

DRAFT FOR DISCUSSION

MEMO: 17 January 2024

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CC: Regenerative Riverscape Agroforestry Interest Group

RE: 2023 Reiner Farm Buffer Design Charrette Outputs

Overview

On Friday, June 23, 2023 the NOAA Restoration Center (RC) and Snohomish Conservation District (SCD) hosted a design charrette to explore the application of “regenerative riverscape agroforestry” at three units of the Reiner Farm. This effort aimed to fulfill four purposes, to: 1) test standard rapid assessment methods that support riverscape design, 2) test a one-day field charrette collaboration model, 3) develop conceptual designs for three units in the Old Reiner Farm buffer, 4) to begin to define emergent principles and patterns of regenerative riverscape agroforestry.

In preparation we distributed a thought piece on “regenerative riverscape agroforestry” and a unit assessment packet including maps. Ideas were recorded throughout the charrette, organized and embellished by the facilitation team, and reviewed by participants to generate this document.

Charrette Description

The event was hosted by SCD’s agroforestry program (Carrie Brausieck and Intern Jared Busen) and RC’s senior restoration ecologist (Paul Cereghino). Volunteers from The Ecosystem Guild network supported the host team, including Maddie Price & Antonio Flores (Beacon Hill Food Forest) and Frank Sanborn (Burners Without Borders Washington). The following individuals participated in the event: Austin Richards (Tulalip Tribes), CK Eidem (Ducks Unlimited), Hillary Ethe (Edmonds College Horticulture), Josh Hall (Natural Resources Conservation Service), Marcia Fischer (Natural Systems Design), Linzie Crofoot (NW Indian College), Ryan Lewis (Snoqualmie Indian Tribe), and Patrick Shults (WSU). .

Attendees were recruited through targeted invitations and a broad solicitation through the Western Washington Riparian Workgroup List. The aim was to engage a mix of motivated learners and experienced practitioners from a range of disciplines and perspectives, including public and private project managers, funders, ethnobotanists, and educators. Participants were asked to maximize the productivity and resilience of the riverscape without limiting designs with the presumed constraints of existing regulatory or funding mechanisms. We imagined a high level of human involvement in a landscape that created benefits for its stewards while regenerating a wide range of ecological functions. Participants were also encouraged to reveal

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the assumptions behind their recommendations, including observations of the land and unspoken purposes. A standard assessment framework was provided and described, in the form of a half-page form that was used over the remainder of the workshop for keeping notes to structure our inquiry into the following design elements:

- **Design Drivers** - existing conditions that drive design (both social and ecological)
- **Future Target** - desirable future structures and processes (considering a ten-year and 100-year timeframe), and

A three-part framework for describing a regenerative treatment, including:

- **Site Preparation/Disturbance** - useful disturbance to existing system,
- **Propagation/Planting** - introduction of new species, and
- **Aftercare** - management over time to respond to drivers and to achieve targets.

After this introduction, the group was divided into three teams, each assigned responsibility for conceptual design at one of three units on the Reiner Farm (Figure 1). The morning was spent visiting and discussing conditions observed at each location. In the afternoon teams developed recommendations using the standard assessment framework (presented below) and presented their findings, receiving questions and comments from other groups.

For each unit, we aggregated and presented observations and recommendations of charrette participants without attribution. The authors added additional information where easily available to expand on or embellish suggestions. Where possible we present suggested actions in response to a design driver or observation and for a specific purpose. Participants were given the opportunity to review and add to the findings. Questions that emerged during the process are also included.

As a final activity, participants evaluated the charrette process. All notes and materials were aggregated first by the facilitation team, and then reviewed by participants. More general principles and strategies were extracted from the workshop notes and outputs by the authors, and are offered here as an initial inquiry into Regenerative Riverscape Agroforestry. All materials and related resources are archived on the Salish Sea Restoration Wiki.

The Mother Garden Unit - Conceptual Design

Summary: While the site was initially presented as an opportunity to experiment with mechanical control of knotweed, the opportunity to cultivate a dry sunny floodplain meadow was not consistent with a root starvation strategy that likely depends on shading. This design proposes mindful chemical control of knotweed, followed by establishment of a shrubby meadow canopy gap, maintained by regular disturbance from cutting, harvest, and experiments with winter pile burning.

Design Drivers

- Well established colonies of Japanese knotweed prevent regeneration of native biodiversity.
 - Repeated mowing is not well tested as a control method, and anticipated to be a protracted labor intensive process. Any inconsistency of effort could result in rapid loss of any progress made toward root starvation.
 - The use of herbicides prevents or discourages human harvest and ethnobotanical use over an unknown time frame.
- Sand soils (Pilchuck series) observed on site have very low nutrient and water holding capabilities.
 - Human interaction (compost toilets, burning, biochar) associated with stewardship camps can increase nutrient import and cycling.
- The large canopy gap at this site provides an opportunity to cultivate sun-loving species suited to natural river levee sand soils to increase beta diversity (variation in community type at a landscape scale).
 - Cultivation of complex ground vegetation increases the challenge of mechanical *Polygonum* control because it precludes rapid shading, which supports root starvation.
- Sand and silt deposition during flood events is anticipated to result in crown burial and introduction of seed. Rhizomatous meadow species are more likely to be resilient to this regime. Regeneration after flood disturbance could be augmented by seeding.
- Proximity to one of the best camping areas on the site increases the value of this unit for education, increasing the value of cultivating a unique ecotype and increasing biodiversity by retaining shade.
- The railroad trestle abutment may prevent the river from recruiting trees.
- Large canopy trees planted near the water's edge could help with water temperature and biotic inputs.
- White-tail deer will be attracted to the open site for foraging and have been observed on site.

Target Conditions

- **Vegetation Structure Goals**
 - Eradicate *Polygonum* to allow development of native biodiversity.

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- Develop large conifer and deciduous stems in a forest zone near the river to provide shade and biotic inputs.
- Develop a large and biodiverse shrub, forb and grass meadow zone suited to dry soils and the river disturbance regime.
- Encourage high levels of species diversity suited to soils and canopy to support educational goals.
- **Ecological Process Goals**
 - Develop anthropogenic disturbance/harvest strategy to prevent succession of the meadow into shrub thicket and/or forest and to control species composition.
 - Tolerate selected non-indigenous species with ethnobotanical value, while affecting composition through anthropogenic disturbance (harvest, mowing, burning, selective weeding), and observe to increase knowledge of meadow dynamics (*Hypericum perforatum*, *Tanacetum vulgare*)
- **Social Goals**
 - Increase use of the site by Tulalip tribe and community and maximize the educational value of the site.
 - Actively involve students in development of the site.
 - Integrate with field station events.
 - **QUESTION** - should we plan to accommodate some trampling by children?
 - Use seed and divisions collection from this site to increase site species diversity in other nearby sites.

Disturbance/Site-preparation

- Divide the site into a forest zone along the river, while retaining a significant area to the south as sunny meadow to maximize the unique value of the site while increasing benefits for salmon.
- Harvest and process invasive species debris into mulch strips in the forest zone, while preventing re-rooting to increase survival and growth of transplants on dry nutrient-poor soils in sun.
- Potentially increase light penetration into the meadow areas and forest edge by limbing up trees to maximize the meadow qualities of the site, without tree removal.
- Apply minimum effective herbicide at optimal time and rate to eradicate knotweed, while minimizing cost, effort, and any deleterious effects.
 - Harvest knotweed for mulch after risk of flooding in spring to reduce leaf area, and increase shoot to root ratio, with goal of reducing herbicide required and increasing translocation to roots.
 - [Pennsylvania extension recommends](#) cutting, waiting 8 weeks between cutting and spraying, and to spray during fall nutrient withdrawal to minimize herbicide and maximize effectiveness. Glyphosate has less residual toxicity and less soil activity, and associated uptake by tree roots.
 - **QUESTION** - What is the best timing for herbicide application combined with mowing to optimize root translocation?

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- **QUESTION** - What are the risks of residual herbicide toxicity from herbicides on revegetation, and ethnobotanical harvest?
- **QUESTION** - What herbicide application minimizes deleterious effects on soil biota or subsequent planting survival, and what is the appropriate waiting period between herbicide application and human consumption of shoots or roots?
- **QUESTION** - Should areas of tillage be incorporated to create seed beds in the meadow area or between mulch strips in the forest area? Glyphosate does not photodegrade and may remain active until incorporated into soil.
- **QUESTION** - How does burning and spreading ash support nutrient cycling and species performance in dry riparian meadow ecosystems?

Propagation/Planting

- Fall broadcast seed (species list derived from work by NW Meadowscares, check for suitability).
 - Forbs from seed: Self Heal (*Prunella vulgaris*), Western Yarrow (*Achillea millefolium*), Large Camas (*Camassia leichtlinii*), Puget Sound Gumweed (*Grindelia integrifolia*), Riverbank Lupine (*Lupinus rivularis*), Bigleaf Lupine (*Lupinus polyphyllus*), Meadow Checkermallow (*Sidalcea campestris*), Woolly Sunflower (*Eriophyllum lanatum*), Western Buttercup (*Ranunculus occidentalis*), Showy Fleabane (*Erigeron speciosus*), Prairie Cinquefoil (*Potentilla gracilis*), biscuit root (*Lomatium nudicale*), wild blue flax (*Linum lewisii*)
 - Annuals: Douglas Meadowfoam (*Limnanthes douglasii*), Globe Gilia (*Gilia capitata*), Farewell to Spring (*Clarkia amoena*), Sea Blush (*Plectritis congesta*), Fragrant Popcorn flower (*Plagiobothrys figuratus*), Bicolor Lupine (*Lupinus bicolor*), White Meadowfoam (*Limnanthes alba*)
 - Grasses from seed: Roemer's Fescue (*Festuca romerii*), Tufted Hairgrass (*Deschampsia cespitosa*), Meadow Barley (*Horedum brachyantherum*)
- Fall root cutting and division transplants of rhizomes, bulbs or divisions (deep in sand?).
 - Shrubs: thimbleberry (*Rubus parviflorus*), blue elderberry (*Sambucus nigra* ssp. *cerulea*), serviceberry (*Amalanchier alnifolia*),
 - Forbs: fireweed (*Epilobium angustifolium*), pearly everlasting (*Anaphalis margaritacea*), camas (*Camassia quamash*), beargrass (*Xerophyllum tenax*), Columbia lily (*Lilium columbianum*), goldenrod (*Solidago canadensis*), Strawberry (*Fragaria vesca*), nettle (*Urtica dioica* ssp. *gracilis*).

Aftercare

- Site receives regular attention from stewardship camps as a focus area for low-intensity cultivation of meadow species, and for collection of propagules.
- Maintain an active disturbance regime coordinated with harvest to maintain forb dominance and create gaps for ruderal species, slow succession, and reduce dominance by competitive mono-typic stands of rhizomatous shrubs and forbs (e.g. bracken, fireweed, thimbleberry, goldenrod).
 - Harvest seeds in Summer, and store to sow on disturbed soil in fall.

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- Periodically (every 1-3 years) Mow (scythe) and pile cuttings in late summer after seed fall. Cover with tarp before return of rains.
- In fall after rains, burn piles, and spread ashes and charcoal.
- Harvest rhizomatous shrub, forb divisions, and volunteer trees to create disturbed ground and slow succession,
- Replant disturbed and burned areas with more seeds and transplant bulbs and root divisions of culturally desirable species.
- Spring to summer, selective weeding to remove unwanted species. Harvest for ethnobotanical use.

The Pond Unit Conceptual Design

The scope of this unit was expanded to encompass more generally forested areas surrounding the pond, as well as the pond itself (Figure 1; W1, W2, and GP1). Participants saw this area as a lower priority for tending because it has an established canopy and higher species diversity than other areas. The pond is both an important habitat feature and has an unnatural shoreline created by gravel mining that could be modified through earthwork to increase biodiversity and habitat functions.

Design Drivers

- Due to the existing canopy, and higher biodiversity of this site, it may only require a light touch to maintain and improve ecological functions, with the exception of the pond.
- The abandoned gravel pit/pond has very steep edges (near the angle of repose) leaving the opportunity to improve edge habitat in the pond by creating shallow areas that would support emergent vegetation.
- A road and trail and the gravel pit pond allow for easy access to the site.
- Sunny areas with water availability allow for a higher diversity of plants and opportunities for new plants
- Soils on the south side of the site contain more silt and organic matter than other sites along the river (consistent with adjacent Sultan soils).
- The current forest stand is hardwood dominant (big-leaf maple, cottonwood) and many areas have no softwood recruitment.
- A 2022 planting experiment, isolated inside the blackberry thicket was still heavily browsed by deer.
- Bullfrog observed in pond.
- **QUESTION** - Due to thicker understory in the gaps will there be some issues for tree regeneration?
- **QUESTION** - How would the whole site be best subdivided for planning and tracking stewardship?

Target Conditions

- Ecological Structure Goals
 - Improve the pond for wildlife habitat and species diversity.
 - Maintain the trails and road to increase human interaction/education, and monitoring of the land/wildlife.
 - Cultivate sun-loving food and medicinal plants (berries, sun-loving herbs).
 - Generate cuttings, coppice, layering, divisions that can be used for vegetative propagation on other projects.
 - Increase shade-tolerant conifer recruitment while allowing continued sun penetration and hardwood dominance.
- Ecological and Social Process Goals

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- Bring in guests to experiment with biocultural restoration, observe wildlife, and conduct hands-on work for plant propagation or invasive species removal incorporate
- Develop a “food forest” by adding culturally significant plants, and experiment with integrating cultivation and regenerative harvest.
- Opportunity to monitor change over time on a site while using low intensity management strategies and increasing biodiversity under deer browse pressure.
- Promote bullfrog harvest as element biocultural restoration, and to reduce pressure on native amphibians.

Disturbance/Site-preparation

- Use equipment to improve the pond habitat and create a wetland edge
 - Decrease slope angles leading into the pond
 - Create shelves along the edges of the pond for emergent aquatic vegetation
 - Provide easier access for wildlife to water
 - Remove blackberry during earthwork.
- Identify zones in which to insert species, and experiment with least-effort methods to create planting sites to establish target species.
- Experiment with cost-effective strategies for creating sites to underplant and establish conifers.
- Increase sunny pockets on the southern edge by selective coppicing of cottonwood in winter to increase the area of productive shrub and small tree plantings. Use stem and branches for stakes and poles.

Propagation/Planting

- Pond Edge Emergents
 - Cattail, tule, wapato and other culturally significant plants, depending on suitability.
- Experiment with “forest edge guilds” (structurally complex mixtures of species that enjoy the sun found on the forest edge)
 - South facing forest edge - blue elderberry, osoberry, thimble berry, trailing blackberry, serviceberry, Nootka rose, cascara, tall Oregon grape
- Underplant cedar, hemlock and yew.
- QUESTION - to what extension is a monoculture of snowberry (as an alternative to blackberry) common in these young forests, and should that outcome be resisted?

Aftercare

- Use stewardship camps to experiment with frequent but well timed and light touch management methods (selective pruning) to promote planted species.
- Experiment with methods to reduce deer impact (for example, brush mulch, temporary fencing, reusable cages, sprays).
- Evaluate cost benefit of first year irrigation, and test least-effort irrigation technology.

The Conifer Plantation Conceptual Design

Summary: This site is predominantly a densely planted Douglas-fir stand with an issue of unauthorized camping. This design proposes selective thinning for conifers while maintaining a closed canopy. Slash from the thinning will be used to create habitat piles, lopped and scattered in place and potentially used to create biochar on site. The meadow on the south could be developed into an open woodland with Gary oak, fruit/nut bearing trees and understory.

Design Drivers

- The 30-40' north of the conifer plantation is a riparian hardwood stand with a well developed understory with some presence of Japanese knotweed, Himalayan blackberry and English ivy.
- The conifer plantation has little to no understory currently, with only a few scattered individuals of blackberry or knotweed.
 - There are Grand-fir, Western Red Cedar and Sitka Spruce within the stand that appear to predate the plantation planting
 - **Assumption** - The closed canopy and severe shading of the conifer stand is preventing understory species from establishing within the conifer stand.
- There has been unauthorized camping within the stand, but no active camps at the time of observation. Currently there is little use in the stand from the landowners.
 - **Assumption** - A greater presence from the landowners and any crew working in the stand will reduce or eliminate unauthorized camping.
- Soils are mapped as "Riverwash" with periodic overtopping of the levee accompanied by deposition of fine sand. Any plantings, particularly in low areas, will need to withstand some level of flooding and riverwash deposition.
- Douglas-fir on site is undergoing stem exclusion. leaving around 30-40% of the crown in place, the area has a very closed canopy. Pockets of Douglas-fir have die off issues
 - **Assumption** - In addition to stem exclusion riverwash deposition is killing off some of the Douglas-fir by burying the root crown and lower part of the trunk
- Between the plantation and the cornfield SE of the site there is a triangular weedy patch consisting mainly of Himalayan blackberries. This area is not part of the cultivated land, nor part of the conifer plantation. This is a possible area for the development of a small open woodland. This was not fully discussed during the charrette, but will be explored in the future.

Target Future Conditions

- Ecological Structure Goals
 - Control the spread of the invasive species in the hardwood riparian zone, particularly blackberry and knotweed.
 - Rapid growth of large conifers, forest vigor and potential long term recruitment of large woody debris into the river

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- Use a variable thinning strategy to create structural complexity while maintaining a closed canopy in the conifer plantation to maximize habitat variation.
 - **Assumption** - Control the spread of invasive species from the riparian hardwood zone by leaving the canopy closed, minimizing sunlight to the ground
- Experimental production of mushrooms on softwood logs, using a variety of techniques.
- **QUESTION** - what are the goals for recovery of understory biodiversity?
- Social and Ecological Process Goals
 - Presence of people actively working or enjoying the space of the conifer stand will discourage unauthorized camping on site
 - Disturbance from periodic flooding and associated sediment and debris deposition can be utilized to create a structurally complex understory
 - Habitat piles and slash left in place will be moved by the river, then partially buried by the soil deposition. These are also likely to rack against the remaining conifers creating complexity within the underlying structure of the stand, decomposing to increase biomass within the soil
 - Increase the amount of wildlife utilizing this area by providing cover and habitat by increasing structural complexity of the understory.
- Beneficial Tulalip and community and educational use of the site.
 - Fruit/berry plants that have cultural and social significance in canopy gaps and along the southern edge woodland will increase human activity in the site
 - Increasing and encouraging human interaction with the site is a key part of biocultural restoration.

Disturbance/Site-preparation

- Remove trash in the area from unauthorized camping. Needles have been observed on ground so precautions for any crew working in the area will need to be taken into consideration
- Predict water flow pathways that are likely during flood, and organize woody debris to increase retention and capture of flotsam on site.
- The variable density thinning effort within the conifer stand would result in canopy gaps around selected large trees, areas thinned, but with canopy retention and areas left with dense conifer cover. Consider likely areas of sediment deposition as part of design.
 - Preferentially retain Spruce, Cedar, Grand-fir and hardwoods over Douglas-fir
- **QUESTION** - Can biochar be created on site from the thinning in a way that provides enough benefits to justify the effort?
 - Will this improve water retention in the soil to a beneficial level
 - Will this increase biomass in the soil to a beneficial level
 - Can the biochar be used as mulch to prevent spread of invasive species

Propagation/Planting

- Experiment with planting the understory in the conifer stand

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- Plant rhizomatous conifer understory species suited to the level of sediment deposition, moisture and closed canopy
- Consider planting of species suited to adventitious root formation and stem burial in canopy gaps (spruce, cedar). QUESTION - which conifer species are best suited to stem burial in alluvial sediment?
- Consider seed based propagation of new understory species.
- Mushroom cultivation in the thinned material may be a source of revenue and add cultural and social significance increasing human activity in the site
 - The following mushroom species may be suitable for log cultivation on Douglas-fir:
 - Chicken of the woods (*Laetiporus sulphureus*) - semi-parasitic, edible
 - Phoenix oyster (*Pleurotus pulmonarius*) - edible
 - Western varnished conk “reishi” (*Ganoderma oregonense*) - medicinal
 - Dowels are more suitable for field inoculation than sawdust injection due to slower moisture loss, and longer lifespan.
 - Mycelial survival in the first summer could limit viability. Leaving stems as snags in shade, and inoculating near the ground in fall (where more moisture is present) may maximize success.
- Open woodland will need to be planted
 - Garry oak (*Quercus garryana*), chestnuts (*Castanea spp.*), currant (*Ribes sanguineum*), huckleberry (*Vaccinium ovatum*), tall oregon grape (*Mahonia aquifolium*), ocean spray (*Holodiscus discolor*)... bird and pollinator friendly species list

Aftercare

- Site receives regular attention from stewardship camps
 - Monitor effects of selective thinning
 - Use of an increment borer 3-5 years after thinning to determine changes in growth rates of the conifers
 - Monitor habitat woody debris movement and racking after flood events. Were they racked against trees as per the assumption?
- Physical control of unwanted species in late spring

Charrette Evaluation

Each participant reflected on the event, and these notes aggregate and synthesize those reflections. In general a range of planned elements created value recognized by participants:

- **ON-SITE VALUE** - Being able to stand on site was very useful compared to working through maps and reports. There is no replacement for being on site. The intimate understanding of a specific landscape is more likely to lead to wise stewardship.
- **INTERDISCIPLINARY VALUE** - Being able to hear how people with different backgrounds see the same site broadened our perspective.
- **EDUCATIONAL VALUE** - This kind of exercise provides an extremely high value experience in multi-stakeholder planning for students who are coming into the industry.
- **PROGRAM-INDEPENDENT VALUE** - It was important and useful to think about site stewardship holistically and independent of the government programs that might or might not support implementation. This reduces the potential for having stewardship vision truncated by institutional policies that may not suit the needs of the site, and creates more valuable conversations
- **EFFICIENT AGENDA** - The agenda made good use of a single day and is worth repeating and adapting. It made good use of time, without waste.
- **INQUIRY TOOL VALUE** - Using the unit form was a very effective way to focus attention and build shared purpose.
- **COLLECTIVE SYNOPSIS VALUE** - It was rewarding to not be doing this work alone, and to look over multiple sites while not going too deep on each site. It provided a novel perspective on the work.

A number of ideas emerged that propose ways to further enhance or expand on the experience:

- **INCREASE CROSS-SPECIES THINKING?** - Identifying keystone fauna associated with different ecotones could help us think broadly of stewardship for the benefit of many other-than-human inhabitants.
- **EXPAND TO MULTI-DAY?** - A multi-day model could be powerful, culminating in layout and marking of sites for treatments.
- **ADD PROVOCATIVE TOPICS?** - A potentially useful addition might be to identify key issues (for example herbicide use in restoration) and present them as provocative statements, and allowing for a period of discussion to develop group wisdom around those issues.
- **PARTICIPATION EFFECTS?** - Broadening the conversation in this way raises the question of who participates in restoration planning, and how unintentional constraints on who participates can affect stewardship.
- **ADD WSDOT?** - It might be interesting to include a WSDOT land manager in the conversation, given the scale of work completed in that agency.