions (e.g. moisture, aspect, slope).

### *Trail Networks*

Due to the sensitive nature of mapping trails across eased and private lands, we have chosen not to sketch out designs for trails, although we have included rough estimates in our budgets for each of the

arboretum locations. The potential exists to leverage the creation of an arboretum into a system of interconnected trails between Ucross facilities. This trail network could extend connectivity to all parts of the Ucross Foundation — the Big Red Lane Offices and Gallery, the future Coal Creek Road Arboretum, the SchoolHouse / Depot / Bunkhouse, the Chapel, and the UHPSI Headquarters in the Raymond Plank Creative Center (which would include future installations in the building and the “Flower Room”, an enclosed flower garden located on the lawn of the RPCC, maintained by Carol Melver’s tree-planting crew). Furthermore, such a trail network would provide recreational opportunities at multiple levels, i.e. simple exercise for Ucross residents and community-members; an increased number of accessible locations for meditation, relaxation, and reflection; or areas that local school groups could use for “Bio-Blitz” field trips.

This proposed trail network could leverage existing ecological areas in the riparian area behind the Raymond Plank Creative Center (comprising a proper Riparian Education Area), which is also the location of one of the UHPSI’s permanent acoustic monitoring stations and a common area for wildlife in general (turkeys and deer being the most common). Again, harnessing existing resources results in significant project savings and thus an expanded overall vision and achievable scope. The trail network could include signage at various intervals that discusses multiple dimensions of the ecology and stewardship on the ranch proper, in turn fulfilling the educational / didactic goals of the project in a novel way. The trail network could also provide access to wooden benches for reflection and relaxation, and could even include a bridge that crosses Piney and/or Coal Creeks. Including the Flower Room in the trail network, moreover, would give visitors ample opportunity to enjoy attractive non-native vegetation in a more properly manicured setting that showcases the landscaping expertise of Carol Melver’s work crew.

In all aspects of the trail construction (as well as the Coal Creek Road Arboretum), the UHPSI team sees significant potential for input from artists-in-residence to add personality and aesthetic flair, e.g. artists could carve / brand designs in the benches along the trail and in the bridge across lower Piney Creek. Furthermore, artists would be welcomed and encouraged to add semi-permanent/permanent outdoor installations along the trail network (in the vein of Andy Goldsworthy’s work among others),



**Figure 8 - Grassland Trail**

which has the potential to evolve into an Outdoor Ucross Gallery that visitors external to the Ucross Community could enjoy.

### ***Native Plant Nursery***

A native plant nursery would serve dual purposes in conjunction with an arboretum at Ucross. First, the nursery would be a fantastic educational tool in telling a story about ecological reclamation and restoration in the American West. Visitors would be offered a tangible example of the power of native vegetation in restoring historically over-used landscapes.

Second, the nursery would have long-term practical impact in ensuring the self-sufficiency of the arboretum, of the tree-planting program, and of stream/draw restoration work. Currently, the majority of trees/shrubs planted at Ucross are purchased from local greenhouses and nurseries. With an up-front investment in irrigation and fencing infrastructure, much of the needed trees and shrubs could be grown from seed by Ucross staff. This would free more resources for labor and materials needed for restoration



**Figure 9** – Simulated nursery at Ucross. Imagery courtesy of Tad Savinar

and stewardship projects. The image to the left is an example of what the nursery might look like in the Ucross landscape.

Because the native plant nursery is a proposed addition to an arboretum site, we have decided to omit the boundary of the nursery from our arboretum site maps during the site selection process. However, once an arboretum location has been

designated, additional analyses should be undertaken to ensure the viability of an adjacent native plant nursery. Alternatively, this could be located near an existing Ucross facility (e.g. Big Red, the RPCC, or the Ucross barn near the silo) to leverage infrastructure (e.g. water, tools, manpower).



## ***Rangeland Education***

A rangeland education area, in conjunction with one of the proposed arboretums, could provide educational signage that would introduce visitors to the fundamentals of rangelands and their management — the principal ecosystem of the Ucross ranch as a whole. This area will highlight the nationally recognized and award-winning work by Apache Foundation on the Ucross ranch. The education area could involve minimal upfront costs beyond those associated with signage and basic mowed paths. Planning for this Rangeland Education Area alongside the arboretum expands the project to encompass the entire spectrum of ecosystems in the High Plains, while also rounding out the connectivity of the trail network. A potential benefit from the Rangeland area could include honey bee hives where visitors could see yet another economic outlet that grasslands can provide – one that helps increase rangeland health, while also maximizing income from the land.

As the rangeland education area will likely require little infrastructural development apart from signage and kiosks, we have not mapped out the spatial needs for this area in our arboretum maps. However, the rangeland area would ideally be located adjacent to the arboretum, with easy trail access from both the arboretum and its associated parking area.



**Figure 10** - Cattle in North Childress Pasture, Ucross ranch

## ***Concluding Remarks***

The UHPSI team intends for this proposal to act as a first iteration of the operational planning process for a new Ucross arboretum. Many details and specifics, such as the most effective way to connect the trail networks between the selected arboretum location and the Raymond Plank Creative Center, Big Red, and the Artist Residences, will be fully planned once the project moves into the next step of implementation. The team welcomes suggestions and constructive criticism — large and small — to the ideas detailed here in. At its essence, the project seeks to accomplish the goals set forth by Raymond Plank. As such, the UHPSI team has synthesized this document to clearly illustrate how such a project could accomplish these goals within realistic ecological, social, and fiscal constraints.

Intallation Costs				
	Coal Creek	Burma Bell	Finger Lakes	CCR
Trails	\$ 553.58	\$ 840.43	\$ 969.99	\$ 691.84
Wells	\$ -	\$ 24,000.00	\$ -	\$ -
Trees (young/old)	\$ 8,767.25	\$ 5,260.35	\$ 6,312.42	\$ 8,065.87
Shrubs	\$ 1,528.80	\$ 588.00	\$ 705.60	\$ 1,470.00
Grasses	\$ 3,917.20	\$ 3,487.40	\$ 3,917.20	\$ 3,917.20
Planting Cost	\$ 974.00	\$ 584.40	\$ 701.28	\$ 896.08
Fencing (exclosure)	\$ 2,887.50	\$ 1,732.50	\$ 2,079.00	\$ 2,656.50
Maintenance (mulching, etc.)	\$ 1,380.00	\$ 660.00	\$ 792.00	\$ 1,302.00
Trail Signage (Cedar Posts)	\$ 800.00	\$ 1,200.00	\$ 1,200.00	\$ 1,200.00
Interpretive Signage	\$ 3,200.00	\$ 1,600.00	\$ 1,600.00	\$ 1,600.00
Benches	\$ 3,000.00	\$ 3,000.00	\$ 3,000.00	\$ 3,000.00
Boardwalk	\$ 300.00	\$ 300.00	\$ 300.00	\$ 7,500.00
Picnic Tables	\$ 1,500.00	\$ 1,000.00	\$ 1,500.00	\$ 1,500.00
Parking Area (Built by Ucross)	\$ -	\$ 3,107.50	\$ -	\$ 2,940.16
Restroom Facilities	\$ 740.00	\$ 740.00	\$ 740.00	\$ 740.00
Kiosk	\$ 2,000.00	\$ 2,000.00	\$ 2,000.00	\$ 2,000.00
pumps, timing system, electricity?)	\$ 2,800.00	\$ 1,400.00	\$ 2,240.00	\$ 2,800.00
Solar Powered Water Pump	\$ 2,650.00	\$ 2,650.00	\$ 2,650.00	\$ 2,650.00
Staff Clean up	\$ 1,080.00	\$ 405.00	\$ 405.00	\$ 405.00
Arborists	\$ 2,500.00	\$ 500.00	\$ 500.00	\$ 500.00
Permitting Costs	Unknown State Government Permitting Costs			
Crosswalks on 14/16 (State Issue)				
<b>Installation and Construction Cost-----&gt;</b>	<b>\$ 40,578.33</b>	<b>\$ 55,055.58</b>	<b>\$ 31,612.49</b>	<b>\$ 45,834.65</b>

Yearly Maintenance Costs				
	Coal Creek	Burma Bell	Finger Lakes	CCR
Trail Maintenance per Year	\$ 338.00	\$ 757.12	\$ 621.92	\$ 419.12
Water Rights Costs per Year	\$ -	\$ 82.00	\$ -	\$ -
Watering Cost per Year	\$ 2,895.00	\$ 1,732.50	\$ 1,050.00	\$ 1,575.00
Arborists per year/staff pruning	\$ 1,250.00	\$ 1,250.00	\$ 1,250.00	\$ 1,250.00
Restroom Maintenance	\$ 500.00	\$ 500.00	\$ 500.00	\$ 500.00
<b>Total Yearly Cost (first 5 years)-----&gt;</b>	<b>\$ 4,983.00</b>	<b>\$ 4,321.62</b>	<b>\$ 3,421.92</b>	<b>\$ 3,744.12</b>
<b>Total Yearly Cost (year 5 onwards)---&gt;</b>	<b>\$ 2,088.00</b>	<b>\$ 2,589.12</b>	<b>\$ 2,371.92</b>	<b>\$ 2,169.12</b>

Replanting - Year 10				
	Coal Creek	Burma Bell	Finger Lakes	CCR
Trees	\$ 1,753.45	\$ 1,753.45	\$ 1,753.45	\$ 1,753.45
Planting Cost	\$ 194.80	\$ 194.80	\$ 194.80	\$ 194.80
Fencing (exclosure)	\$ 577.50	\$ 577.50	\$ 577.50	\$ 577.50
Maintenance (mulching, etc.)	\$ 600.00	\$ 360.00	\$ 432.00	\$ 552.00
<b>Total Replanting Costs-----&gt;</b>	<b>\$ 3,125.75</b>	<b>\$ 2,885.75</b>	<b>\$ 2,957.75</b>	<b>\$ 3,077.75</b>

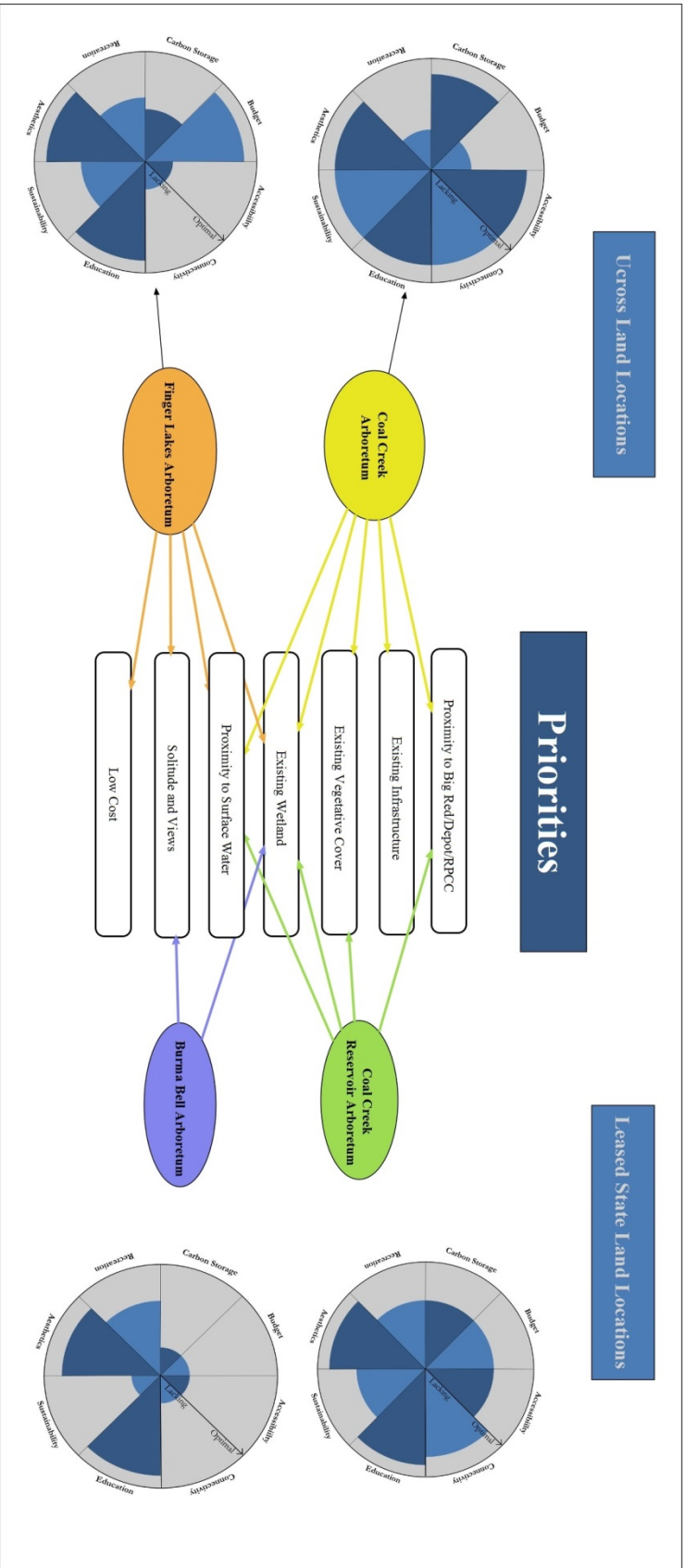
  

TOTAL CUMULATIVE COSTS				
	Coal Creek	Burma Bell	Finger Lakes	CCR
<b>Total Costs for Year One-----&gt;</b>	<b>\$ 45,561.33</b>	<b>\$ 59,377.20</b>	<b>\$ 35,034.41</b>	<b>\$ 49,578.77</b>
<b>Total Costs after Year Five-----&gt;</b>	<b>\$ 70,476.33</b>	<b>\$ 80,985.30</b>	<b>\$ 52,144.01</b>	<b>\$ 68,299.37</b>
<b>Total Costs after Year 10-----&gt;</b>	<b>\$ 84,042.08</b>	<b>\$ 96,816.65</b>	<b>\$ 66,961.36</b>	<b>\$ 82,222.72</b>

COSTS PER ACRE				
	Coal Creek	Burma Bell	Finger Lakes	CCR
<b>Total Costs per acre for Year One-----&gt;</b>	<b>\$ 4,831.53</b>	<b>\$ 12,370.25</b>	<b>\$ 5,197.98</b>	<b>\$ 3,645.50</b>
<b>Total Costs per acre after Year Five-----&gt;</b>	<b>\$ 7,473.63</b>	<b>\$ 16,871.94</b>	<b>\$ 7,736.50</b>	<b>\$ 5,022.01</b>
<b>Total Costs per acre after Year 10-----&gt;</b>	<b>\$ 8,912.20</b>	<b>\$ 20,170.13</b>	<b>\$ 9,934.92</b>	<b>\$ 6,045.79</b>

**Figure 7** - Basic comparative budgeting for the four proposed arboretum sites at Ucross, WY. Note that labor costs are worked into all these estimates at a standard rate of \$13.50 per hour.



**Figure 8** – Decision tree for arboretum siting. Based on priorities, and desire for construction on private vs. public land, decision makers can trace the path to the optimal location.