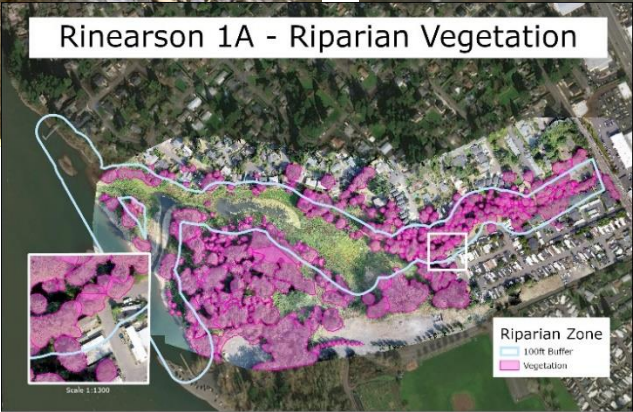


Streamside Stewards Program

Final Report
2020-21



Map created by Mitchell Gelfhaus
Portland Community College GIS Internship Winter 2021
Source: GeoEye, Maxar, Microsoft, USDA FSA, GeoEye,
Maxar, NCCWC & Mosak Ecology

Funded by:



With additional support from:

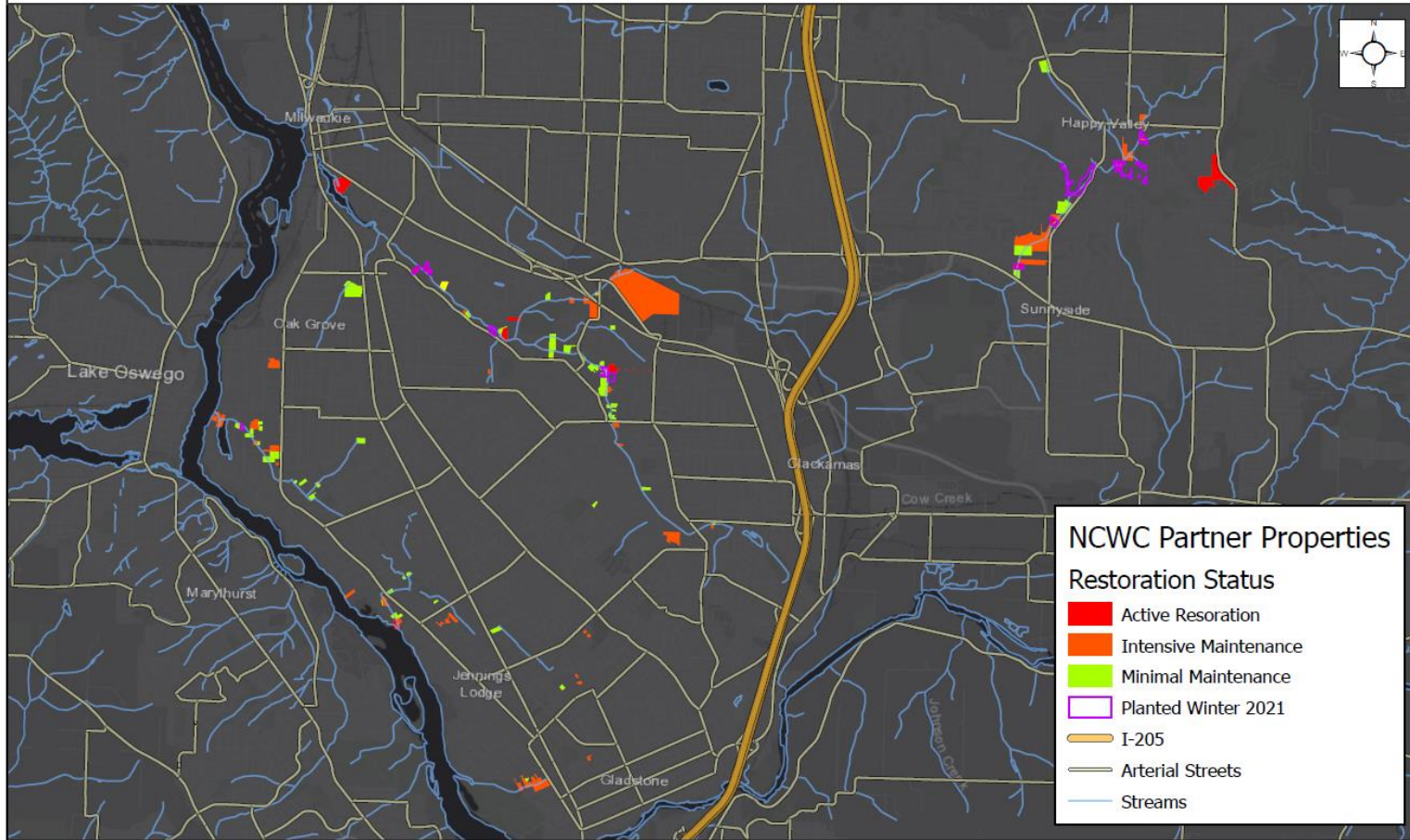


Highlights

- 160 sites
- 86 sites in active restoration or intensive maintenance
- 76 sites in minimal maintenance (30 in 2019-20)
- 19 new sites
- 4,425 plants installed
- 62,970 trees and shrubs planted since program start
- 114 acres (28% increase) / 24,669 linear feet (37% increase) of streambank in restoration
- 8 workshops held on 3 topics for 83 participants (58 unique attendees)
- 75% of participants rated their learning highly (4 or 5 out of 5)
- 74% of participants reported feeling “much more” (53%) or “more” (21%) motivated to take action to protect watersheds than before participating in a workshop

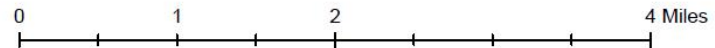
NCWC Program Overview, 2021

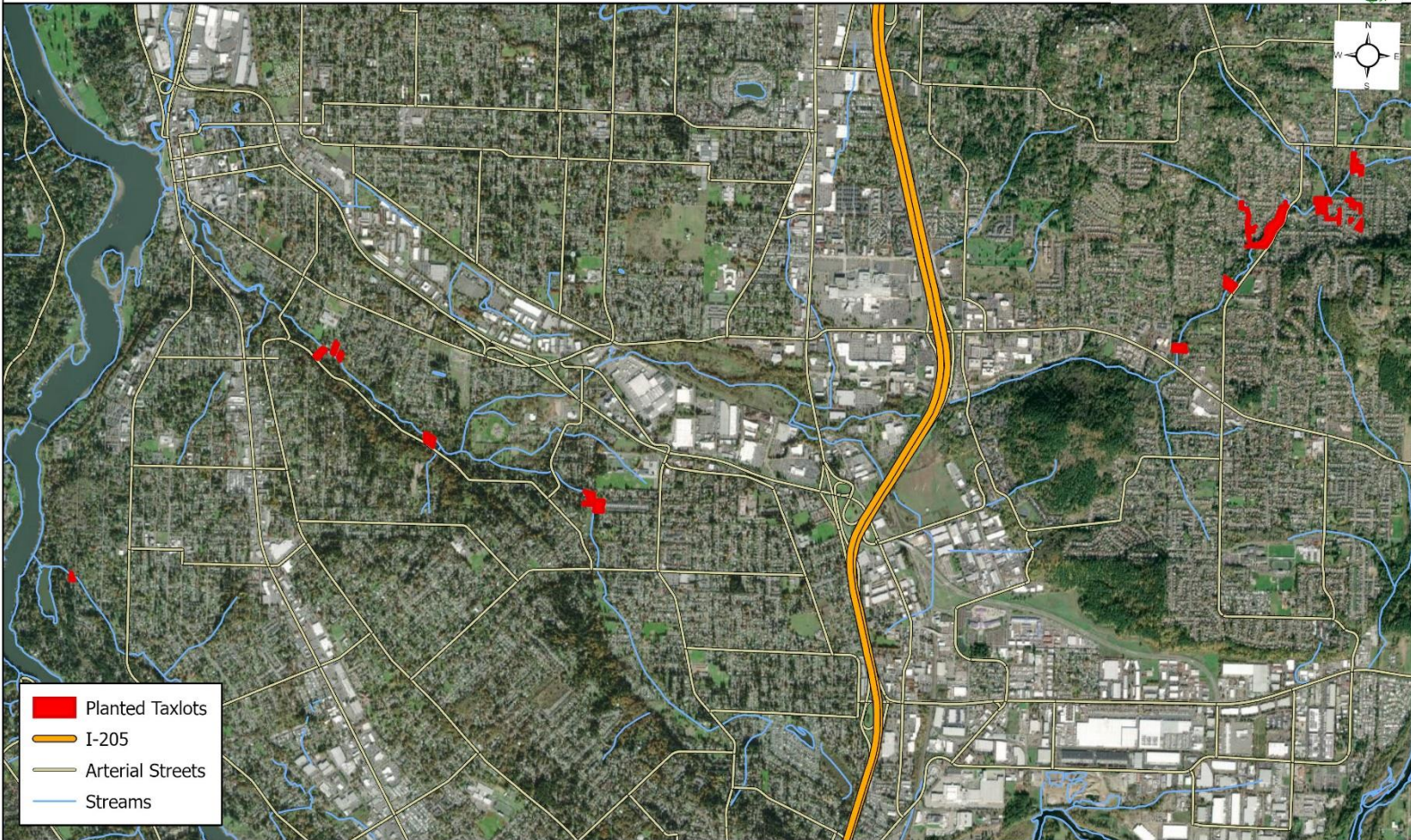
Highlighting properties being planted and restored in partnership with NCWC



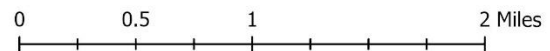
Created by Mosaic Ecology on 7/2/2021

Sources: Oregon Metro, Bureau of Land Management, State of Oregon, State of Oregon DOT, State of Oregon GEO, Esri, HERE, Garmin, USGS, EPA, NPS, Esri, HERE, NPS, and user generated





Created by Mosaic Ecology on 3/19/2021
Projection: NAD_1983_HARN_Stateplane_Oregon_North_FIPS_3601_Feet_Intl
Sources: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, Oregon Spatial Data Library, and GIS User Community, METRO, and User Generated



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Summary

Since 2013, the North Clackamas Watersheds Council has managed the Streamside Stewards Program to restore native vegetation to riparian zones in the Kellogg, Mt. Scott, Rinearson, River Forest, and Boardman watersheds. By combining elements of professionally-managed restoration, working closely with willing landowners to develop a stewardship ethic, and creating an understanding of how watersheds work, the program achieves the following goals:

- Restoring native riparian vegetation to create future shade and thus lowering water temperatures for aquatic life
- Controlling erosion, providing future sources of woody debris for salmonid habitat, controlling invasive species, and restoring native plant assemblages
- Ensuring restoration success with professional maintenance regimes
- Providing a low barrier to entry for the restoration of private lands
- Building a watershed stewardship ethic and an understanding of watershed function among program participants to create effective stewards for years into the future.

Despite the challenges of the past year, the Streamside Stewards Program is expanding and thriving (see the next section). Trees planted during the early years of the program are becoming sufficiently established to allow more properties to enter phases in which minimal maintenance is required. Areas of contiguous shade across multiple parcels are also being created. In response to Covid restrictions, we've been working with landowners so they become more involved in the monitoring of their sites. Shade data collected and analyzed through the Streamside Stewards Program is being incorporated into the Council's Watershed Action Plan. Major projects have been identified on Boardman Creek and River Forest Creek, and one of these projects has secured funding. Our educational workshops, piloted during a pandemic, have had positive, measurable impacts. The program is fulfilling its promise, even in a challenging year for all of us. While there are no doubt challenges ahead, with sustained effort, healthier watersheds for fish, wildlife, and people await us in the future.

Achievements in 2020-21

2020-21 was a tumultuous year for all of us in many ways. We navigated the impacts of the Covid-19 pandemic, the impact of recent wildfires near our service area, and an increasing focus on social justice. These had profound impacts on our work, and on the people who live in our watersheds. These impacts are complex and still being felt as we transition into 2021-22. However, we could not have weathered any of these challenges without your enduring support.

Key Accomplishments:

Protecting Investments in Restoration via Professional Maintenance

One of the hallmarks of the Streamside Stewards Program is that the majority of site maintenance is done by professional crews. This is a vital step in ensuring that plants survive, reach their desired ecological future condition and provide shade and that nearly a decade of public-sector ratepayer and taxpayer investment in these sites is protected. While landowner-driven restoration helps build a stewardship ethic, it seldom creates desired ecological conditions that endure over time; this is especially true when dealing with species such as *P. cuspidatum* that tend to grow aggressively when hand-pulled by well-intentioned landowners and in urban areas with relatively small parcels and substantial edge effects, where re-infestations are frequent. While new plantings are popular with volunteers and the public, they are less cost-effective and ecologically impactful than maintaining trees and shrubs planted in previous years. This regular maintenance is also essential to retaining landowners in the program from year to year and giving them a positive view of restoration, the Council, Oak Lodge Water Services, and the City of Milwaukee.

In FY 20-21, as in past years, the Council prioritized ongoing maintenance before adding new sites to ensure restoration outcomes. Dedicated funding within WES territory and the ability to leverage funds from OLWS, WES, and City of Milwaukee into further OWEB Small Grant funds allowed maintenance to move forward, even under challenging Covid-19 restrictions (see below). This, along with the ongoing growth of plants installed in previous years, has resulted in 76 sites, the largest total in the program's history, reaching minimal maintenance mode.

Expansion into Contiguous Habitat

The transitioning of sites into minimal maintenance mode and additional resources for intensive maintenance allowed us to bring new sites into the program. Nineteen new sites were brought into the Streamside Stewards Program, with a focus on the Upper Mt. Scott region; this region contains some of the Kellogg-Mt. Scott

watershed's most intact habitat. We have expanded habitat linkages between areas of restoration via a multiyear project led by Happy Valley Heights HOA, which contains one of the headwaters of Mt. Scott Creek, and other ongoing restoration efforts led by Friends of Trees and the City of Happy Valley. These additional sites, along with Mt. Talbert Natural Area, Happy Valley Nature Park, and Scouter's Mountain, are creating a growing core of contiguous restoration and future shade. The presence of several large HOA-owned parcels also provides opportunities for restoration at scale not possible elsewhere in the watersheds.

In the City of Milwaukie, restoration focused on the Aldercrest stretch of Kellogg Creek and on the planting of sites cleared in 2019-20. This has enabled the Council to restore the north bank of Kellogg Creek to complement restoration on the south bank of Kellogg Creek performed in WES territory in previous years. As a result, future shade will develop on both side of the creek, and sources of invasives that threatened past restoration sites on the WES side are being eliminated.

Watershed Stewardship Education

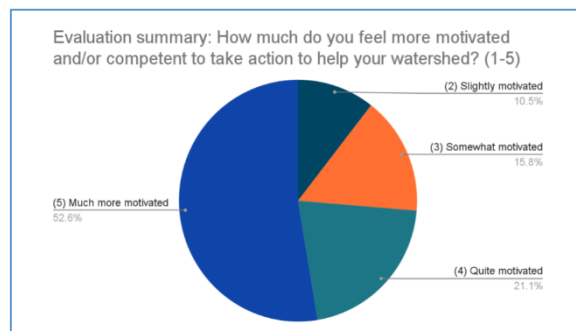
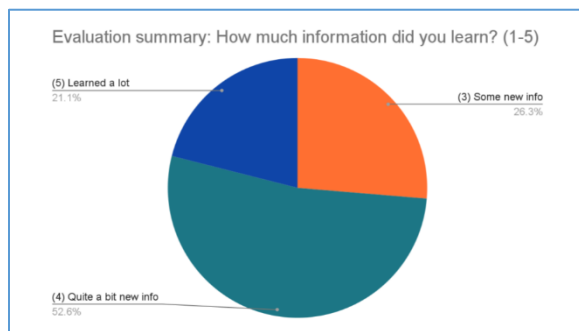
In FY 19-20, the Council set the goal of creating a stewardship education program for adult landowners and residents. Rather than broad-brush education that results in high numbers of participants but little action, improvement in watershed practices, or retention of information over time, the workshops developed as part of this program were based on the Clean Rivers Collaborative's Community-Based Social Marketing framework, in which the Council, WES, OLWS, and other partners all participate.

The Council launched these workshops and presented them online in order to help existing and potential future Streamside Stewards and watershed residents understand the watershed beyond their individual properties; the value of natural wetlands, side channels, and stream complexity; the roles of impervious surfaces; cutting-edge stormwater management approaches; flooding and how watersheds function in urban areas. These workshops experienced early success despite the pandemic and not being at actual watershed sites.

- The Council presented 8 workshops covering 3 topics (Watershed Function, Watershed Wildlife, and Watersheds & Human Health)
- 83 total participants and 58 unique participants, with 25 attending multiple workshops in a 3-part series.
- In spring 2021, the Council partnered with the Clackamas Community College Environmental Learning Center for the Wildlife & Water Friendly Gardens Series lunchtime workshops, offered for free to community members on Zoom. The Council recommended speakers and outreach venues, promoted the

events, co-hosted the majority of the workshops, coordinated with speakers in advance, and facilitated attendee engagement throughout.

- The workshops the Council co-hosted were attended by 132 community members and 193 with recording views; 62 unique Clackamas County residents were reached in total through this series.
- Because these workshops were held online, participants living in other nearby watersheds (Johnson Creek, Clackamas River Basin, etc.) could and did attend. Since these watersheds face many similar issues as the Kellogg-Mt. Scott, River Forest, Boardman, Rinearson, and Willamette watersheds, this provided opportunities for broader education beyond these boundaries and for synergies in watershed stewardship.
- In response to the rise of Covid-19, the Council created and leveraged online tools for landowners sheltering at home to use to help identify and respond to new weed infestations appropriately. The Council also coordinated a collaborative group of local watershed councils (North Clackamas, Clackamas, Tryon, Johnson Creek, Greater Oregon City) and other partners (Backyard Habitat, Clackamas SWCD, SOLVE) to share resources, avoid replication, and share best practices for online delivery of content.



Information about the percentages of participants who have made progress toward or completed their commitments to actions in watersheds health is being collected over time. Participants have expressed thanks for the personalized and regular follow-up that the Council has provided.

Shade Study and Link to Watershed Planning

Starting in 2019-21, the North Clackamas Watersheds Council and its partners began a shade analysis of the River Forest, Boardman, and Rinearson Creeks and their riparian areas in the western portion of the Council's service area. The purpose of the study was to assess the condition of riparian shade in the riparian zones of these small tributaries to the Lower Willamette River. The ability of these streams to provide critical cold water refugia for salmon, steelhead, cutthroat trout, and lamprey in the Willamette River, Clackamas, and Lower

Columbia River populations has been identified by Oregon DEQ (2020) and USGS (2018). This purposes of this study are to:

- Track changes in shade over time due to ongoing restoration, development, and other changes in the riparian zone
- Identify shade-deficient areas
- Prioritize parcels for future restoration to create continuous shade
- Where increasing shade in shade-deficient reaches is not possible due to land use, geography, etc., to provide guidance for other ways to enhance habitat and water quality
- Create an analytical methodology for future replication
- Inform the 10-year Restoration Strategy being developed by the North Clackamas Watersheds Council

As of June 2021:

- A flight protocol has been developed
- Landowner permission has been secured for launching/landing areas
- Most of the area has been flown twice (once before leafout and once after)
- The flights captured color aerial imagery, NVDI (Normalized Vegetation Differential Index, which measures vegetation via the use of near-infrared and red light), LAS (LIDAR) and a DSM (a 3D digital surface model, 3D).
- An analysis methodology was created and implemented by Mitchell Gellhaus and Christina Friedle at Portland Community College
- The methodology was documented for future replication
- A presentation was given to Oak Lodge Water Services staff
- The methodology, raw data, and preliminary interpretation were shared with Samara Group and GeoEngineers for incorporation into the Watershed Action Plan, which is being developed in 2021.

The following will occur in 2021-22:

- One remaining section of Boardman Creek will be flown in 2021-22
- An analysis will be performed to prioritize specific parcels for restoration
- Recommendations will be shared with agencies managing key portions of our watersheds and will be incorporated into the Council's Watershed Action Plan.

Challenges and Responses

Covid-19

The Covid-19 pandemic had, and continues to have, multiple impacts on the Streamside Stewards Program.

- To adhere to social distancing guidelines and preserve worker safety, restoration crews from Mosaic worked in smaller crews (1-4 instead of up to 15) and did not share vehicles or tools throughout FY 2-22. This greatly

reduced the efficiency of the work and increased the cost. As a result, the costs/acre of the program were higher than usual, and the usual coverage of properties with maintenance was not possible.

- Site visits were delayed at sites where the potential for uncontrolled social contact was high and/or where medically vulnerable landowners did not want visitors on their property.
- Face-to-face meetings were cancelled, and workshops and site tours that were initially intended to be held in the field had to be converted to online delivery formats
- Volunteer events were cancelled

Council Response

The Council responded to the changes brought about by Covid-19 in several ways. Due to the timing of the response, these responses will be continuing into at least early 2021-22.

- *Engaging Landowners in Photo Monitoring and EDRR*

The Council sought to engage landowners more by having them take quarterly monitoring images and fill out a user-friendly checklist to identify any returning invasive species and assess the conditions of their plantings as well as any other changes on site. This additional engagement had two objectives: 1) to identify incursions of invasives in order to use the much more limited contractor time efficiently by visiting high-priority sites and 2) to more fully engage landowners in recognizing ecological conditions.

This initial approach has met with moderate success and has provided lessons learned. Approximately ¼ of stewards regularly return quarterly images. The Council responded to this rate of return by calling each landowner who had not replied regularly. The reasons cited for not providing images were 1) lack of email capability, 2) lack of mobility to access steep riparian parts of properties, 3) lack of confidence in this new technique, and 4) the difficulty of building new habits, especially when the survey interval is infrequent. In 21-22, the Council is performing individual site visits to each landowner in order to show them the technique in person, ask what has made the technique challenging, and respond accordingly.

The Council is also dedicating a larger portion of its Streamside Stewards funding across its territory to maintenance in FY 21-22. This is to prevent two years of slower-than-normal maintenance and the consequent impact on sites and to ensure that past investments in restoration are not lost.

- *Shifting to Online Education*

The Council was obligated to present workshops online rather than in-person. While this posed some challenges associated with the lack of first-hand experiences at watershed sites, our workshops met benchmarks for participation and outcomes (learning and motivation to be better watershed stewards) as well as for follow-up. As mentioned earlier, the online format attracted participants from a broader geographic range than might have attended workshops tied to a particular location as well as participants who experience travel difficulties. As of this writing, the Council is preparing to bring these workshops into the field, as was originally intended, with supplemental online delivery to take advantage of this unexpected experience.

- *Forming a Collaborative Group*

The Council was obviously far from the only watershed organization wrestling with multiple core questions about how to engage landowners during the pandemic: how to cross the digital divide, especially with older landowners; how to deliver content and build community online that are fundamentally of firsthand experience in the natural world and building community together. The Council and contractor Alexis Barton convened a group (still functioning) that is curating online resources, sharing experiences converting in-person activities to webcasts, finding participants for online activities, and assessing the evolving readiness for different types and amounts of content as the pandemic evolves and our populations struggle with multiple and shifting impacts. This group is composed of multiple Watershed Councils in Clackamas, Multnomah, and Washington County, multiple SWCDs, the Backyard Habitat Program, SOLVE, and several other agencies and nonprofits.

Extreme Weather, Fires, and Ice Storms

Fires, extreme heat, and ice storms significantly affected the Streamside Stewards Program. Though only one small fire occurred in our area, the wildfires in 2019 and the hot weather during May-June 2021 have exacerbated landowner concerns about defensible space around buildings as well as the density of vegetation. These concerns have required adjustments to planting prescriptions that are designed to create shade.

The ice storm in February 2021 created landscape challenges as well as educational opportunities. Many trees that provided significant shade were lost, and several sites will need to be re-cleared and replanted in FY 21-22 as a result. One positive outcome from the storm is that several of these fallen trees are now adding to instream complexity.

Council Response

The Council began shifting planting prescriptions to include more drought-tolerant plants in 2017. The Council has been consulting with ODF to connect landowners

with fire safety resources and to identify areas where best practices for fire safety may conflict with existing planting approaches.

Many landowners contacted the Council in the weeks and months following the ice storm. This was an opportunity to educate landowners about the natural roles of logs and branches in streams; many landowners believed that they needed to be removed for stream health and were unfamiliar with regulations relating to large wood that naturally falls into fish-bearing streams. The Council conducted numerous site visits (both virtual and in-person) to educate landowners.

Landowner Turnover

The Streamside Stewards Program remains a low-barrier-to-entry program that does not require easements or any other binding commitment to continue restoration. Therefore, most of the sites that are withdrawn from the program are withdrawn because landowners sell their property. As elderly residents downsize in certain areas of our watersheds, we anticipate that higher turnover rates will occur in future years; however, the exact timing and extent of this turnover remains unknown. We expect that this trend will occur first in the Oak Lodge Water Services territory, which has the oldest population in our service area and is experiencing a substantial influx of new residents, according to other research.

Council Response

We continue to monitor these trends and seek permission from new landowners to continue the program. In addition to improving the photo/site monitoring reports from landowners, the landowner visits by the Council in the coming year will allow us to determine whether any properties have changed hands, are likely to do so, and to have a face-to-face interaction with new landowners.

Plans for FY 2020-21

- Continue rigorous maintenance regimes, protecting the multiple years of investment in restoration sites.
- Continue to expand restoration in the Upper Mt. Scott Target Area for future expansion, adding 4-6 sites depending on acreage and level of infestation. This area is ecologically critical due its location at the creek headwaters and provides opportunities for contiguous habitat restoration as well as efficiencies through collaboration with several large HOAs, restoration work by the Happy Valley Heights HOA, and projects by the City of Happy Valley. This is also a vulnerable area where Streamside Stewards hopes to offset what could otherwise be significant downstream impacts from rapid development.

- Add 1-2 sites in the Aldercrest area (border of WES/Milwaukie) and continue maintenance.
- Expand and implement workshops and tours to engage more landowners in understanding watershed functions beyond their property, likely through a hybrid of in-person and online instruction.
- Conduct site visits to each landowner in the program over the next two years.
- Expand and refine our work with landowners doing their own photo monitoring and restoration EDRR, seek ways to sustain this energy over time, more effectively target EDRR weed work, and work with landowners across the digital divide.
- Conduct the final drone flights in the Boardman watershed, complete prioritization analysis, and extend our partnership with Portland Community College.
- Continue participation in the Clean Rivers Collaborative and develop a community-based social marketing campaign to improve messaging and communications for the Streamside Stewards Program.
- Resume our volunteer stewardship event at the Happy Valley Nature Park addition property, in partnership with Friends of Trees
- Support restoration by the Wetlands Conservancy at Hearthwood Wetlands at the headwaters of Kellogg Creek.
- Continue intensive restoration funded by OWEB at the Boardman/Rinearson headwaters, at Milwaukie Presbyterian Church on Kellogg Creek, and at North Clackamas Park in partnership with North Clackamas Park & Recreation District.

CLACKAMAS WATER ENVIRONMENT SERVICES

Highlights

- 82 sites under restoration & active maintenance
- 70.4 acres
- 13,206 linear feet of riparian zone in restoration
- 38 sites in minimal maintenance
- 99% high or intermediate-priority sites in KMS Watershed Action Plan
- 8 workshops held on 3 topics for 83 participants (58 unique attendees)
- 75% of participants rated their learning highly (4 or 5 out of 5)
- 74% of participants reported feeling “much more” (53%) or “more” (21%) motivated to take action to protect watersheds than before workshop participation

Desired Vegetation Assemblages

- 40 Riparian Forest
- 20 Emergent Wetland
- 14 Forested Wetland
- 3 Oak Savanna
- 1 Wet Prairie
- 1 Upland Forest
- 1 Shrub Scrub

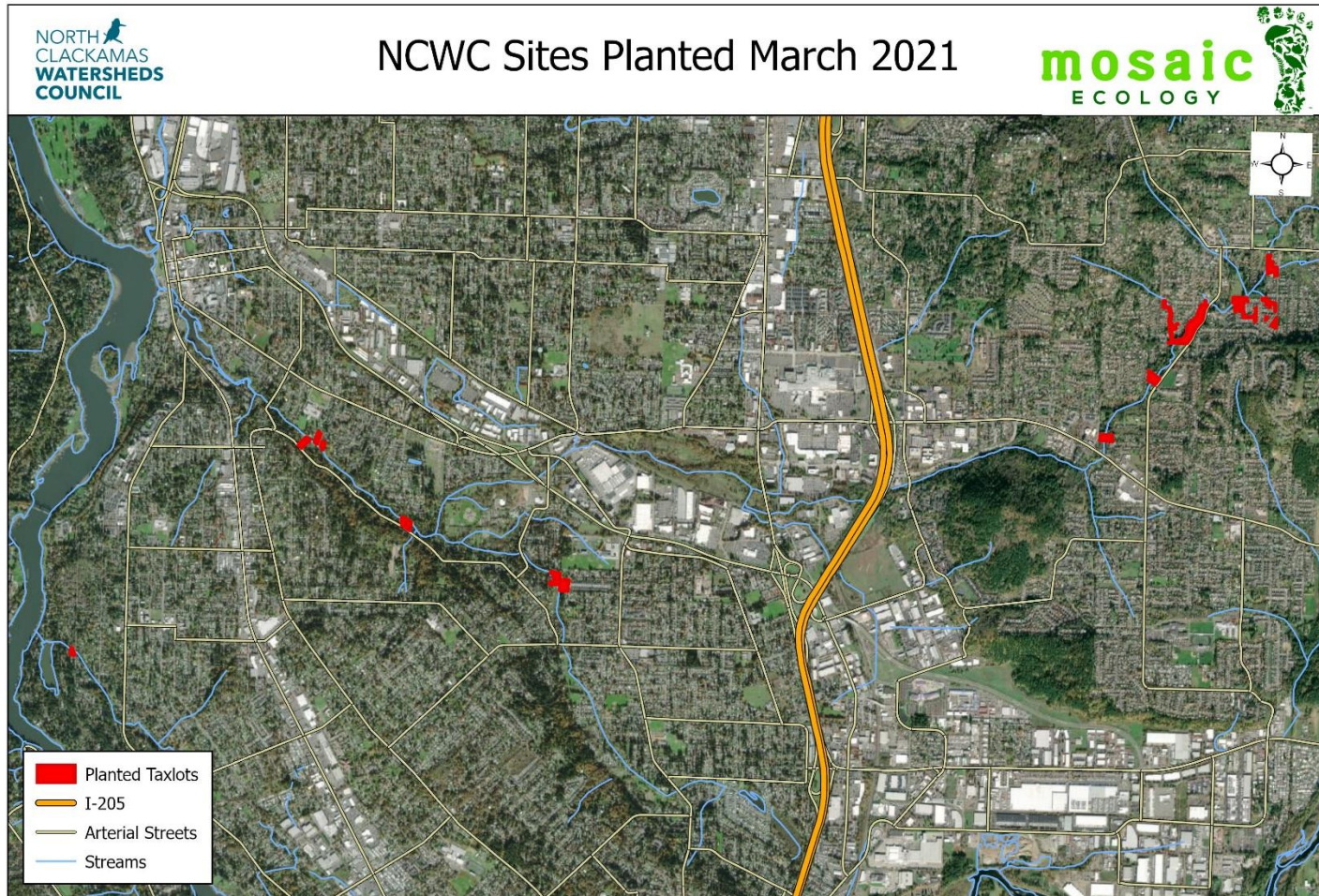
Keys to Success

- Outreach and expansion along Mt. Scott Creek over multiple years
- Additional resources for ongoing maintenance allowed the expansion of restoration efforts in this area and protected investments in past restoration
- Creative deployment of online workshops , participant agreements to take specific actions, and specific follow-up following workshops
- Focusing on large HOAs for contiguous restoration
- Coordination with Happy Valley Heights, Friends of Trees, City of Happy Valley and City of Milwaukie for contiguous restoration
- Continuing to engage landowners in site monitoring and EDRR

Plans for 2021-22

- Expansion of a new planting area in Mt. Scott Creek
- Ongoing maintenance to cover any gaps created by Covid-19
- Bringing workshops into the field at key sites in WES territory
- Individual visits to landowners

Maps

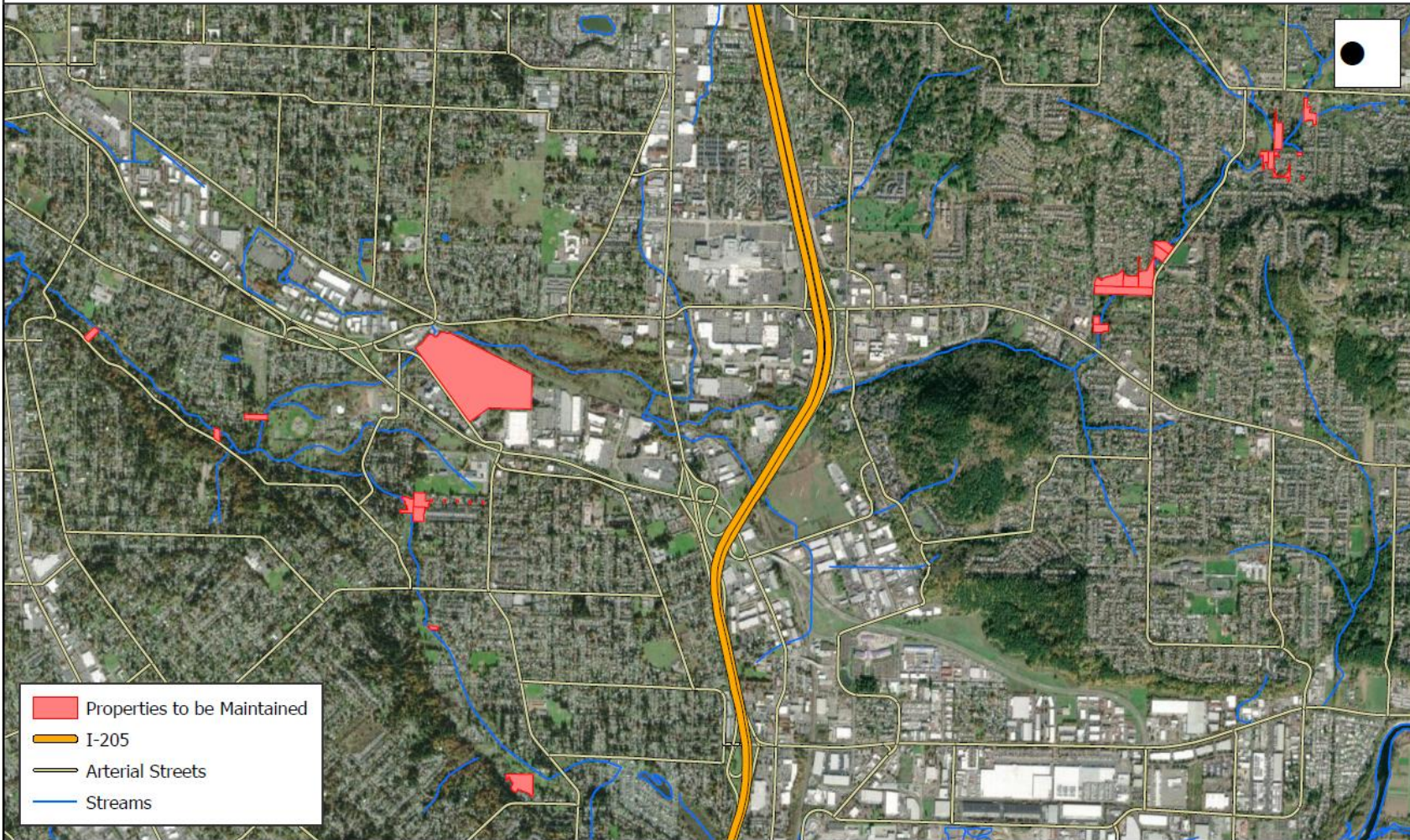


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Projection: NAD_1983_HARN_Stateplane_Oregon_North_FIPS_3601_Feet_Intl
Sources: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,
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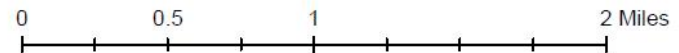
0 0.5 1 2 Miles

Maintenance for 2021

Taxlots identified for ongoing maintenance for 2021-22



Created by Mosaic Ecology on 3/29/2021
Sources: USDA FSA, GeoEye, Maxar, and user generated



**RIVERHEALTH WATERSHED STEWARDSHIP PROGRAM
RIPARIAN RESTORATION AND ENHANCEMENT REPORTING FORM**

Project Name: North Clackamas Watersheds Council Streamside Stewards Program

Tax Lot No. See Site Spreadsheet, attached

Area of NEW planting (not maintenance): 7.7 acres

Organization Info:

Organization name	North Clackamas Watersheds Council
Project manager	Neil Schulman, Executive Director
Phone number	503-550-9282

Project Info:

Fiscal year for activities (e.g. 2018-19)	2020-21
Stream/Tributary	Kellogg & Mt. Scott Creeks & Tributaries
Watershed Action Plan Priority Rating (H, I, M or NA)	25 high, 56 intermediate
Approx area worked on, acres	70.42
Length of stream worked on, linear feet	13,206
Left bank, right bank, (looking downstream) or both	Both, see spreadsheet
Width-left bank	See spreadsheet
Width-right bank	See Spreadsheet

Landowner name and address: Multiple, see attached spreadsheet

Landowner contact and agreement obtained: Yes No **Attached:** Yes No (Available on request)

*Attach map and site plan showing creek & extent of work area, number and locations of LWD or other habitat features, and photos of work. Please send map showing parcel and area worked on, and shape file if possible. May use <http://metromap.metro-region.org/metromap.cfm?Accept=accept> . **Attached.**

Focus of restoration activities: Use (M) for Major; (m) for minor activity for activities below.

Riparian vegetation planting: M Instream: Cleanup: Erosion: m Other: Invasive species control, downed wood advising

Invasives removed (acres): 63

Dominant invasive species: *Hedera helix, Reynoutria japonica, Rubus discolor, Alliaria petiolata, Phalarus arundinacea, Vinca major, Geranium lucidum, Crataegus monogyna, Ilex sp., Impatiens capensis, Solanum dulcamara, Prunus laurocerasus, Ficaria verna, Clematis vitalba, Iris pseudacorus, Convolvulus arvensis, Prunus lusitanica, Dipsacus sp., Fargesia scabrida, Buddleja davidii*

Removal techniques used: Spray, cutting, spot spraying, chipping of larger material. Herbicides used: Vastian, Garlon 3A, Rodeo

Level of infestation: Heavy, dense: Moderate: Light, scattered: Multiple, see attached spreadsheet

Maintenance visit: Year 0 15 Year 1 7 Year 2 5 Year 3 8 Year 4 2 Other 45
 (Note: Year 0 means year plants were installed, Year 1 means first year after planting.)

Maintenance type performed: Spray, cutting and spot spraying, interplanting

Check here if site is graduating (last year of maintenance under grant agreement)

38 sites have entered minimal maintenance status (1 visit/year for EDRR barring new infestations)

Natives Planted: (list species, numbers, and form-bare root or container, etc.)

See spreadsheet for complete species breakdown.

Trees	No.	Density or spacing	Size/form
<i>Quercus garryana, Fraxinus latifolia, Pseudotsuga menziesii, Tsuga heterophylla, Salix geyerana, Salix lasiandra, Rhamnus purshiana</i>	675	Variable	Bare root
Total # trees	675		
Shrubs		Variable	Bare root
<i>Cornus sericia, Mahonia aquifolium, Philadelphus lewisii, Ribes sanguineum, Sambucus pprox. , Sambucus racemose, Spirea douglasii, Symphoricarpus albus, Polystichum minitum, Mahonia</i>	2925		

<i>aquifolium, Rubus spectabilis, Rubus parviflorus, Oemleria cerasiformis, Holodiscus discolor</i>			
Total # shrubs	3600		

Other materials such as coffee bags, geotextile, stakes, browse protection, mulch, soil amendments, fencing, signage, etc.

Material	Approximate number or amount
Soil amendments/mulch, plant protection, erosion control fabric, herbicide, surfactant, indicator dye	Various

List any schools that participated, if any: __Not applicable_____

Donated Hours:

No. of volunteers	Total donated hours	Hourly rate	Value of volunteer time
35	105	\$ 28.54 (Independent Sector Rate)	\$2,996.70
# of volunteers in District zip codes:	N/A	% of volunteers in District zip codes:	

Monitoring Results:

% survival	% weed cover	% bare soil	Other results or performance standards

Planned accomplishments or recommendations for future work on this site: Multiple sites, see attached spreadsheet and narrative.

Estimate for future maintenance: pprox.. \$ per year	\$30,000 for full program
Estimate for future maintenance: pprox.. # of years	Variable with new infestations. Most sites currently in minimal maintenance mode take approximately 6-8 years to reach this point of stability where one visit/year is sufficient to maintain desired vegetation assemblage and conduct EDRR.

Lessons Learned (how will management activities change based on results to date, what worked well, how to respond to unanticipated conditions, advice for those undertaking similar work, changes from original scope of work, etc.):

See attached narrative

Photographs: Please provide representative samples of digital photos taken for District projects and indicate which can be used in District publications and websites.

See attached photos

EXHIBIT B

2020-21 EDUCATION & OUTREACH REPORTING FORM

Project Name: Streamside Stewards Watershed Education

Organization Name: North Clackamas Watersheds Council

Project Info:

Watershed	Kellogg-Mt. Scott
Total number of educational events, community presentations, and public tour participants	8

Activities:

Public outreach events 1 Educational events or tours for general public 7

Educational events for students and/or teacher training 0

Other (describe) N/A

For Public Outreach/Ed/Tabling/Online Events:

Name of Event	Get to Know North Clackamas Watersheds Workshop Series
Dates	10/7/2020, 12/1/2020, 12/8/2020, 1/12/2021, 3/30/2021, 4/6/2021, 4/13/2021
Brief description of event	North Clackamas Watersheds Council (NCWC) developed a three-part online workshop series, offered via Zoom to community members through 2020-2021. The topics were: Get to Know North Clackamas Watersheds (offered three times), Wildlife in North Clackamas Watersheds (offered twice), and North Clackamas Watersheds, People, and Places (offered twice). NCWC followed up with workshop attendees, sharing resources and responding to specific interests or stewardship actions identified by individuals.
No. of attendees in WES service district or WES district zip codes	52
No. of community presentations or tours, online or in person	8
No. of tour or online participants	83 (+ Milwaukie Earth Day?)

Name of Event	City of Milwaukie's Earth Day Event
---------------	-------------------------------------

Date	4/24/2021
Brief description of event	The City of Milwaukie hosted a virtual Earth Day event featuring presentations from partner organizations (including NCWC) and city staff covering a variety of sustainability topics aligning with the climate action plan. Each presentation included an interactive discussion (Council was a panelist) and a call to action for community members to volunteer or implement into their daily lives.
No. of attendees in WES service district or WES district zip codes	Data not collected by City of Milwaukie
No. of community presentations or tours, online or in person	2
No. of tour or online participants	83

For School (Student/Teacher Education): Not applicable

Names of schools	
No. of students or no. of attendees	
No. of educational events or online sessions	
No. of volunteers	

- 83 total participants
- 58 unique participants
- 25 participants attended multiple workshops in the series

Evaluation Summary:

"On a scale of 1-5 (5 is high), how much did you learn about our watersheds that you didn't know before?"

- 5 (learned a lot): 21% (4 individuals)
- 4: 53% (10 individuals)
- 3: 26% (5 individuals)
- 2: 0% (0 individuals)
- 1 (no new info): 0% (0 individuals)

"On a scale of 1-5 (5 is high) how much do you feel more motivated and/or competent to take action to help your watershed?"

- 5 (feeling much more motivated and/or compelled to action): 53% (10 individuals)
- 4: 21% (4 individuals)
- 3: 16% (3 individuals)
- 2: 10% (2 individuals)

- 1 (no change): 0% (0 individuals)

Quotes from evaluations:

- "The presentation was very well done. The Power Point and lecture [were] interesting and informative."
- "There's so much for me to learn and much more curiosity that I have. Definitely participating again!"
- "It was a great presentation, and I learned a lot. Thank you!!"
- "Thank you for sharing updated information with community."
- "Mixture of photos, videos, and info was great!"
- "I look forward to learning more about in future topics"

SELECTED SITE PHOTOS

City of Happy Valley, 12E35BD01300, 12/17/2020



Meyer Property, 22E06CB00300, 3/2019



City of Happy Valley, 12E35BD01300, 4/6/2021



Meyer Property, 22E06CB00300, 1/2021



OAK LODGE WATER SERVICES

Highlights

- 66 sites, totaling 24.32 acres under restoration
- 6,344 linear feet of riparian area
- 570 trees and shrubs planted
- 34 sites in minimal maintenance mode
- Shade analysis methodology developed, tested, and documented
- 8 workshops held on 3 topics for 83 participants (58 unique attendees)
- 75% of participants rated their learning highly (4 or 5 out of 5)
- 74% of participants reported feeling “much more” (53%) or “more” (21%) motivated to take action to protect watersheds than before workshops
- Convened and facilitated larger group of partners to adapt landowner engagement to Covid-19

Desired Vegetation Assemblages

- 36 Riparian Forest
- 7 Emergent Wetland
- 17 Forested Wetland
- 8 Upland Forest

Keys to Success

- Shade analysis for more strategic restoration in the future
- Intensive communication with landowners due to Covid-19 restrictions, fires, and ice storm impacts
- Engaging landowners in photo point monitoring and EDRR
- Positioning for a temperature study to begin in 2021-22

Plans for 2021-22

- Increased maintenance to make up for any ground lost due to Covid-19 restrictions
- Fly the final section of Boardman Creek; complete shade analysis and incorporate analysis into Watershed Action Plan
- Continue partnership with Portland Community College
- Finalize temperature study protocol in partnership with DEQ and the City of Gladstone; deploy temperature loggers

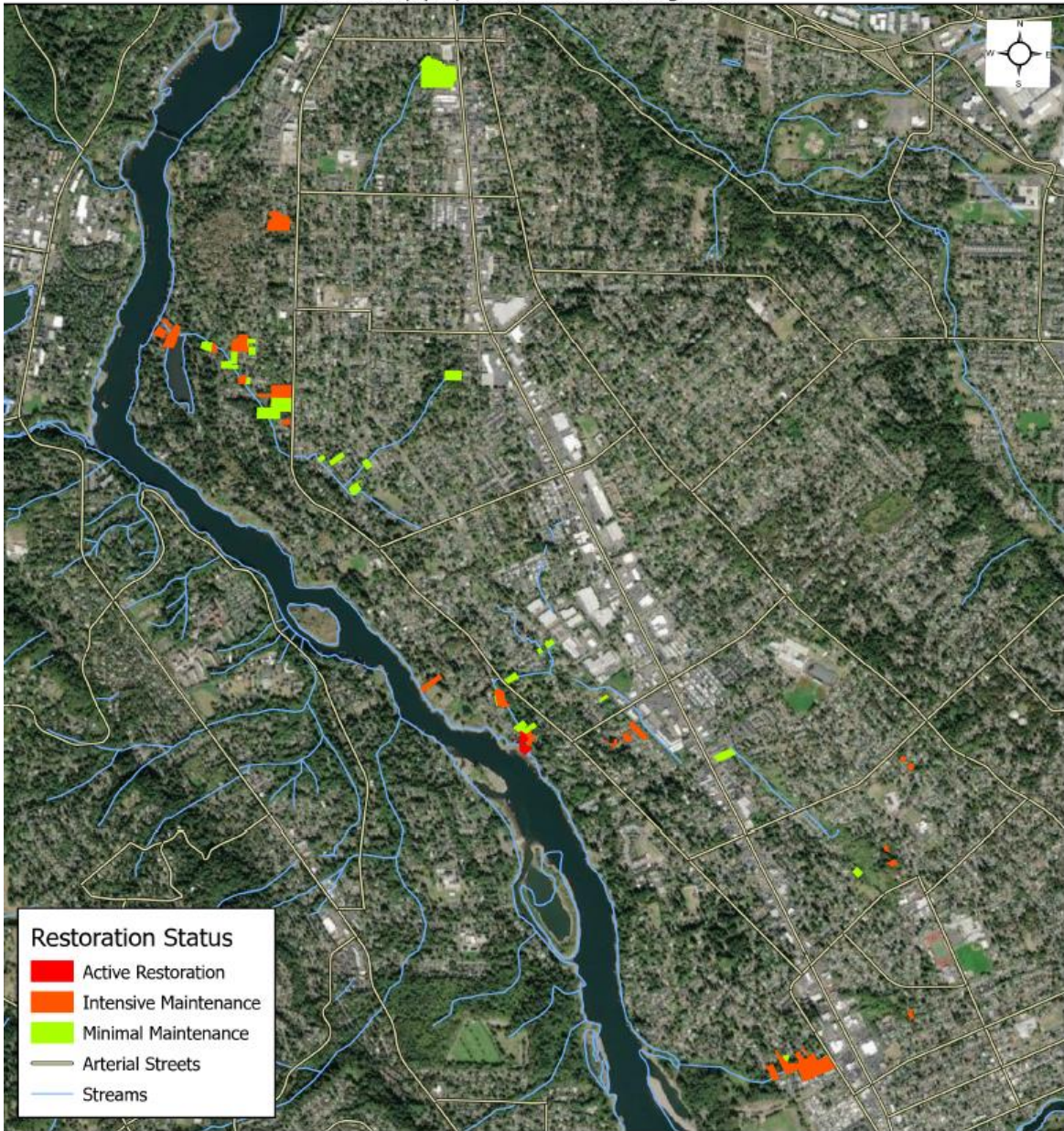
Maps



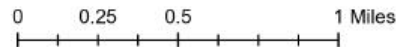
Maintenance Status of Oak Lodge Sites



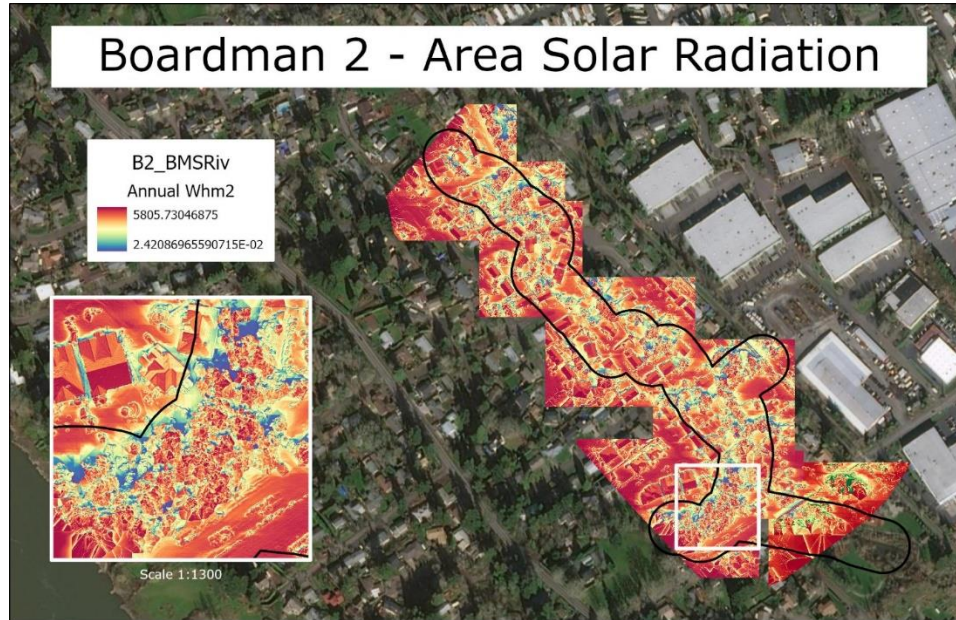
Highlighting Maintenance status for 2021 of NCWC Partnership properties within Oak Lodge area.



Create by Mosaic Ecology on 6/21/2021
Service Layer Credits: World Imagery: Earthstar Geographics,
Metro, and User Generated



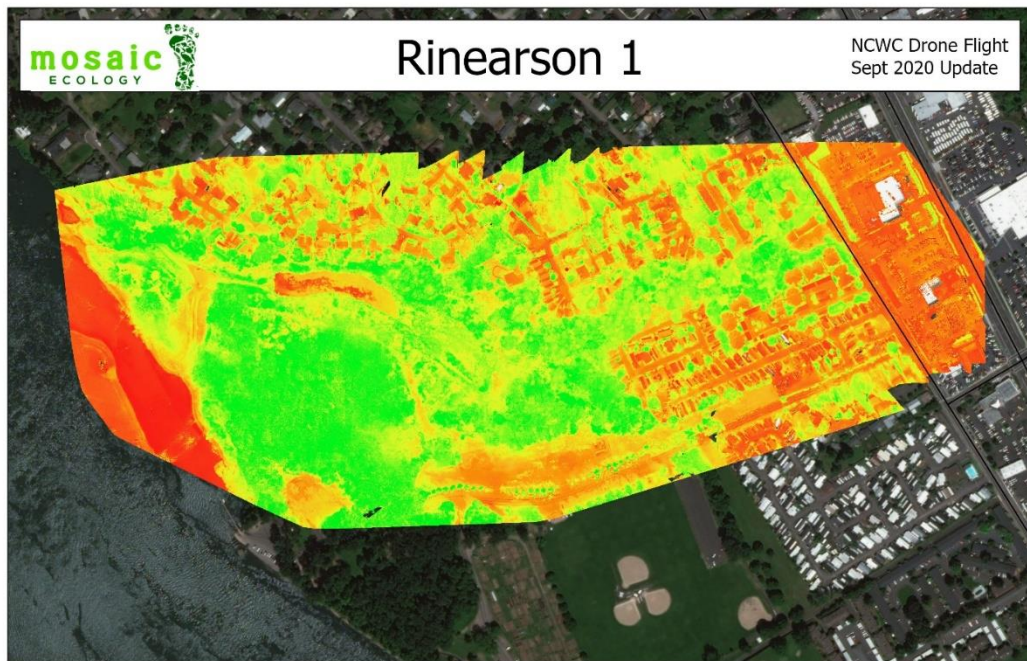
Shade Analysis Sample Plots



Map created by Mitchell Gellhaus
Portland Community College GIS Internship Winter 2021
Source: GeoEye, Maxar, Microsoft, USDA FSA, GeoEye,
Maxar, NCWC & Mosaic Ecology

0 250 500 1,000 Feet

Scale 1:4000



NDVI Reflectance

Created by Mosaic Ecology on 9/10/2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,
AeroGRID, IGN, and the GIS User Community, Metro RLIS, and User Generated.

0 375 750 1,500 Feet





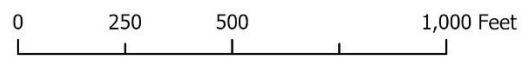
River Forest 2

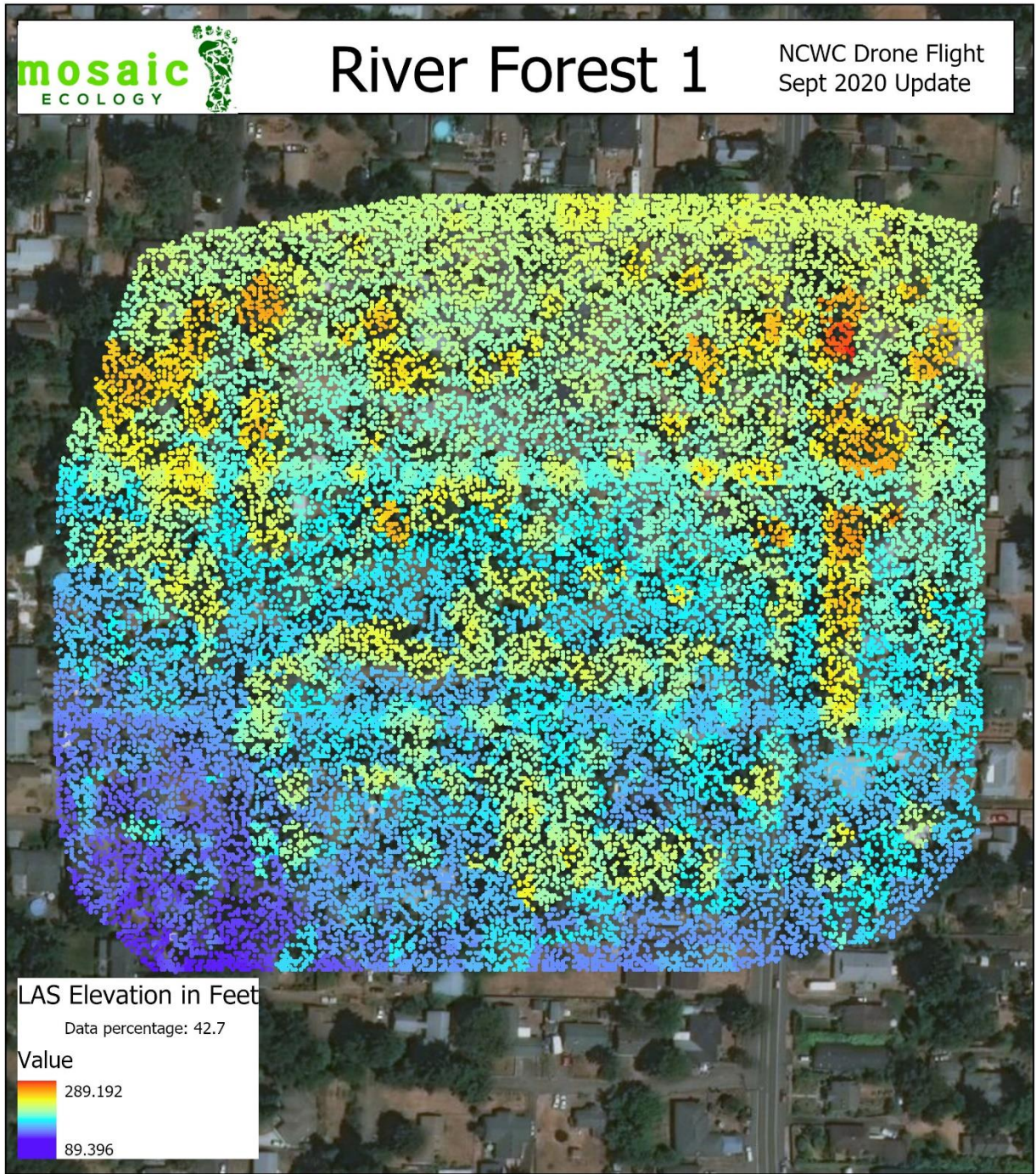
NCWC Drone Flight
Sept 2020 Update



Digital Surface Model

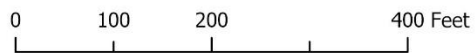
Created by Mosaic Ecology on 9/10/2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/
Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User
Community, Metro RLIS, and User Generated.

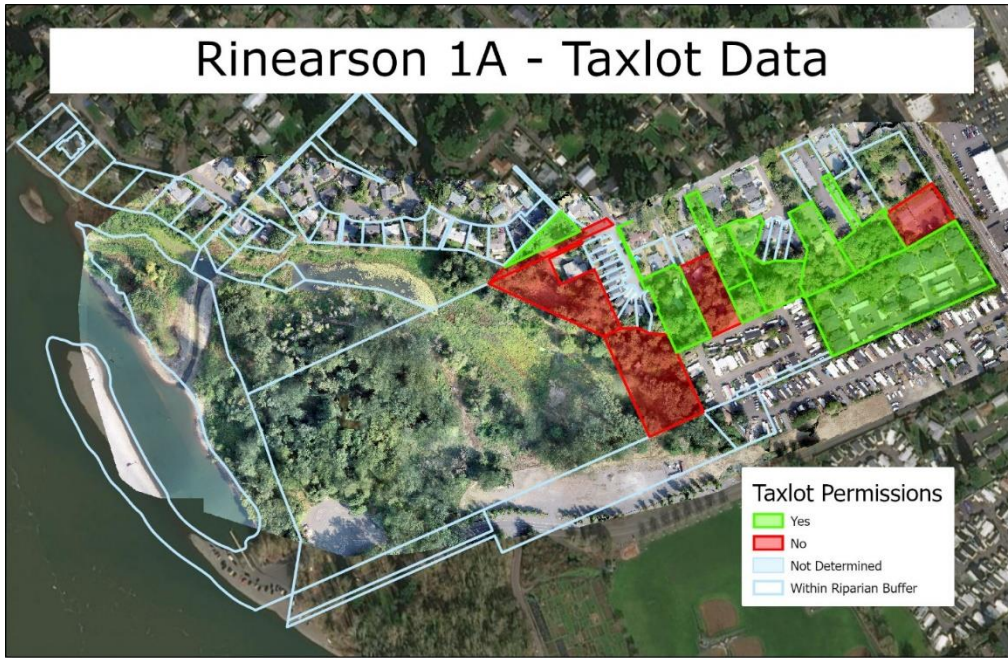




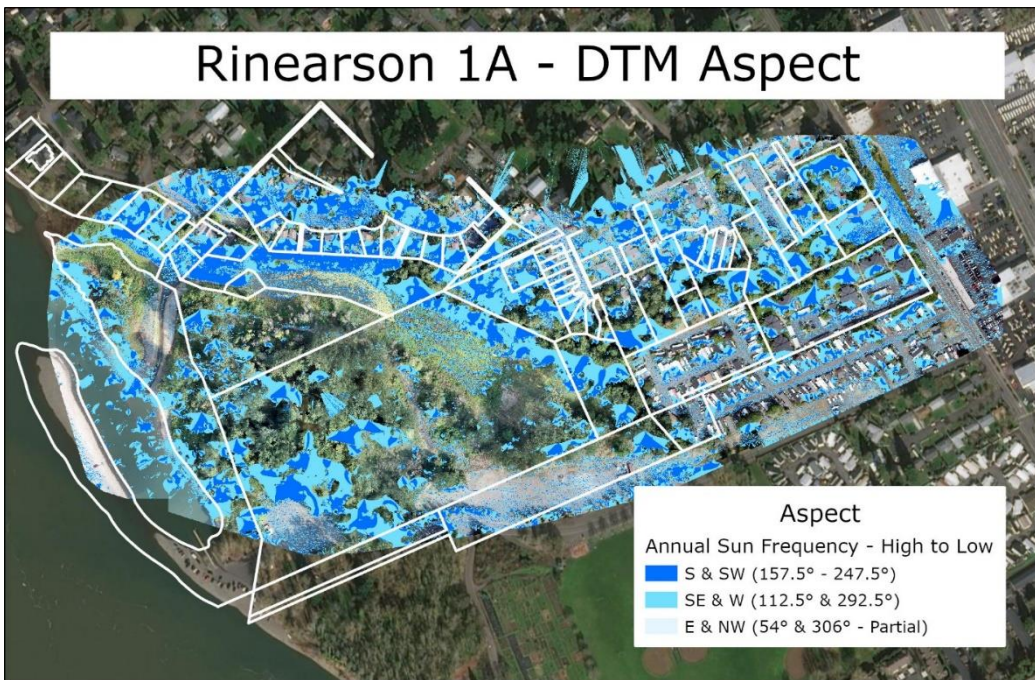
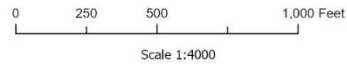
LAS point elevation data in US feet

Created by Mosaic Ecology on 9/10/2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Metro RLIS, and User Generated.

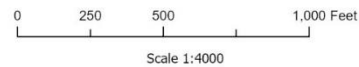




Map created by Mitchell Gellhaus
 Portland Community College GIS Internship Winter 2021
 Source: USDA FSA, GeoEye, Maxar, NCWC & Mosaic Ecology



Map created by Mitchell Gellhaus
 Portland Community College GIS Internship Winter 2021
 Source: USDA FSA, GeoEye, Maxar, NCWC & Mosaic Ecology



Lewis Property, 22E19DB00701, 10/10/2020



Lewis Property, 22E19DB00701 6/23/21



MILWAUKIE

Highlights

- 12 sites in active restoration
- 19 acres, 5,119 linear feet of streambank
- 570 trees and shrubs planted

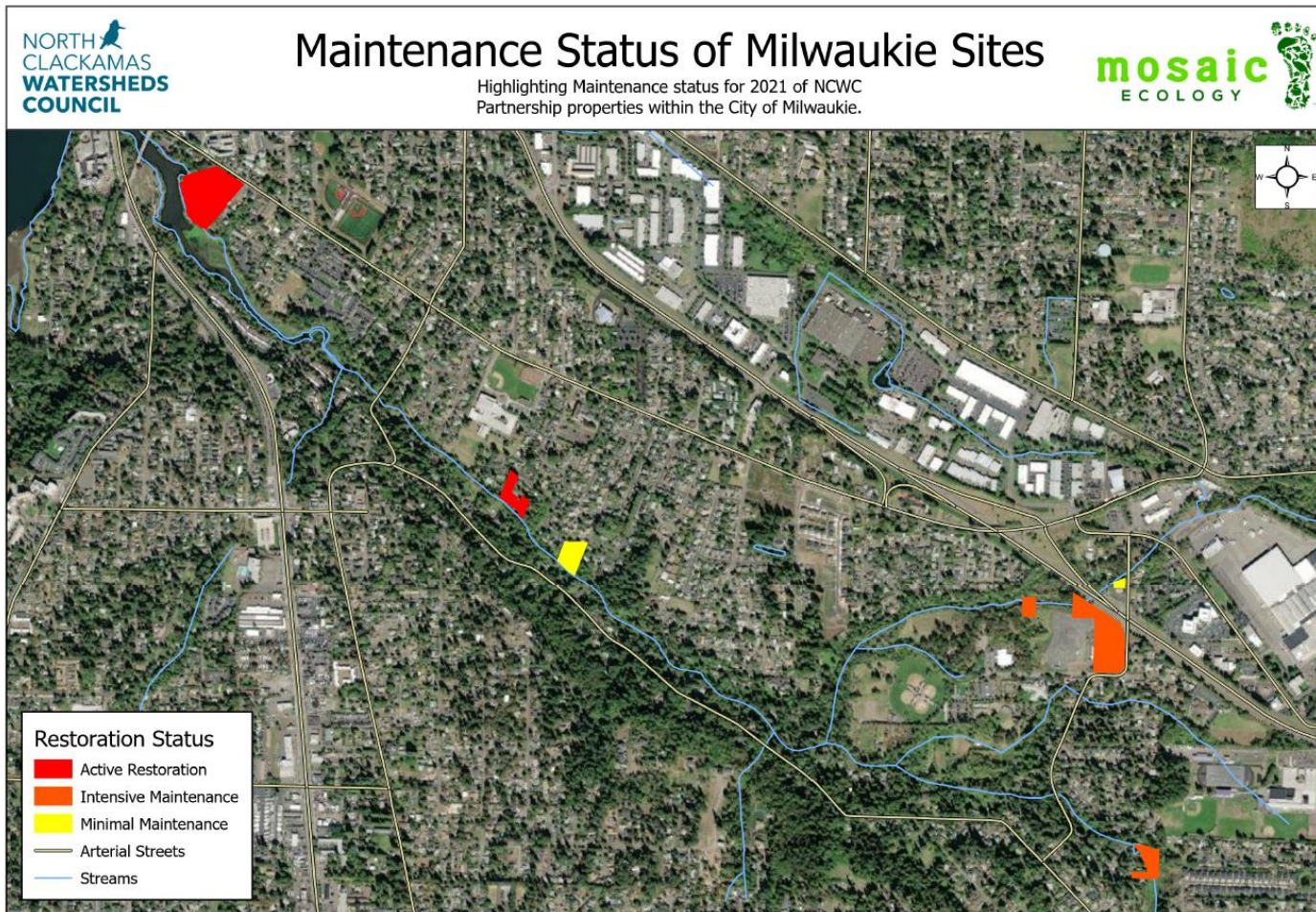
Keys to Success

- Leveraged funding for intensive restoration at Kellogg Lake Sanctuary owned by Milwaukie Presbyterian Church when a partnership with Milwaukie High School was cancelled due to pandemic
- Creative Outreach during Covid-mailers, phone calls, etc.
- Focusing on specific geographical areas, with contiguous restoration across Kellogg Creek from WES restoration sites to create one large acreage
- Multiyear agreement with the City of Milwaukie has provided landowner assurances and adequate maintenance

Plans for 2021-22

- Continue landowner communication, resume face-to-face visits that were not possible in 2020-21
- Continue active restoration at sites
- Identify 2-4 new sites, depending on acreage

Maps



SITE PHOTOS

Beideck Property, 21E01AB00400, 11/15/19



Beideck Property, 21E01AB00400, 1/6/21



SHADE ANALYSIS METHODOLOGY

Developed as a partnership among the Council, Mosaic Ecology, and Christina Friedle and Mitchell Gellhaus of Portland Community College.

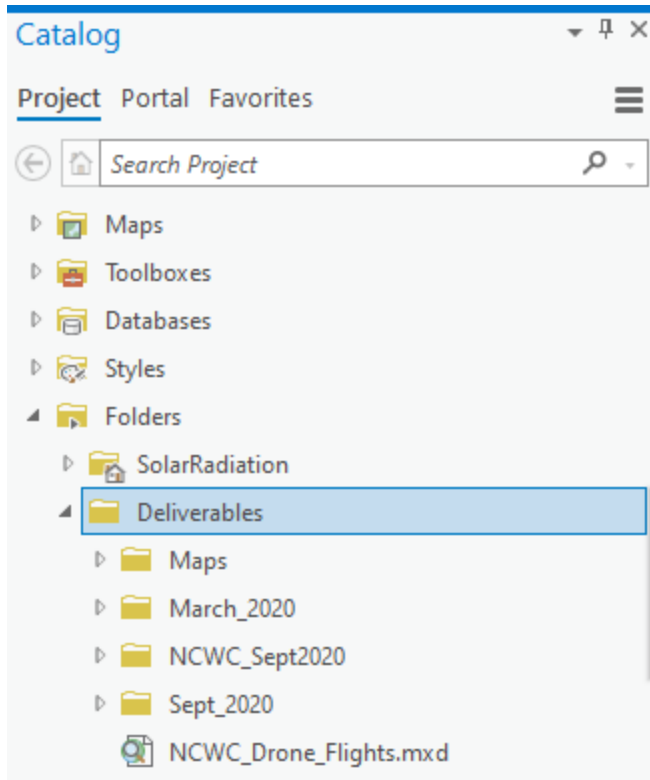
After the project design, landowners were contacted for permission to use their property for drone landing/launching. As many were and are existing Streamside Stewards partners, this was a relatively simple process. The Council notified landowners via email, a website posting, and social media posting about the nature of the project to allay any concerns about privacy related to the drone flights.

Drone aerial imagery was collected by Mosaic Ecology and rendered into raster data sets during the months of March 2020 and September 2020. The data consisted of Orthomosaic, Digital Surface, Lidar data and Digital Elevation models. Raster transparency and symbology were adjusted to best display overlapping images in the digitization of the riparian vegetation and water bodies.

Digitization of Vegetation & Riparian Zones

Riparian buffer zones of 100 feet from the water's edge were constructed. The buffer size was determined based on shade measurements taken during the summer solstice (maximum altitudes and headings representing peak sun exposure to an area).

1. In the **Catalog** pane, left-click on **Folders** to connect location of raster datasets.

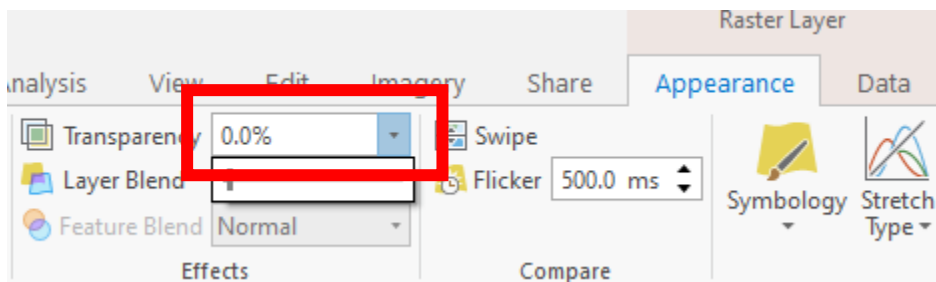


If this is already connected, navigate to the desired raster datasets, then drag & drop them into the **Map** pane. Rasters used and drawing order placement are:

- Orthomosaic
- DSM
- Lidar

2. **Highlighting the Orthomosaic**, change the transparency so that the DSM and Lidar rasters can be seen beneath. This is found under the **Appearance** tab on the **Effects** pane.

Between 25-40% transparency is sufficient.°

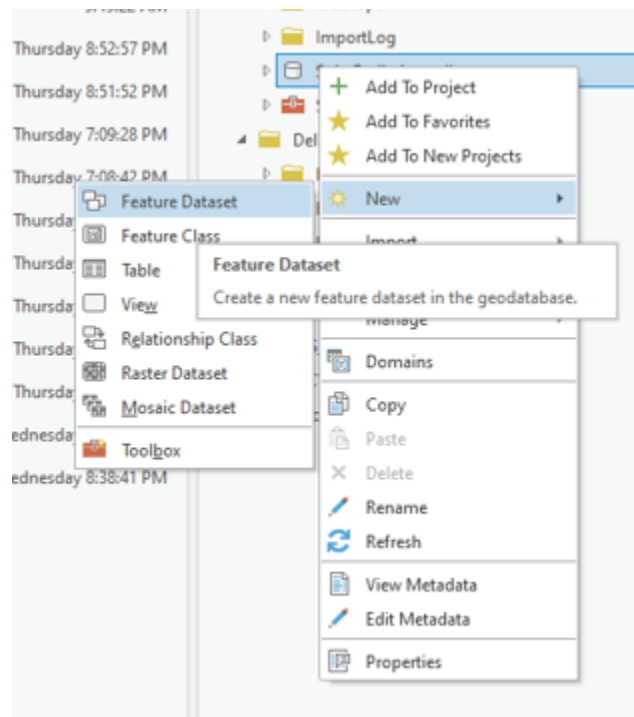


3. Navigate to the **Catalog** pane and navigate to your Arc Geodatabase (.gdb) under the **Folders** tab. Right-click > New > Feature Dataset. Name your **Feature Dataset** for organizing digitized features (Ex: B2_RiparianFeat, B2_Vegetation).

Set the Spatial reference to **NAD 1983 HARN StatePlane Oregon North FIP (Intl Feet)**. This will keep the layers within the feature dataset at the same projection.

This will be used to organize digitized features in the raster area

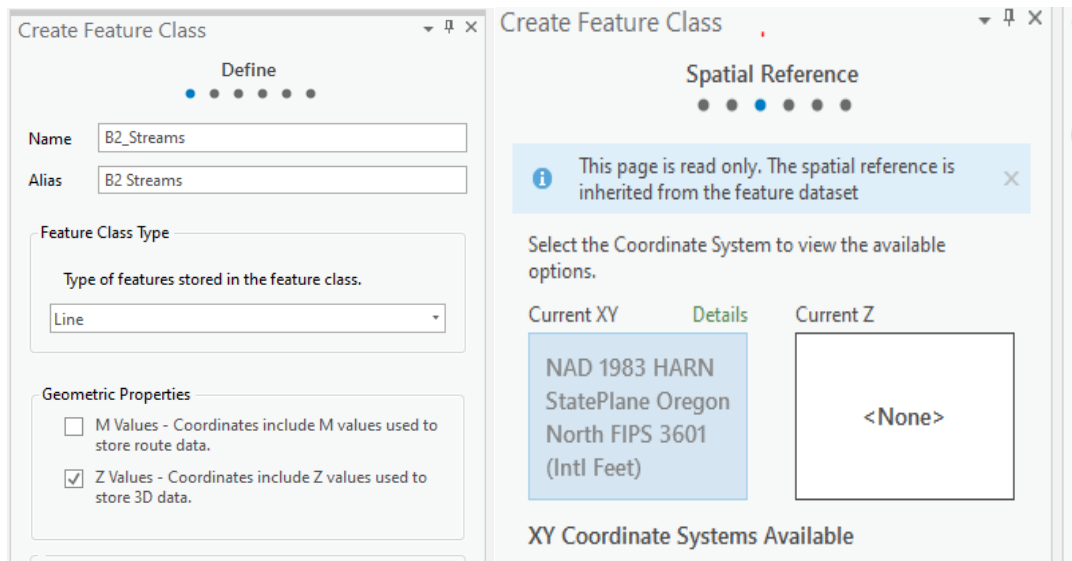
- Can include all vegetation & water,
- Taxlots of our area (Boardman2) or,
- Separate feature datasets can be used for individual group organization



4. Within the **Feature Dataset** right-click & insert a **Feature Class**. We will start with streams and rivers.

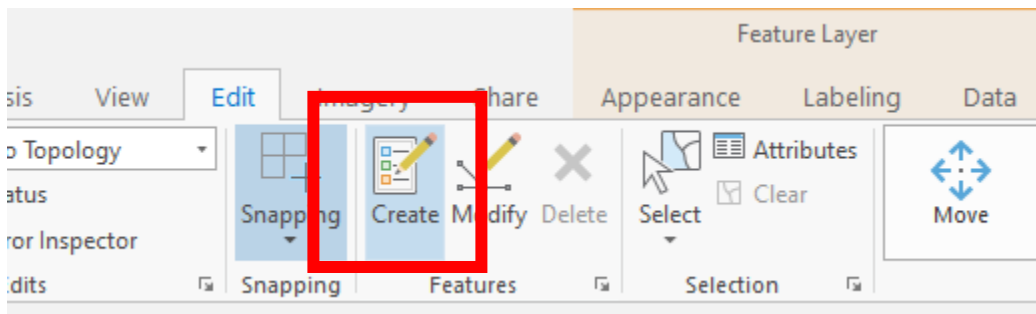
Name this layer in reference to **Water** (ex: B2_Streams, B2_WaterBodies, B2_River).

Make sure the **Feature Class Type** is **Line** and confirm the **Spatial Reference** is **NAD 1983 HARN StatePlane Oregon North FIP (Intl Feet)**.



Click **Finish**

5. Select the new stream layer under the **Catalog** pane, click the **Edit** tab and open **Create Features**.

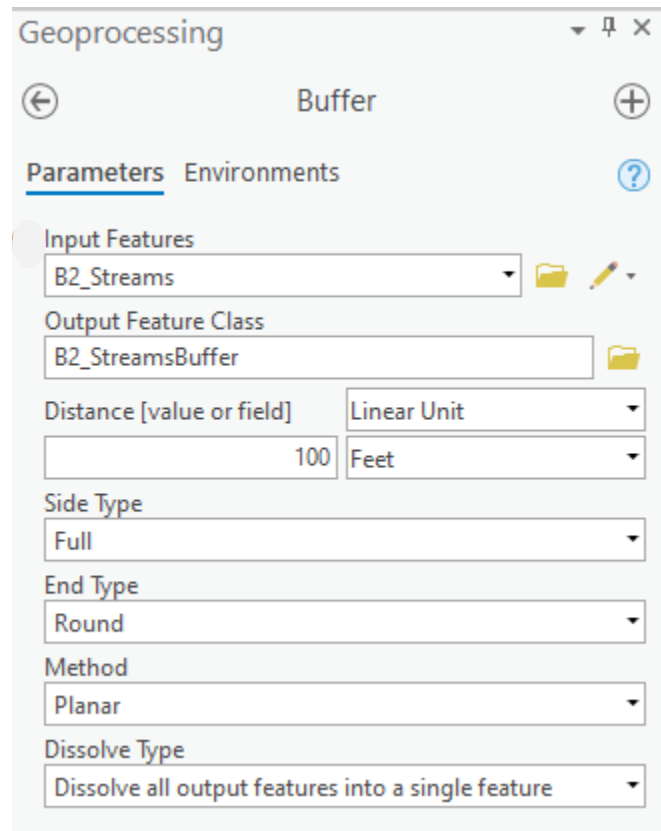


6. Viewing the transparent Orthomosaic over top the DSM and/or Lidar, navigate and digitize the stream channel by creating vertexes along the waterway. As you come to larger bodies of water such as ponds or lakes, continue the line digitization around the perimeter. Zoom in and out as needed to best create these features.

7. Once satisfied with the layer creation, make sure to **Save** your edits & project.
8. In **Geoprocessing**, go to the **Buffer** tool. Input your created stream layer and name the output **B2_StreamBuffer**. Make sure the output folder is to a desired location.

Make the **Distance** parameter **Linear Units** and **100 feet***
Set **Dissolve Type** to **all output features into a single feature**

Click **Run**



*this was determined by finding the maximum altitude and heading for the sun through the year (Altitude: 68°; Heading: 54° to 306°) and measuring the approximate shadow distance from the base of vegetation. This helps show which riparian areas have maximum sun exposure and should be prioritized for shade restoration.

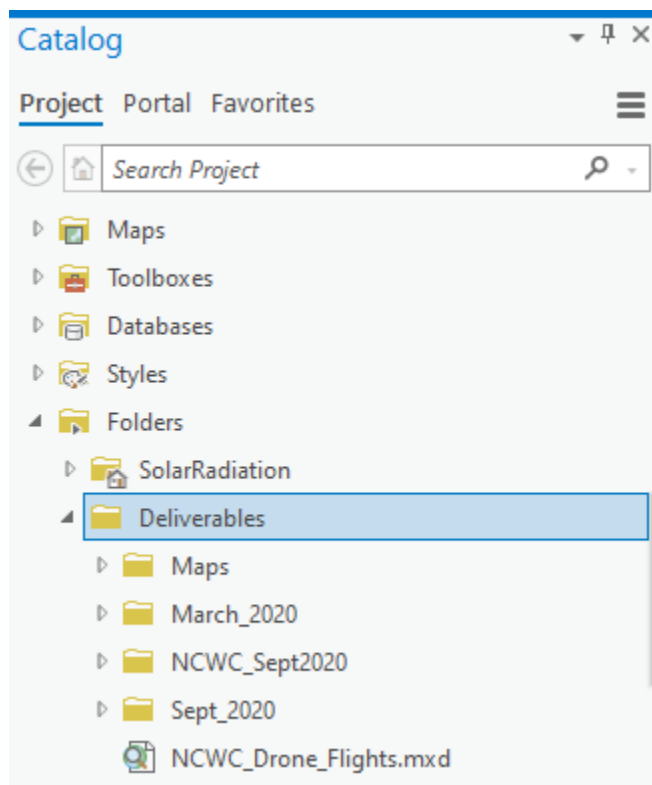
9. Repeat steps 3 through 5 for **Vegetation** with the **Feature Class Type** as **Polygon**. Digitize a vegetation layer that lie within and just outside the Stream buffer zone. Use the transparent Orthomosaic raster over the Lidar & DSM rasters for best accuracy of digitization.

Save edits and the Project.

Creating Taxlot Layers & Information

Using Clackamas County tax lot data, On X Hunt's land ownership layer, and Mosaic Ecology-provided data, I was able to derive the tax lots that intersected with each riparian buffer zone. Permission of each ownership lot was determined as a Yes, No, or Null value and exported as individual data layers. The Null values represent properties that still need to be contacted, if restoration is necessary/desired within their tax lot.

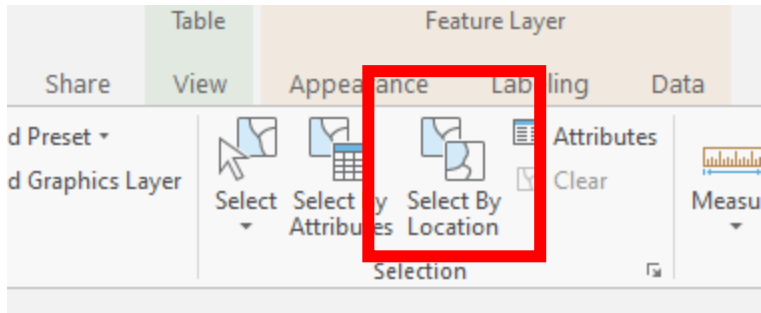
1. Return to the **Catalog** pane, left-click on **Folders**, and navigate to the location of the taxlot data.



Drag & drop the taxlot shapefiles into the map pane.

These will be labeled depending on study area. Here, I used **tax_parcel.shp** (All of Clackamas County) and **NCWC_Taxlots.shp** (Relevant Mosaic Ecology taxlot data)

2. Navigate to the **Select by Location** tool and open.



Set the following criteria:

- **Input Feature:** tax_parcels
- **Relationship:** Intersect
- **Selecting Features:** B2_WaterBuffer

Click **Apply** and then hit **OK**. This should highlight any taxlots that fall within the 100 ft. riparian buffer zone. Right-Click on tax_parcels in the **Contents** pane > **Data** > **Export Features**

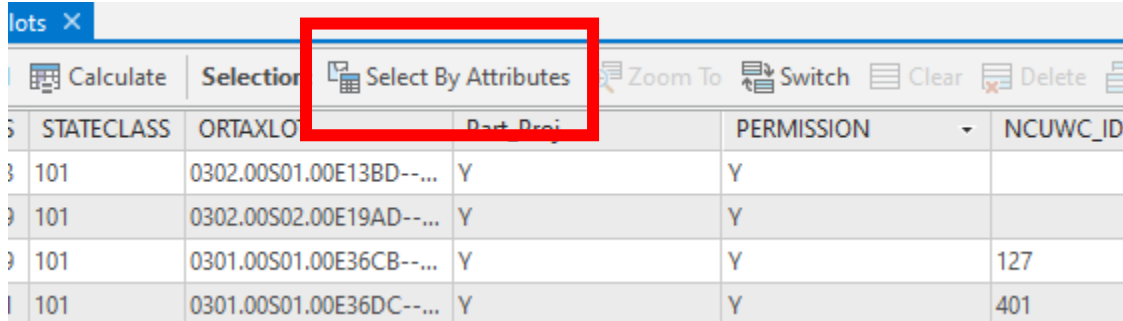
Label these taxlots as **B2_taxlots**.

Repeat step 2 with **NCWC_Taxlots** as the input and export lot data as **NCWC_B2_Taxlots**

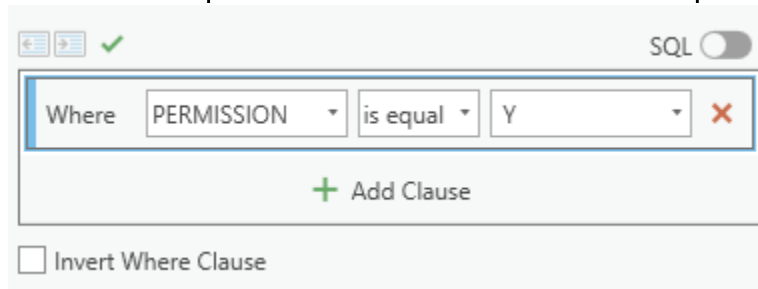
- From Contents, Right-click on **NCWC_B2_Taxlots** and open the **Attribute Table**.

This will show you more detailed information on all the taxlots included within the shapefile. Scroll through to find the 'PERMISSION' column label and observe the values are either Y (yes), N (no), or empty (Null).

- Open the **Select by Attributes** tool found in the table



- Start a **New Expression** where 'PERMISSION' 'is equal to' value 'Y'.



Apply and click **OK**. Then Export the Y Permission features into a new feature layer.

Repeat with the '**Null**' and the '**N**' permission values in the Boardman creek area.

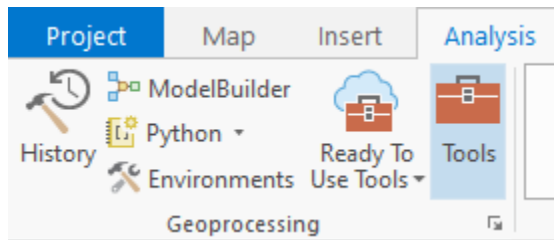
Using Clackamas County tax lot data, On X Hunt's land ownership layer, and Mosaic Ecology-provided data, I was able to derive the tax lots that intersected with each riparian buffer zone. Permission of each ownership lot was determined as a Yes, No, or Null value and exported as individual data layers. The Null values represent properties that still need to be contacted, if restoration is necessary/desired within their tax lot.

Using the DSM raster for each location, I conducted area solar radiation analysis to determine areas of high solar exposure. The parameters and environments for this were:

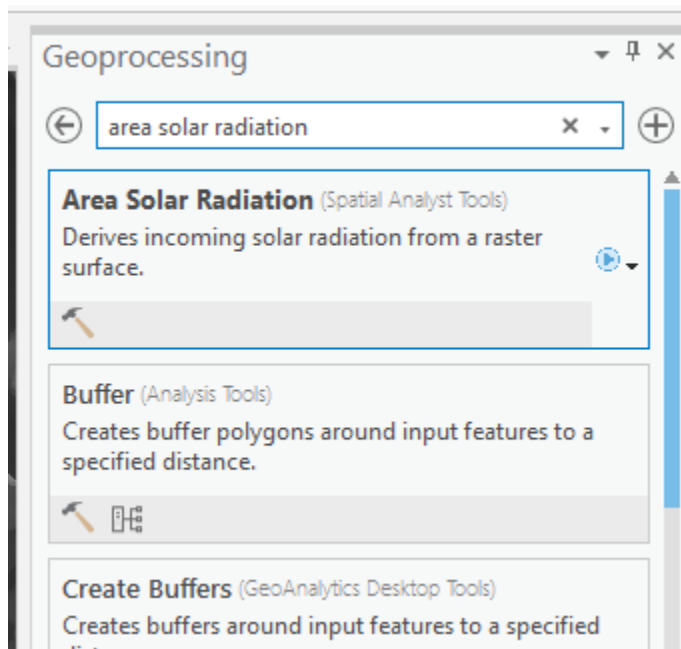
With Special days being equal to the Solstice and Equinox, extent equal to the buffer zone

Area Solar Radiation Analysis

1. Under the **Analysis** ribbon, select the **Tool** box. This will open **Geoprocessing** search box.



2. Under **Geoprocessing**, search for and open the **Area Solar Radiation (Spatial Analyst Tools)** tool.



3. Begin setting up Parameters as follows:
 - Set the **Input Raster** as the **DSM** of the study area (ex: B2_DSM_Sept2020)
 - Change the **Output Global Radiation Raster** to a suitable name for reference (ex: AreaSolar_B2_Taxlot1)
 - i. Make sure the output folder location is your desired destination for the raster
 - The **Latitude** is automatically created when the **Input Raster** is selected (in this case, the latitude of the DSM). **Latitude** helps determine the position of the sun.
 - Keep **Sky Size/Resolution** as **200**, the default.

- Under **Time Configuration**, select **Special Days**. These represent the Solstices and the Equinoxes.
 - i. This value was decreased to these four days to reduce calculation time. And represent potential highs & lows.
 - **Hour Interval** was set to **2**.
 - **Calculation Directions** were set to **8**.
 - i. The tool automatically sets 32 azimuth directions but was decreased for the sake of calculation time. Values must be in multiples of 8 (8, 16, 24, 32, etc.)
 - Leave the rest default
4. The Environments set up is as follows:
- **Output Coordinate System**: Same as the **DSM** raster
 - i. NAD 1983 HARN StatePlane Oregon North FIP (Intl Feet)
 - **Extent** is set to the desired area size
 - i. **DSM** if processing speed allows,
 - ii. **Buffer** for smaller range of processing,
 - iii. **Taxlots** layer(s) as can be easily rendered by the operation system
 - All lots, a few lots, null/yes/no permission lots, singular lots
 - **Cell size** is **Same as layer DSM**
 - Leave the rest Default

Geoprocessing Area Solar Radiation

Parameters Environments

Input raster
B2_DSM_Sept2020_Clip

Output global radiation raster
AreaSolar_B2_Taxlot1

Latitude 45.400595720153284

Sky size / Resolution 200

Time configuration Special days

Hour interval 2

Topographic parameters

Z factor 1

Slope and aspect input type
From the input surface raster

Calculation directions 8

Radiation parameters

Zenith divisions 8

Azimuth divisions 8

Diffuse model type
Uniform overcast sky

Diffuse proportion 0.3

Transmittivity 0.5

Optional outputs

Run

Geoprocessing Area Solar Radiation

Parameters Environments

Output Coordinates

Output Coordinate System
NAD_1983_HARN_StatePlane_Oregon_North_FIP!

Geographic Transformations

Processing Extent

Extent As Specified Below

7655498.72145669 7655918.5656168

638499.381561682 638790.763123363

Raster Analysis

Cell Size
logy\B2\Boardman2.gdb\B2_DSM_Sept2020_Clip

Cell Size Projection Method
Convert units

Mask

Snap Raster

Geodatabase

Output CONFIG Keyword

Auto Commit 1000

Raster Storage

Tile Size Width 128 Height 128

Run

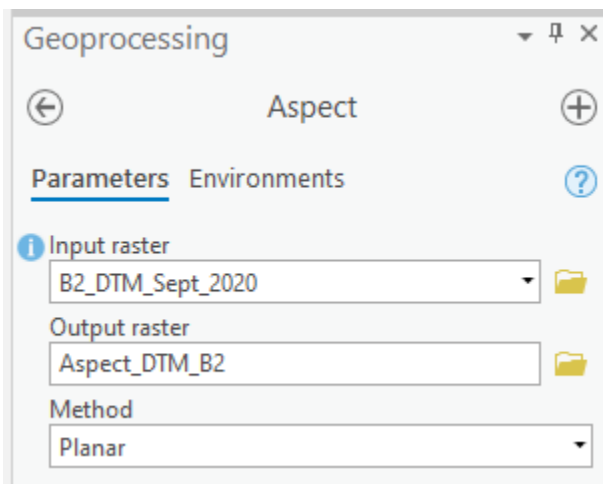
Example of Boardman Creek 2 Area Solar Radiation rendering (8-9 taxlot chunks; between 3 to 11 hours each)



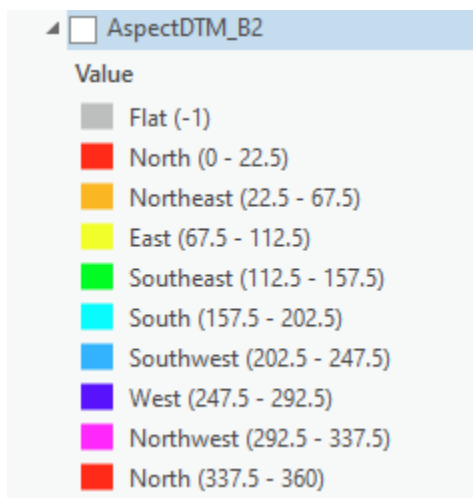
Aspect Layer Creation to Determine Highest Yearly Sun Heading Exposure

Here, an Aspect layer of the study area was created and then reclassified to highlight which terrain slopes face the sun throughout the year. Due to the location of the study areas, the aspects with the highest yearly sun exposure and solar radiations are

1. Open the **Geoprocessing** window to find the **Aspect (Spatial Analysis Tool)**
2. Select the **Input** as the B2_DTM_Sept_2020 raster (If this layer is not in the Contents pane, navigate to it within Catalog > Folder). Name the Output and select the appropriate location for the raster.

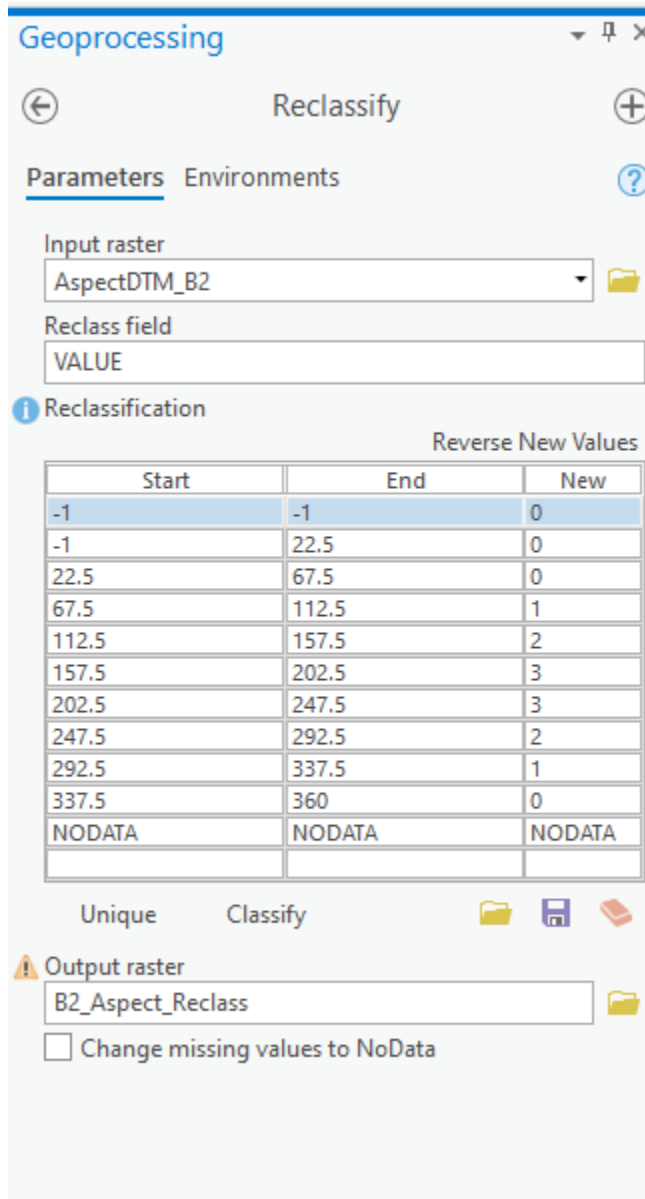


The output file should be represented by cardinal directions and degrees



3. Return to the **Geoprocessing** window and open the **Reclassify** tool.

Select the newly made **AspectDTM_B2** raster and manually reclassify the new field values as 0, 1, 2 and 3 (seen below).



Click **Run**

The values represent which areas most face the sun's heading throughout the year:

3 - 2: year-long sun heading with highest sun altitudes

1: Partial sun headings (not full angle; mainly in summer)

0: Obscured from sun direction; No data values

In regards to the shade analysis of this project, we are mostly interested in South and West facing slopes. Because of the solar heading range through the year and this

interest, our window lies slightly larger with slopes facing between 112.5° - 292.5° (SE - NW).

4. Open the **Symbology** window for **B2_Aspect_Reclass**. Adjust the color palette as desired of each value to best show areas of interest.

CON Tool Raster for Shade Priority Areas

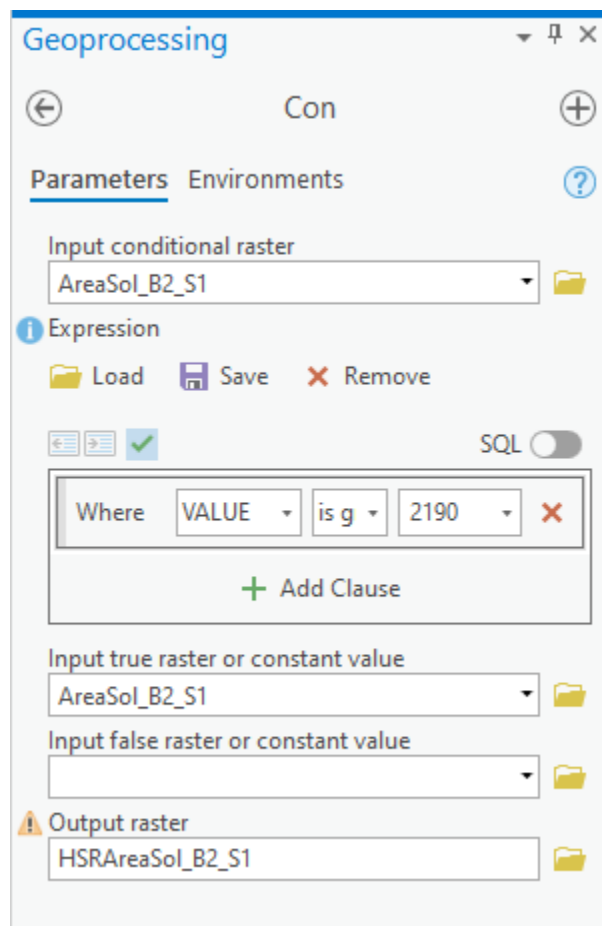
Conditions for finding areas to prioritize shade restoration projects are determined using the aspect and solar radiation rasters of a study area. Areas highlighted are greater than or equal to 2190 whm2 (solar) and between 112.5° - 292.5° (aspect). Further analysis can be conducted to clip out the vegetation layer from the con raster and then intersected with taxlots to see what areas should be prioritized.

1. In the **Geoprocessing** window, search for and open the **Con** tool. Begin with the Area Solar.

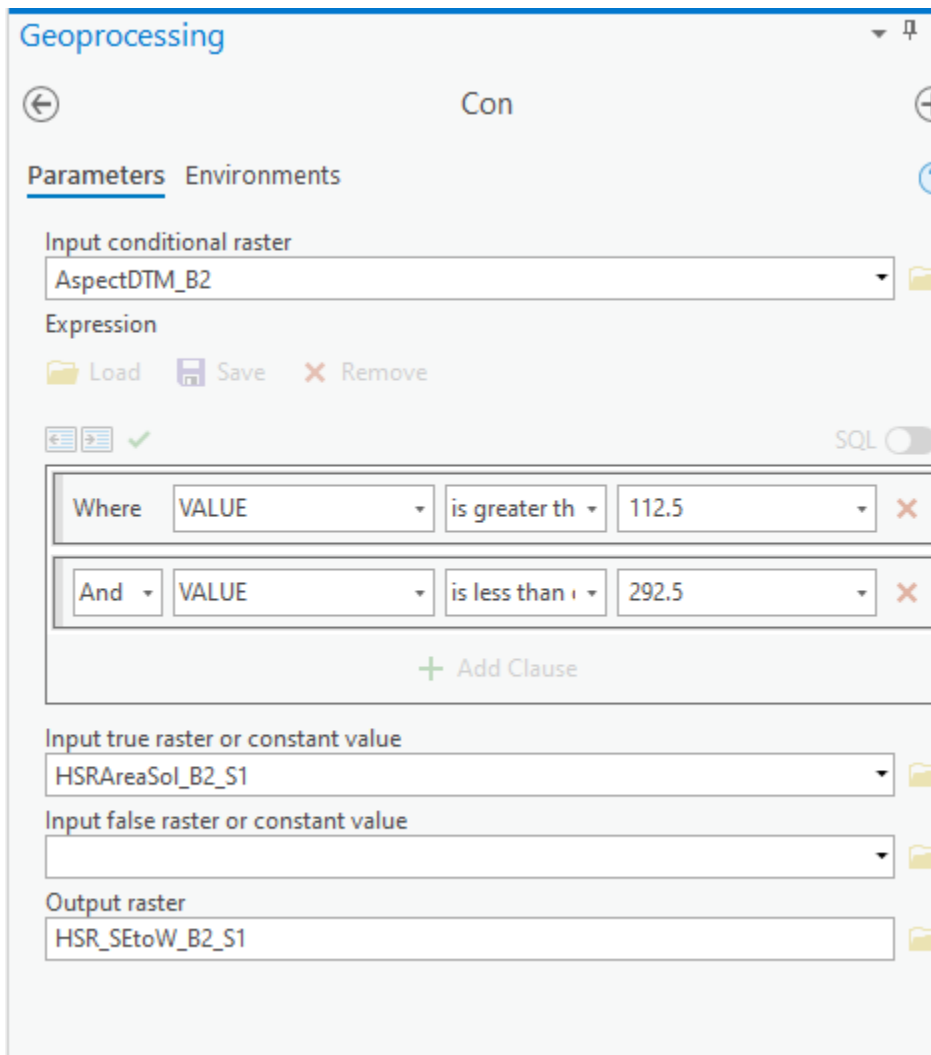
Make the **Input Conditional Raster** and **True Raster** both match as the desired solar raster.

Set the **Clause** where **VALUE** is greater than or equal to 2190.

Set location and name then click **Run**.



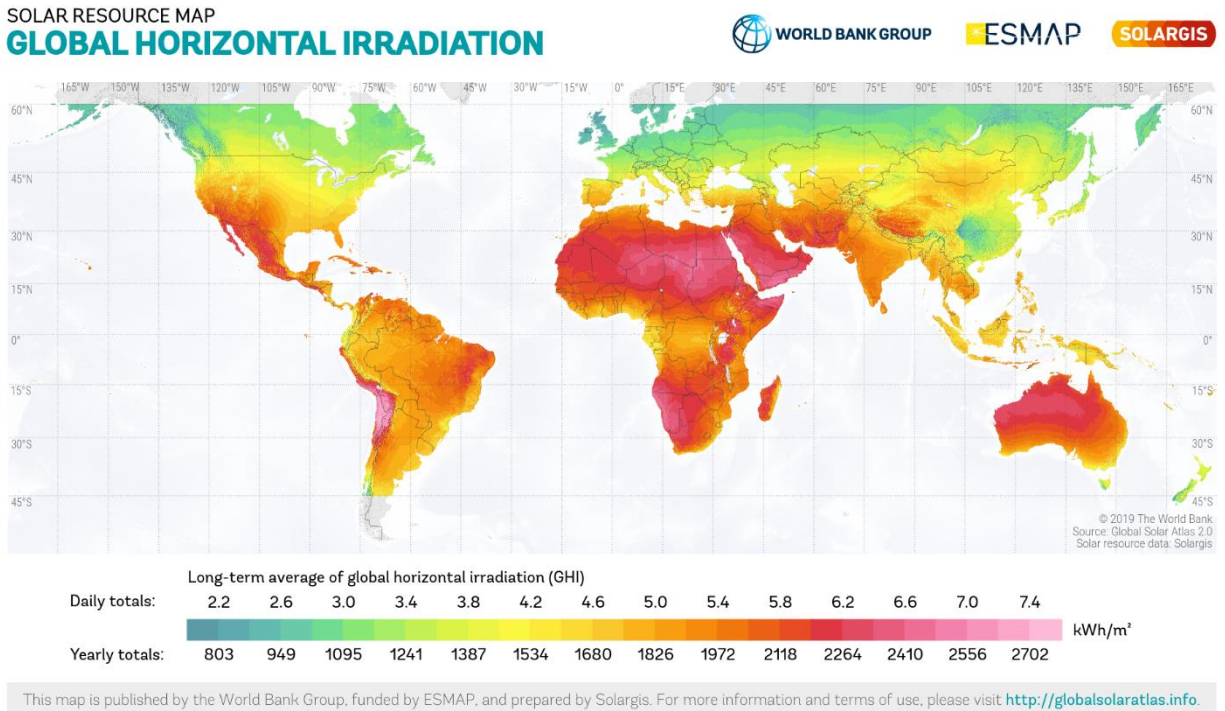
- Return to the **Con** tool to set the aspect. These new Parameters include:
Input Conditional: Aspect layer (AspectDTM_B2)
Input True: Previously created Con raster (HSRAreaSol_B2_S1)
Clause: Where **VALUE** is greater than or equal to **112.5**
(+ Add Clause) **AND** where **VALUE** is less than or equal to **292.5**
Output: appropriate name and file location (HSR_SEtoW_B2_S1)



- (Still working up)

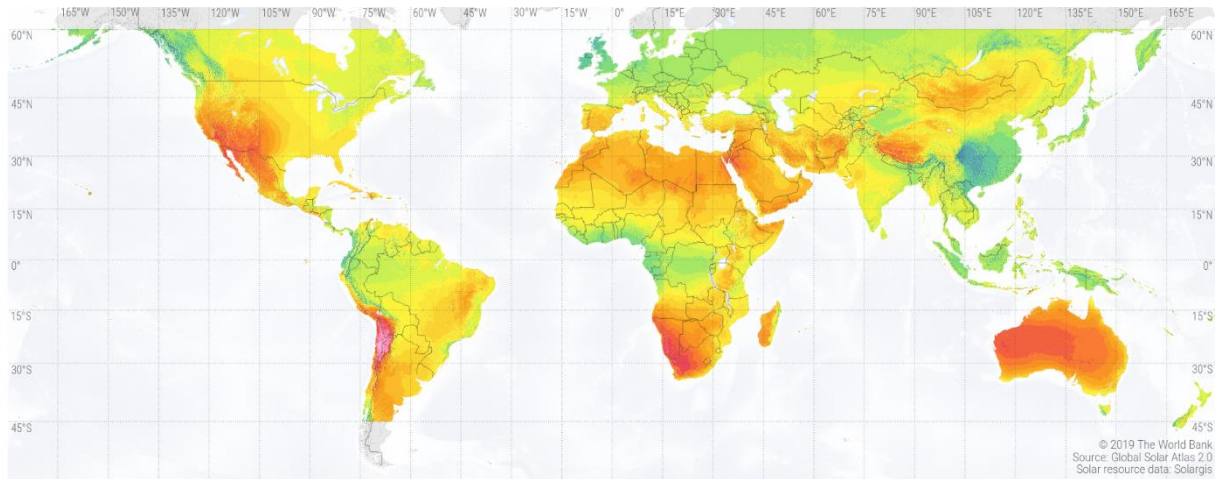
- Clip HSR_SEtoW_raster with vegetation layer to remove areas on canopy
- Intersect clipped raster with taxlots to identify owners to contact for project work

Working notes and examples for Solar radiation numbers:



https://upload.wikimedia.org/wikipedia/commons/1/1e/Global_Map_of_Global_Horizontal_Radiation.png

SOLAR RESOURCE MAP
DIRECT NORMAL IRRADIATION



Long-term average of direct normal irradiation (DNI)	
Daily totals:	1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 kWh/m ²
Yearly totals:	365 730 1095 1461 1826 2191 2556 2922 3287 3652

This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

The SI unit of irradiance is watt per square metre ($W/m^2 = Wm^{-2}$).

An alternative unit of measure is the Langley (1 thermochemical calorie per square centimeter or $41,840 J/m^2$) per unit time.

The solar energy industry uses watt-hour per square metre (Wh/m^2) per unit time ^[citation needed]. The relation to the SI unit is thus:

$$1 \text{ kW/m}^2 \times (24 \text{ h/day}) = (24 \text{ kWh/m}^2)/\text{day}$$

$$(24 \text{ kWh/m}^2)/\text{day} \times (365 \text{ days/year}) = (8760 \text{ kWh/m}^2)/\text{year}.$$

2190 Whm² (6 per day) high production

Standard Operating Procedures created by Mitchell Gellhaus

ATTACHMENTS

Additional file attached: Excel file for Streamside Stewards with multiple tabs, updated as of 6/30/2021

- Current properties under restoration
- Properties currently in minimal maintenance mode
- Property waitlist
- Sites withdrawn from program
- Planting lists for multiple years

The up-to-date document is maintained online in real-time by the Council and Mosaic, and is viewable online at: <https://docs.google.com/spreadsheets/d/1RO-Gm2tbklOd9BQjj739e7ymkUuRZTmbgcLBPdnPhaA/edit#gid=1574974308>