Climate-Ready Landscape Plants

2021-2022 University of Washington Trial Results

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Executive Summary

During the 2020-2022 Climate Ready Landscape Plant Trials, 15 landscape plant taxa were evaluated at the Center for Urban Horticulture of the University of Washington Botanic Gardens (UW-CUH). Plants were installed in spring 2021 and irrigated amply at a maintenance level (80 % ET_0) for the first summer to establish the plants before the irrigation treatments were applied. All plants were subjected to one of three deficit irrigation treatments during the second year from June to September 2022. The treatments were based on the Water Use Classification of Landscape Species (WUCOLS) categories corresponding to high (80 % ET_0), moderate (50 % ET_0), and low (20 % ET_0) water need (Costello and Jones, 2014). Most taxa tested in the trial exhibited statistically comparable ratings on overall appearance across three irrigation treatments and thus are deemed suitable for 'low' irrigation in sites similar to ours in the region. The exceptions included *Hydrangea quercifolia* 'Pee Wee' for which 'moderate' irrigation is recommended and *Mahonia aquifolium* for which 'low' irrigation is recommended with a note to avoid excess irrigation. The UW-CUH site hosted an Open House event in September 2022 where participants with various horticultural backgrounds rated one representative plant of each taxon and treatment combination on their aesthetic qualities. Participants were also surveyed at the end of the event on their favorite plant, which plants they would use professionally, and their overall impressions of the plants evaluated. Based on the Open House survey, *Lagerstroemia* 'SMNLICBF' Center Stage® Red received the most votes as the favorite plant winning the UW People's Choice Award while *Vitex* 'SMVACBD' Blue Diddley® was the runner-up in this year's trial.

2022 People's Choice Award at UW

- **Winner:** *Lagerstroemia* 'SMNLICBF' Center Stage® Red
- **Runner-up:** *Vitex* 'SMVACBD' Blue Diddley®

Results Summary

Table 1 Mean overall appearance scores (range 1–5) for each taxon and treatment combination over the growing season from June to September 2022. An irrigation recommendation is given based on significant differences found in seasonal means between treatments. For taxa with significant treatment differences, the treatment effects are indicated by superscript letters where treatments sharing the same superscript are not different from each other. If no treatment differences are found, 'Low' irrigation is recommended by default. Plants with seasonal means significantly below 2.5 ($p < 0.05$) are denoted by '*'. When this is the case across irrigation treatments, no recommendations (NR) are made for irrigation of these plants for the site.

Plant	Mean Overall Appearance Rating by treatment ET_0 (%)			Irrigation Recommendation
	80%	50%	20%	
Ceanothus thrysiflorus 'Victoria'	2.6	2.8	2.7	Low
Hibiscus syriacus 'JWNWOOD4' Pink Chiffon®	3.6	3.2	3.1	Low
Hibiscus syriacus 'Gandini Santiago' Purple Pillar®	2.7	2.5	2.7	Low
Hibiscus syriacus 'ORSTHIB5x1' Petite Pink Flamingo™	2.9	2.7	3.2	Low
Hydrangea quercifolia 'Pee Wee'	3.4^{a}	3.5^{a}	2.8^{b}	Moderate
Lagerstroemia 'SMNLICBF' Center Stage® Red	3.1	3.3	3.2	Low
Mahonia aquifolium[1]	2.2^{b*}	2.9^{a}	2.4^{ab}	Low (avoid High)
Osmanthus heterophyllus 'Variegatus'	3.0	3.2	3.2	Low
Philadelphus lewisii 'Blizzard'	2.3^{*}	2.0^{*}	2.2^{*}	NR
Philadelphus Swan Lake®[2]	1.8^{*}	-	2.1^{*}	NR
Rosa 'MEIRIFTDAY' Oso Easy® Double Pink ®	3.4	3.3	3.5	Low
Rosa 'Meibenbino' Petite Knock Out	2.9	3.0	2.9	Low
Rosa 'ChewPatout' Oso Easy® Urban Legend®	3.5	3.7	3.7	Low
Rosmarinus 'Arp'[3]	3.5	3.9	3.9	Low
Vitex 'SMVACBD' Blue Diddley®	3.6	3.8	3.7	Low

Note: [1]*Mahonia aquifolium* in high irrigation treatment (80% ET_0) displayed significantly lower overall appearance than moderate irrigation plants. [2]*Philadelphus* Swan Lake® did not have enough replicates for a moderate (50% ET_0) treatment set. [3]*Rosmarinus* 'Arp' was not analyzed statistically due to a low number of replicates across treatments.

Methods

Plot Setup

This study was carried out at the Center for Urban Horticulture of the University of Washington Botanic Gardens (UW-CUH) in Seattle, Washington. The study site is located in USDA Hardiness Zone 9a (version 2023), American Horticultural Society Heat Zone 2 (version 1997), and Sunset Zone 5 (https://sunsetplantcollection.com/climate-zones/zone/western-washington/). The climate of Seattle is characterized by warm summer with dry season centered around July and August and mild winter defined by rainy season with annual precipitation of ~40 inches of which more than 75% is falling during the wet winter season (Felton, 1998). The UW-CUH site is part of a multi-state Climate Ready Landscape Plant project which spans locations in five western states: Arizona, California, Oregon, Utah, and Washington (Figure 1). This report focuses on the results from the UW-CUH site only. For reports from other sites, see: https://ucanr.edu/sites/UCLPIT/Climate_Ready_Plant_Trials/

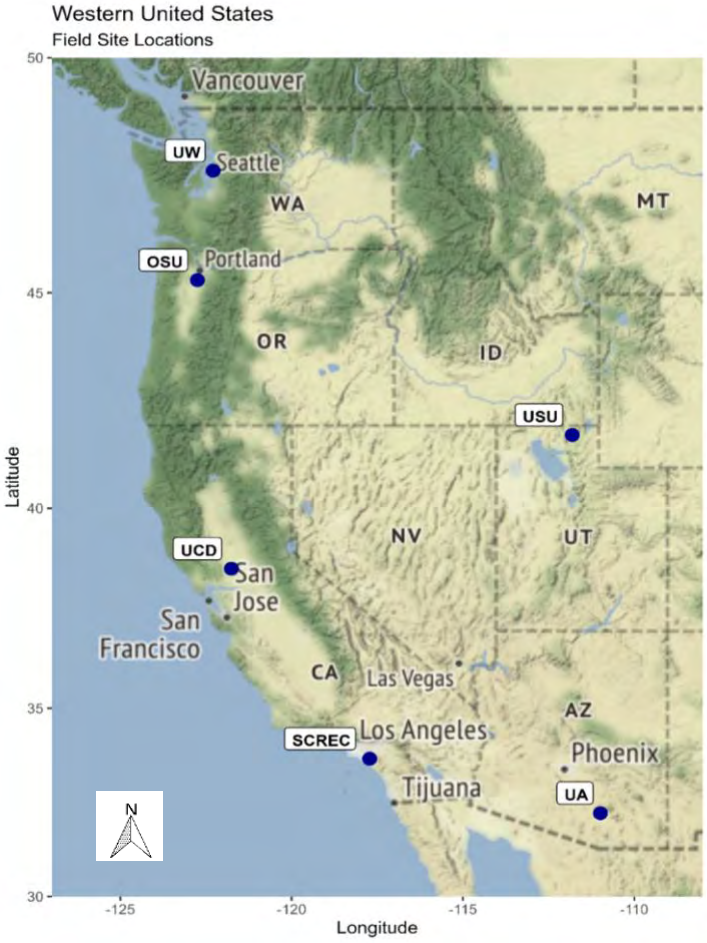

*Figure 1.*Climate-Ready Landscape Plants project sites

At the UW-CUH site, fifteen taxa were evaluated with 24 plants in each taxon. These taxa included *Ceanothus thrysiflorus* 'Victoria', *Hibiscus syriacus* 'Gandini Santiago' Purple Pillar®, *Hibiscus syriacus* 'ORSTHIB5x1' Petite Pink Flamingo™, *Hibiscus syriacus* 'JWNWOOD4' Pink Chiffon®, *Hydrangea quercifolia* 'Pee Wee', *Lagerstroemia* 'SMNLICBF' Center Stage® Red, *Mahonia aquifolium, Osmanthus heterophyllus* 'Variegatus', *Philadelphus lewisii* 'Blizzard', *Philadelphus* 'ORSTPHILx1' Swan Lake®, *Rosa* 'MEIRIFTDAY' Oso Easy® Double Pink, *Rosa* 'Meibenbino' Petite Knock Out®, *Rosa* 'ChewPatout' Oso Easy® Urban Legend®, *Rosmarinus* 'Arp', and *Vitex* 'SMVACBD' Blue Diddley.

The research plot was newly set up in spring of 2021 in the previously unmanaged field dominated by a mix of cool-season C_3 grasses with a high-water table. Portions of the field experienced periodic inundations during rainy seasons in winter and early spring. Plants were installed in June of 2021, one year before treatments were implemented, giving the

plants time to establish and acclimate. The plants received irrigation equivalent to 'high' irrigation treatment (80% ET_0) during the summer of establishment year in 2021. The position and deficit treatment assigned to each plant in the plot were arranged in a completely randomized design. Plants were spaced two meters away from their nearest neighbor in each direction. Each row was covered with 5-8 cm (2-3 in.) of mulch 1 m in width to retain moisture and reduce weeds. All rows were separated with a 1-meter wide strip of garden fabric. The soil type at this site was classified as loamy sand with a water holding capacity of 7%. Three irrigation tubes were installed alongside each row in the plot corresponding to one of the three water deficit treatments. Each plant had an irrigation drip ring with a flow rate of 2.11 mL s^{-1} connected to the tube of its assigned treatment. All row tubing was connected to one main PVC pipe and an irrigation timer.

Irrigation Treatments

Irrigation treatments started at the end of June 2022 and finished at the end of September 2022. There were three water deficit treatments, based on reference evapotranspiration (ET_0), corresponding to high (80% ET_0), moderate (50% ET_0), and low (20% ET_0) water need. These levels were based on the Water Use Classification of Landscape Species (WUCOLS) through the University of California Davis Center for Urban Horticulture (Costello and Jones, 2014). There were up to 8 replicates per treatment per taxon. The final number of replicates varied among treatment and taxa combinations because of variable mortality rates during the experimental period (see Table 5). Irrigation occurred for a treatment when the accumulated ET_0 was equivalent to 50% of the plant available water (Sisneroz et al., 2019). The volume of water applied during an irrigation event was based on soil texture, soil water holding capacity, and an imaginary cylinder representing the root volume 1m in diameter and 0.5m deep (Reid et al., 2021). The treatment level determined how fast ET_0 accumulated, which controlled the irrigation frequency. An important note is that the same volume of water was applied to recharge the soil occupied by the plants regardless of treatment during an irrigation event and irrigation happened at different times based on treatment. For example, plants in the low water need treatment may only have been irrigated two or three times throughout the field season compared to the high treatment that was watered more than 10 times, but when any of the treatments were irrigated plants received the same volume of water to fully recharge the soil. Water was applied in pulses for uniform soil infiltration. Daily ET_0 and precipitation were monitored by the closest weather station to the field site located at UW Center for Urban Horticulture (UW-CUH) and documented to keep track of irrigation timing (Washington State University AgWeatherNet: https://weather.wsu.edu). Total evapotranspiration (ET_0) and precipitation recorded in centimeters for each month during the field season and irrigation summary are represented in Table 2 and Table 3. Our hypothesis was that plants using water at a lower rate than the reference plant will take longer to use up the plant available water in the soil or, if all available water is used, they can withstand water deficit conditions longer until water is provided again.

Table 2 Total evapotranspiration (ET_0) and precipitation recorded in centimeters for each month during the field season. All data were retrieved from the Washington State University AgWeatherNet (n.d.).

	June	July	August	September
Total ET_0 (cm)	9.32	12.57	10.92	7.06
Total Precipitation (cm)	8.79	0.38	0.23	0.23

Table 3 Irrigation events and total water applied in liters per 0.39 m^3 for each irrigation treatment from June 30th to September 22nd.

Treatment (% ET_0)	Number of Irrigation Events	Mean Interval (days)	Dates Irrigated	Liters of Water Applied Per 0.39 m^3
High (80%)	12	7	7/10, 7/15, 7/22, 7/28, 8/2, 8/8, 8/15, 8/23, 8/31, 9/8, 9/12, 9/22	143.5
Moderate (50%)	7	10	7/14, 7/22, 7/31, 8/9, 8/15, 8/27, 9/12	85.9
Low (20%)	3	24	7/22, 8/15, 9/12	43.2

Aesthetic Ratings and Growth Measurements

Each plant was assessed in six aesthetic categories: foliage quality, flowering, pest tolerance, disease resistance, vigor, and overall appearance. One baseline rating of each plant was completed just before the deficit irrigation treatments started. Once the treatment phase began, the plants were rated once a month. Additionally, flowering and overall appearance ratings were collected two weeks after a monthly measurement. Plants were rated on a scale of one to five, with one representing a severely damaged or dying plant, two representing unacceptable appearance, three representing an average/acceptable plant, four representing a very nice plant, and five representing a top-performing, excellent plant (Table 4). A score of three also indicated the lowest acceptable performance of a plant. Plants that were not flowering received a score of zero, and overall appearance could be scored in half point intervals (i.e. 1, 1.5, 2, 2.5 …).

Each plant's length (l), width (w), and height (h) in centimeters were measured at the same time as the monthly appearance ratings. These measurements were used to calculate a plant growth index (PGI, equation 1) in centimeters modified from Irmak et al. (2004).

$$PGI = \frac{h + [(l + w)/2]}{2} \quad (1)$$

Plants were measured north/south (length), east/west (width), and top of the soil to the top of the plant (height) from the furthest leaf in each direction. After baseline *PGI* was calculated for each plant, that measurement was used to calculate the relative plant growth index (*rPGI*) for each month (equation 2). The *rPGI* represents plant growth over the treatment period accounting for initial variation in plant size. PGI_m represents the *PGI* of the current month, and PGI_i represents the initial *PGI* value before treatments started (equation 2).

$$rPGI = \frac{PGI_m}{PGI_i} \quad (2)$$

Statistical Analysis

All aesthetic and growth measurements were compared between treatments for each taxon during each month of the trial using a one-way analysis of variance (ANOVA) or a Type III Sum of Squares test using the *lm* function in R based on the balance of replicates per treatment per taxon. A Fisher's LSD post-hoc test was used to test how treatment means differed from each other at the 5% significance level ($p < 0.05$). All data were analyzed using R version 2023.3.386 for desktop computer (Posit team, 2023). Irrigation recommendations represent the treatment where growth, health, and aesthetics were not compromised.

Open House and Outreach

The UW-CUH site hosted an Open House event on September 7th, 2022 (Figure 1a). A total of 42 participants from various backgrounds including horticultural professionals, researchers, landscape architects, master gardeners, and garden writers participated in the event. During this event, participants rated a select number of plants on foliage quality, flower abundance, and overall appearance. These plants were the healthiest and best-looking individuals on each treatment for each cultivar. Average overall appearance scores +/- standard error were calculated based on the participant surveys (Table 4). Participants also recorded any taxa that were new to them, any taxa they would use professionally, and their favorite taxon (Table 5). Among the 15 taxa evaluated, *Lagerstroemia* 'SMNLICBF' Center Stage® Red received the most votes as the favorite plant by 29 participants with the mean overall rating of 4.3. For this, *Lagerstroemia* Center Stage Red receives the UW People's Choice Award in this trial. *Vitex* 'SMVACBD' Blue Diddley® was the runner-up receiving 8 favorite votes with the mean overall appearance rating of 4.1.

Table 4 Criteria for plant aesthetic ratings. Each aesthetic quality is broken up into ratings 1 (dead/dying) to 5 (excellent). Plants that were not flowering were given a rating of zero. Overall appearance could be scored in half point increments.

RATING	5	4	3	2	1
Foliage	Perfect to excellent; plant is in full leaf with no signs (1% or less) of leaf burn, disease or insect damage, and leaves are distributed uniformly in an appealing shape for the genus/species.	Very nice. Same as 5 except for minor tip burn, edge damage or other minor damage to only a few leaves (1-10%) that does not much affect the appearance (not noticeable from 3-4').	Acceptable; may have non-uniform distribution of leaves or minor damage to 11- 25% of leaves that is less evident from a distance.	Unacceptable; loss of leaves or moderate damage than 25% of leaves; unattractive; plant is declining and may not recover; may be extremely non-uniform.	Completely unacceptable; close to dead.
Flowering	Full, glorious bloom; 80-100% of plant's potential for bloom coverage is open	61-80% of plant in bloom	41-60% of plant in bloom	21-40% of plant in bloom	1 bloom open to 20% in bloom
Pest Tolerance/ Disease Resistance	No visible damage (1% or less) especially from 3-4' away.	Minor to moderate damage to one or two leaves or stems, or very minor damage to a few leaves (1-25%) Not noticeable from 3-4 ft.	Minor damage to many of the leaves or flowers (25-50%); appearance still acceptable from a distance of 3-4'.	Major damage; appearance unacceptable (51-75%).	Severely damaged and probably dying (>75% affected).
Vigor	Pushing out new growth from every growing point.	Pushing out new growth from several growing points.	Plant is surviving and healthy, but not noticeably pushing out new growth.	Plant is very small for the species or is declining; dead/dying branches or leaves present.	Plant is barely alive; close to death.
Overall Appearance	An impressive plant; flowers (if present), leaves, the shape and condition of the plant are all very appealing. It has the WOW factor that makes it an attractive garden plant***, even if each individual factor isn't perfect.***	A very good plant; maybe a 5 when in bloom, or just a very nice species that is not quite at its prime or just lacks the WOW factor. Many foliage plants fall here, while exceptional ones may be 5s.	Acceptable but nothing special; may be past or not quite to its prime; might be better if more uniform; may be described as an 'okay' plant.	Unacceptable for any of the above reasons.	Completely unacceptable and not likely to improve.

On July 27th, 2022, visitors from the Northwest Perennial Alliance group toured our field site. They were also given a presentation of the overview of the project and its real-world applications. Students from the Introduction to Restoration Ecology course at UW attended a presentation of the current research project on October 13, 2021. There were 60 students in attendance. These students were introduced to horticultural and ecophysiological research including learning about the overall design and objectives of the project.

Our team created a webpage (Figure 1b) hosted within the larger University of Washington Botanic Gardens website (https://botanicgardens.uw.edu/science-conservation/climate-ready-plants/). This webpage includes background about the project, how the irrigation treatments were set up, and background of the upcoming Climate-Ready Vines Project (2022-2025). There is also an interactive section where people can read about what taxa were tested in which year, and a link to more information about a particular taxon. Besides the aesthetic ratings and growth measurements, leaf physiology was also considered for this project. In the future, we will add a nested webpage that will include what physiological measurements we recorded, our methods, and what the results were.

a b

Figure 1 A picture from our open house (a), and the Climate Ready Plants website created for the project (b).

Table 5 Participant evaluation results from the 2022 Open House. Recorded is the number of people who had not seen the taxon before (New), the number of people who would use the taxon professionally (Use), and the participant's favorite taxon (Favorite). Average overall appearance rating +/- standard error recorded for each taxon based on participant ratings. Participants rated the plants from 1-5, with 5 representing the highest score.

Taxon	New	Use	Favorite	Overall Appearance
Ceanothus thrysiflorus 'Victoria'	2	16	2	3.2 ± 0.068
Hibiscus syriacus 'Gandini Santiago' Purple Pillar®	13	16	4	3.7 ± 0.063
Hibiscus syriacus 'ORSTHIB5x1' PPAF	7	17	3	3.7 ± 0.067
Hibiscus syriacus 'JWNWOOD4' Pink Chiffon®	11	14	3	3.7± 0.057
Hydrangea quercifolia 'Pee Wee'	3	21	5	3.6 ± 0.059
Lagerstroemia* 'SMNLICBF' Center Stage® Red	**18**	**28**	**29**	**4.3 ± 0.059**
Mahonia aquifolium	*3*	*20*	*3*	*3.6 ± 0.058*
Osmanthus heterophyllus 'Variegatus'	4	18	5	3.9 ± 0.067
Philadelphus lewisii 'Blizzard'	11	7	1	2.5 ± 0.061
Philadelphus Swan Lake®	5	8	2	2.7 ± 0.074
Rosa 'MEIRIFTDAY' Oso Easy® Double Pink	14	5	1	3.2 ± 0.066
Rosa 'Meibenbino' Petite Knock Out®	15	6	0	2.7 ± 0.066
Rosa 'ChewPatout' Oso Easy® Urban Legend®	15	6	0	3.2 ± 0.063
Rosmarinus 'Arp'	7	21	5	3.9 ± 0.066
Vitex* 'SMVACBD' Blue Diddley*	**14**	**24**	**8**	**4.1 ± 0.051**
Number of Responses		**42**		

*: People's Choice Award Winner, **: Runner-up

Results and Discussion

Results for each taxon are listed alphabetically by scientific name, with cultivar and trademark name if applicable. In the taxon summary, the market or trademark name is used for simplicity. Recommendations for irrigation rate were determined based on the point where growth, health, and visual aesthetics were not compromised. In the case where there were significant differences in aesthetic qualities or growth, a range for recommended irrigation level is given. If

there were no significant differences in traits measured, then we recommend irrigating at the lowest level for water conservation.

Our site had a large amount of mortality before the treatment phase began (Table 5). This was most likely due to standing water in the plot and a depression in the middle causing the plants to be waterlogged during the rainy season from late fall to spring. The mortality during the treatment phase in *Lagertroemia* Center Stage Red, *Mahonia aquifolium*, and *Rosmarinus* 'Arp' were unlikely due to any deficit irrigation treatment effect because the plants were already in poor conditions before the treatments started. The one plant that died during the treatment phase for *Vitex* Blue Diddley was most likely due to an unidentified disease as many of its branches succumbed to a disease-like defoliation pattern that spread throughout the plant.

Table 5 Mortality broken down by taxon before the treatments were applied. Mortality during the treatment phase were also documented.

Taxon	Mortality Before Treatment Phase	Mortality During Treatment Phase
Ceanothus thrysiflorus 'Victoria'	6	0
Hibiscus syriacus 'JWNWOOD4' Pink Chiffon®	10	0
Hibiscus syriacus 'Gandini Santiago' Purple Pillar®	7	0
Hibiscus syriacus 'ORSTHIB5x1' PPAF	11	0
Hydrangea quercifolia 'Pee Wee'	13	0
Lagerstroemia 'SMNLICBF' Center Stage® Red	9	2
Mahonia aquifolium	2	1
Osmanthus heterophyllus 'Variegatus'	0	0
Philadelphus lewisii 'Blizzard'	3	0
Philadelphus Swan Lake®.	15	0
Rosa 'MEIRIFTDAY' Oso Easy® Double Pink	0	0
Rosa 'Meibenbino' Petite Knock Out®	0	0
Rosa 'ChewPatout' Oso Easy® Urban Legend®	0	0
Rosmarinus 'Arp'	19	1
Vitex 'SMVACBD' Blue Diddley	0	1

Taxa Performance Summaries

***Ceanothus thrysiflorus* 'Victoria'**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	2.7	2' 6" - 2' 11" by 1' 3" - 1' 5"

Ceanothus 'Victoria' is an evergreen shrub with small, dark green foliage. Most of the plants had an uneven form and looked 'spindly' with bare parts of branches. This cultivar is supposed to have an upright habit and can reach up to 9 feet tall, however it remained growing short to the ground in this two year trial. The flowers are a light blue purple that bloomed in late spring to early summer at our site. They attracted a lot of pollinators, but mostly bees. Some plants had flowers throughout the summer. Throughout the field season, there were no significant problems with foliage quality, pest tolerance, or disease resistance. There were some yellow (chlorotic) leaves that developed in September. Generally, the foliage of this cultivar performed well no matter the treatment or month. This cultivar was not particularly vigorous, scoring around an average rating of 3 for all months. This indicated that the plant was not pushing out new growth nor declining in health, rather it maintained a moderate vigor. While the foliage and flowers were healthy, this plant did not score high in overall appearance due to its uneven growth habit and sparse foliage areas. Six plants died before the treatments began and no plants died once they started. There were no significant differences in aesthetic ratings or growth between treatments, therefore this cultivar would be recommended to be watered in the low (20% ET_0) irrigation.

***Hibiscus syriacus* 'JWNWOOD4' Pink Chiffon®**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.1	1' 3"-2' 3" by 1' 10"-2' 3"

Pink Chiffon® is a deciduous shrub that has soft pink, double flowers that blooms throughout the summer. It can grow to 2.43-3.66 m tall when mature. Pink Chiffon® at our site started flowering in July. When the plant was flowering it was spectacular to see as it created numerous flowers with double petal arrangement. In September when most of the flowers were spent, petals from the flowers would drop on the foliage which detracted from the overall appearance. Similar to the other *Hibiscus* cultivars tested, this cultivar also suffered from chlorotic foliage. Throughout the field season the foliage improved, but there was also minor pest damage noted. This cultivar did not start out in a healthy condition, but it only improved over the field season in all categories and had high vigor in July and August. Before the treatment phase started there were 10 plants that died, and none died during the treatment phase. There were no significant differences in aesthetic ratings or growth between treatments, therefore this cultivar would be recommended to water in the low (20% ET_0) irrigation.

***Hibiscus syriacus* 'Gandini Santiago' Purple Pillar®**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	2.7	2' 0"-2' 6" by 3' 7"-4' 4

Purple Pillar® is a deciduous shrub that grows in a tall, columnar shape and has dark magenta to light purple flowers. This cultivar can reach heights of 3.05-4.88 m tall. At our site, Purple Pillar® had a pleasing columnar habit and ranged in height at the end of the field season from 0.79-1.41 m tall. This cultivar had low scores for foliage throughout the trial due to chlorosis causing the leaves to have yellow tips and veins. The chlorosis was less pronounced as the trial went on because new leaves were not as affected. This also helped to improve overall appearance scores over time. Our site had quite a bit of standing water in the plot over the winter which could be one cause of the chlorosis and why new leaves were less chlorotic. There was some leaf tip burn and leaf spots noted, but they were not widespread like the chlorosis. Despite low foliage performance, this cultivar did score high in pest tolerance consistently. Purple Pillar® flowered from July to September, creating striking blooms all throughout the plant. Seven plants died before the treatments began and no plants died once they started. There were no significant differences in aesthetic ratings or growth between treatments, therefore this cultivar would be recommended to be watered in the low (20% ET_0) irrigation.

***Hibiscus syriacus* 'ORSTHIB5x1' Petite Pink Flamingo™**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.2	1' 1"-1' 5" by 1' 8"-1' 10"

Hibiscus syriacus 'ORSTHIB5x1' Petite Pink Flamingo™ is a new cultivar of *hibiscus* created by Dr. Ryan Contreras at Oregon State University. Like the other *Hibiscus* cultivars in this study, it is a deciduous shrub. Its flowers are a dark magenta color that attract many pollinators. At our site, it flowered later in the summer in August, but it produced numerous blooms. Similar to the Purple Pillar®, *Hibiscus syriacus* Petite Pink Flamingo™ also had chlorotic foliage, although it seemed more severe in this new cultivar. There was some pest damage early in the field trial but this decreased as the trial went on. This influenced foliage and overall appearance scores. There was a significant difference in foliage scores between the low and moderate treatments in the month of August, with the low treatment having a higher foliage score on average. The plants were very small when they arrived

compared to other *Hibiscus* plants. Consequently, they started off small when they were first planted and were still small at the start of the treatment phase. In the month of August, however, the cultivar was very vigorous with new growth from several points on the plant. Before the treatment phase started there were 11 plants that died, and none died during the treatment phase. Given that there were no other significant treatment differences, this cultivar would be recommended to be watered in the low (20% ET_0) irrigation.

***Hydrangea quercifolia* 'Pee Wee'**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Moderate	3.5	2' 7"-3' 1" by 1' 11"-2' 2"

'Pee Wee' is a compact shrub that has cone-shaped white flowers. The flowers turn a pink color in the fall and the foliage turns red. 'Pee Wee' flowered in the early summer in June at our site. Its cones had densely packed white flowers that were a nice balance against the hearty foliage. Generally, pest tolerance and disease resistance were high for this cultivar throughout the trial. However, disease resistance was significantly different between the high and low treatments in September with plants in the high treatment having higher scores. In June there were many plants that had leaf burn, but this was not a problem in later months. In September some plants developed powdery mildew on their leaves, and some leaves started to senesce. Towards the end of the trial the foliage started to turn a lovely red as fall approached. This cultivar was vigorous throughout the trial with high vigor happening in August. Overall appearance was significantly different between high and moderate vs low treatments in September with plants in the high treatment having higher scores. This cultivar had 13 plants die before treatments started, which is more than half of the replicates that were planted. None died during the treatment phase. There were some significant differences in traits measured, and the low treatment plants scored significantly lower in overall appearance than the plants in moderate treatment. Therefore this cultivar would be recommended to be watered in the moderate (50% ET_0) irrigation.

***Lagerstroemia* 'SMNLICBF' Center Stage® Red**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.2	1' 8"-2' 0" by 2' 2"-2' 7"

Center Stage® Red is a deciduous shrub that has dark red foliage with striking salmon and yellow flowers. This cultivar at our site took a long time to break its dormancy, therefore the plants looked spindly or inconspicuous at the start of the trial. However, these plants became very vigorous in July and August. This helped to improve their overall appearance scores throughout the field season scoring 4 or greater in some treatments later in the season. There was a significant difference in vigor in August between the moderate and low treatments with the moderate treatment having higher scores on average. Center Stage® Red started flowering in August and had prolonged high flowering scores through September. When the plant was flowering it was highly attractive with a unique flower shape and color. Pest tolerance and disease resistance were high throughout the trials, and generally this cultivar's foliage was hearty and healthy. Nine plants from this cultivar died before the treatment phase and two plants died during. However, plants that died during the trial were already unhealthy before treatments were imposed. There was a significant difference in foliage but no significant differences were found in overall appearance. Therefore this cultivar would be recommended to be watered in the low (20 ET_0) irrigation with potential to improve foliage quality with moderate irrigation treatment (50%. ET_0). Notably, Center Stage® Red received the most votes as the favorite plant by the participants in the Open House event held in September 2022. Participants gave the mean overall rating of 4.3 for this plant. For this, *Lagerstroemia* Center Stage Red receives the UW People's Choice Award in this trial.

Mahonia aquifolium

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	2.4	1' 4"-2' 2" by 1' 7"-2' 4"

Mahonia aquifolium is a native evergreen shrub to Washington State. Its leaves are dark green and pointed but can turn orange or red in the fall. It produces small berries that are attractive to wildlife. This cultivar started off with sparse, unattractive foliage but this improved in August when the plants became more vigorous. Many of the plants grew in an irregular shape. There was a significant difference in foliage in June between the moderate and the other two treatments with the moderate treatment scoring higher on average. There was some leaf spotting recorded in June. Similarly, foliage was significantly different in August between the high and moderate treatment with the moderate treatment scoring higher. As slow growing natives, these plants did not score impressively early in the

season but overall appearance steadily improved throughout the trial. Only two plants died before the treatments started and one plant died during, however this particular plant was not healthy before the trial started. Some significant differences were noted between treatments for foliage. Plants in high irrigation treatments scored significantly lower than the plants in moderate treatment in overall appearance while there was no statistically significant difference between moderate and low treatments. Therefore, we recommend it to be watered in the low (20% ET_0) irrigation and caution that overwatering (80 ET_0) could lower the aesthetic qualities in these plants.

***Osmanthus heterophyllus* 'Variegatus'**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.2	1' 2"-1' 6" by 1' 2"-1' 5"

'Variegatus' is a small habit evergreen shrub that has variegated foliage. The foliage on this cultivar performed well and was a highlight of this plant as it stood out in our field. It had a generally even growth habit and remained small. There was some leaf spotting in June and leaf yellowing later in the season, but overall foliage quality was high. This cultivar was vigorous in June, not as vigorous in July, and picked back up through August and September. Some of the newer leaves displayed smoother margins compared to the spiked margines of older leaves. Pest tolerance and disease resistance were high in this cultivar, contributing to the high quality of foliage. Despite this plant not flowering, it still had a striking appearance in its foliage. Overall appearance was lower at the start of the season, but quickly improved. There was a significant difference in rPGI for the month of August between high and low treatments with the high treatment having greater growth on average. 'Variegatus' is one of the few cultivars in our trial that had no mortality before or during the treatment phase. There was a significant difference in one growth parameter, but overall this plant performed well despite the treatments, therefore we would recommend this cultivar to be watered in the low (20% ET_0) irrigation.

***Philadelphus lewisii* 'Blizzard'**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	NR	-	2' 7"-3' 2" by 1' 5"-2' 5"

'Blizzard' is a deciduous shrub that is more commonly known as Mock Orange. This cultivar has long, sloping branches and delicate white foliage that have a wonderful fragrance. At our site, this cultivar did not perform well reporting below acceptable scores for overall appearance throughout the whole field season. 'Blizzard' had a strange growth habit that contributed to low appearance scores. It looked sparse with little foliage at the beginning of the trial. This improved slightly throughout the field season especially in September when the plants became vigorous. There were some foliage issues throughout the trial including chlorosis, leaf spots, and pest issues. Generally, pest tolerance was higher than disease resistance in this cultivar. 'Blizzard' bloomed early in the trial in June, and also produced a few blooms in September. This was surprising since this cultivar is known for just flowering in the spring and early summer. Only three plants died before the treatment phase and none died during. There were no significant differences in aesthetic ratings or growth between treatments. However, these plants scored significantly lower than 2.5 across treatments. Therefore, no recommendation is made for irrigation of these plants.

***Philadelphus* 'ORSTPHILx1' - Swan Lake® Mockorange**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	NR	-	1' 4"-1' 9" by 1' 3"-1' 9"

Philadelphus 'ORSTPHILx1' Swan Lake® is a new cultivar of *Philadelphus* created by Dr. Ryan Contreras at Oregon State University. It is a deciduous shrub that has similar fragrant flowers as the 'Blizzard' cultivar, but this new hybrid has a compact and symmetrical growth habit. Plants arrived in small containers and struggled to establish at our site. Plants were small to start with chlorotic leaves that persisted throughout the trial. The leaves were small and appeared stressed. This cultivar did flower in June and must have a similar bloom time as the 'Blizzard' cultivar. However, this new cultivar did not have as fragrant flowers. There was a lot of mortality for this cultivar with 15 plants that died before the treatment phase, but none died during the treatment phase. Due to this mortality, we were only able to test plants in the high and low treatments. Overall appearance started off in the unacceptable category and did not improve. There were no significant differences in aesthetic ratings or growth between treatments. Plants in both

tested treatments scored significantly lower than 2.5. Therefore, no recommendation is made for irrigation of these plants at our site.

***Rosa* 'MEIRIFTDAY' Oso Easy® Double Pink**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.5	3' 2"-3' 10" by 1' 5"-1' 8"

Oso Easy® Double Pink is a short, spreading rose with true pink flowers that bloom throughout the summer. This cultivar performed well at our site, scoring above average in foliage, pest tolerance, and disease resistance throughout the whole field trial. Oso Easy® Double Pink started flowering in June and continued even after the trial finished in September. Due to its prolific flowers, this plant was a beacon for pollinators. Later in the season in August and September when the flowers were slowing down, the spent flowers were unattractive on the plant. This cultivar was very vigorous throughout the whole field trial. Oso Easy® Double Pink was an attractive plant that was mostly healthy, which was reflected in its high overall appearance scores. There was no mortality before or during the treatment phase for this cultivar. There were no significant differences in aesthetic ratings or growth between treatments, therefore this cultivar would be recommended to be watered in the low (20% ET_0) irrigation.

***Rosa* 'Meibenbino' Petite Knock Out®**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	2.9	1' 11"-2' 5" by 1' 10"-2' 3"

Petite Knock Out® is a small habit rose that blooms continually throughout the summer with dark green foliage. At our site this rose had the most compact, clean growth habit compared to the other two rose cultivars. Once the plant flowered it took a while to drop the spent flower heads before the new flowers bloomed, creating an unattractive appearance. The flowers it produced were appealing and numerous, but the in-between period when there was a turnover of flowers was not ideal. This cultivar also had many foliage issues. In June, there was a little bit of pest damage, but by July and beyond pest damage was rampant along with powdery mildew, leaf rust, and black spot. In turn, this caused the overall appearance scores to decrease below acceptable appearance standards. Vigor also decreased as the treatment phase went on, contributing to

the low overall appearance. There was no mortality before or during the treatment phase for this cultivar. There were no significant differences in aesthetic ratings or growth between treatments, therefore this cultivar would be recommended to be watered in the low (20% ET_0) irrigation.

***Rosa* 'ChewPatout' Oso Easy® Urban Legend®**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.7	3' 6"-4' 3" by 2' 0"-2' 9"

Oso Easy® Urban Legend® is a larger rose that has dark green foliage and red semi-double flowers. This cultivar blooms throughout the summer and is supposed to have strong resistance to powdery mildew and black spot. At our site however, almost all the plants developed powdery mildew and black spot by the end of the trial. This subsequently had an impact on foliage scores, but on average foliage scores were at least a three in the acceptable range. Oso Easy® Urban Legend® grew long canes from the main part of the plant, contributing to its large size. This cultivar produced brilliant red/pink flowers throughout the trial that were attractive to pollinators. Scores for vigor were significantly different between the high and moderate treatments in August with the high treatment having higher scores on average. This cultivar was generally vigorous throughout the trial. Overall appearance scores were above a four on average in August, meaning that this cultivar was performing above average, however this decreased in September when flowers were spent and there were more widespread foliage quality issues. There was no mortality before or during the treatment phase for this cultivar. There was a significant treatment difference for vigor, therefore this cultivar would be recommended to be watered in the high (80% ET_0) irrigation.

***Rosmarinus* 'Arp'**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.9	2' 7"-2' 9" by 2' 6"-2' 9"

Rosmarinus 'Arp' is an evergreen shrub with an upright growth habit. It produces light blue flowers in late spring to early summer. As expressed before, our test plot had standing water over the winter before the treatment phase and this cultivar prefers well-draining soil. We think that the prolonged inundated conditions the plants experienced contributed to the high mortality rate of this cultivar. *Rosmarinus* 'Arp' is a popular cultivar to plant in Western Washington when the soil can drain properly. Due to this high mortality, we did not include this cultivar in any statistical

analysis. The plants that did manage to survive grew very well. Other than a few yellow needles, foliage quality was high on this cultivar. *Rosmarinus* 'Arp' scored high in pest tolerance and disease resistance and became very vigorous in August and September. Surprisingly, there were some flowers produced in August and September which is the opposite of this cultivar's expected bloom time. Clearly, by late summer this cultivar was performing exceptionally well, this was reflected in overall appearance scores in the five category. Of the 24 plants that we started out with, 19 of them died before the treatment phase and one died during. It is unknown why one plant died during the treatment phase, but we do not believe it was due to the treatments as it died in July. We cannot base the irrigation recommendation on statistics due to the small population but based on how the living plants performed and their preference for well-drained conditions, we would recommend this cultivar to be watered in the low (20% ET_0) irrigation.

***Vitex* 'SMVACBD' Blue Diddley**

Location	Rec. Irrigation	Mean O/A Rating	Final Width by Height Range
UW-CUH, Seattle	Low	3.7	2' 6"-3' 0" by 2' 2"-2' 11"

Blue Diddley is a deciduous shrub with blue/purple flower spikes that bloom in mid-summer. Its foliage also has a pleasing fragrance. It took a while for this cultivar to break dormancy in the spring, but once it got going it was vigorous throughout the summer. Generally Blue Diddley was pest and disease resistant, however there were some limbs that became limp and died, but the rest of the plant was okay. Occasionally there were some wilting and yellow leaves. Additionally, some plants had an uneven growth habit. Despite some foliage issues, Blue Diddley scored high in overall appearance especially when it started to bloom. This cultivar bloomed starting in early August and continued until the trial ended. There was a significant difference in rPGI in August between the moderate and high treatments with the moderate treatment having greater growth. No plants died before the treatment phase started, but there was one plant that died during. We think that this particular plant died of unidentified disease as some of its branches started to die off individually. There was a significant treatment difference for rPGI but no differences were found in overall appearance. Therefore this cultivar would be recommended to be watered in the low (20% ET_0) irrigation with a note that this plant could grow faster with

moderate irrigation (50% ET_0). Notably *Vitex* 'SMVACBD' Blue Diddley® was the runner-up for the UW People's Choice Award receiving second most votes as the favorite by the Open House participants with the mean overall appearance rating of 4.1.

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Appendix A. Comprehensive Aesthetic Evaluation Data Tables

Table A1 *Ceanothus thrysiflorus* 'Victoria' average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.0	2.5	2.6	2.3	2.6
	50	3.1	2.7	2.9	2.6	2.8
	20	2.9	2.7	2.7	2.5	2.7
Foliage	80	2.8	3.0	3.5	3.2	3.1
	50	3.0	3.3	3.3	2.8	3.1
	20	3.2	2.7	3.2	3.2	3.0
Flower	80	1.7	0.0	0.0	0.3	0.5
	50	2.0	0.0	0.0	0.0	0.5
	20	1.3	0.2	0.2	0.0	0.4
Pest Tolerance	80	4.8	5.0	5.0	5.0	5.0
	50	4.8	4.8	4.8	5.0	4.9
	20	4.5	5.0	5.0	5.0	4.9
Disease Resistance	80	4.2	5.0	5.0	5.0	4.8
	50	4.2	5.0	5.0	5.0	4.8
	20	4.3	4.7	5.0	5.0	4.8
Vigor	80	2.5	2.8	3.2	3.2	2.9
	50	2.7	2.8	3.2	3.3	3.0
	20	2.8	2.8	3.3	3.2	3.0

Table A2 *Hibiscus syriacus* 'JWNWOOD4' Pink Chiffon® average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.1	3.1	4.3	3.8	3.6
	50	2.6	2.9	3.7	3.7	3.2
	20	2.6	2.7	3.6	3.6	3.1
Foliage	80	2.0	3.0	3.8	3.5	3.1
	50	2.2	2.6	3.6	3.8	3.1
	20	2.2	2.6	3.4	3.4	2.9
Flower	80	0.0	0.0	2.5	2.3	1.2
	50	0.0	0.0	1.4	2.2	0.9
	20	0.0	0.2	1.6	3.2	1.3
Pest Tolerance	80	3.5	3.5	4.3	4.0	3.8
	50	2.8	3.0	4.4	4.2	3.6
	20	3.6	3.4	4.4	4.2	3.9
Disease Resistance	80	3.0	3.3	4.0	3.5	3.4
	50	2.4	3.4	4.2	3.6	3.4
	20	3.0	3.4	4.0	3.6	3.5
Vigor	80	3.8	3.5	4.0	3.0	3.6
	50	3.6	3.0	3.4	3.2	3.3
	20	3.0	3.4	3.8	3.2	3.4

Table A3 *Hibiscus syriacus* 'Gandini Santiago' Purple Pillar® average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.4	2.3	3.0	3.0	2.7
	50	2.4	2.0	2.8	2.7	2.5
	20	2.6	2.6	3.1	2.6	2.7
Foliage	80	2.7	3.0	4.2	3.5	3.3
	50	2.8	3.6	4.4	3.8	3.7
	20	2.7	3.4	4.3	3.1	3.4
Flower	80	0.0	0.0	0.0	0.7	0.2
	50	0.0	0.8	0.2	0.0	0.3
	20	0.0	0.0	0.4	0.7	0.3
Pest Tolerance	80	4.2	5.0	5.0	4.8	4.8
	50	4.8	5.0	4.8	5.0	4.9
	20	4.3	4.7	4.7	5.0	4.7
Disease Resistance	80	2.3	3.7	3.8	4.0	3.5
	50	2.5	3.8	4.2	4.0	3.7
	20	3.0	3.1	4.1	3.4	3.4
Vigor	80	3.7	3.8	4.2	3.3	3.8
	50	3.5	3.8	4.6	3.2	3.8
	20	4.1	4.3	4.1	3.0	3.9

Table A*4* *Hibiscus syriacus* 'ORSTHIB5x1' Petite Pink Flamingo™ average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.0	2.8	3.3	2.8	3.0
	50	2.3	2.5	3.1	2.8	2.7
	20	2.6	2.9	3.9	3.4	3.2
Foliage	80	2.0	2.3	3.3	3.3	2.8
	50	2.2	2.3	3.0	2.7	2.5
	20	2.0	2.8	4.0	3.5	3.1
Flower	80	0.0	0.0	0.0	1.0	0.3
	50	0.0	0.0	0.2	1.0	0.3
	20	0.0	0.0	0.3	1.3	0.4
Pest Tolerance	80	4.0	3.3	4.3	4.0	3.9
	50	2.7	3.3	4.0	3.8	3.5
	20	3.3	3.8	4.5	4.0	3.9
Disease Resistance	80	3.3	3.0	3.7	3.3	3.3
	50	2.5	2.8	3.3	2.8	2.9
	20	2.8	3.3	4.5	3.5	3.5
Vigor	80	3.0	3.7	4.0	3.0	3.4
	50	2.5	3.7	4.0	3.2	3.3
	20	2.8	4.0	4.0	3.0	3.4

Table A5 *Hydrangea quercifolia* 'Pee Wee' average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.0	3.0	3.8	3.8	3.4
	50	3.0	3.6	3.8	3.5	3.5
	20	2.6	3.1	2.9	2.6	2.8
Foliage	80	3.0	3.7	4.3	4.0	3.8
	50	3.5	4.5	4.5	3.8	4.1
	20	2.5	3.5	3.3	3.0	3.1
Flower	80	0.3	3.7	3.3	0.7	2.0
	50	0.0	2.3	2.0	1.0	1.3
	20	0.3	2.8	2.0	0.3	1.3
Pest Tolerance	80	5.0	5.0	5.0	5.0	5.0
	50	4.5	5.0	5.0	5.0	4.9
	20	4.8	5.0	5.0	5.0	4.9
Disease Resistance	80	4.0	5.0	5.0	5.0	4.8
	50	4.3	4.8	4.5	4.5	4.5
	20	4.3	4.8	4.5	3.0	4.1
Vigor	80	3.8	3.7	4.3	5.0	4.2
	50	4.0	4.5	4.5	4.0	4.3
	20	3.0	3.8	3.3	3.8	3.4

Table A6 *Lagerstroemia* 'SMNLICBF' Center Stage® Red average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.3	2.9	3.5	3.6	3.1
	50	2.2	3.1	3.8	4.1	3.3
	20	2.1	2.8	4.0	3.8	3.2
Foliage	80	2.0	3.8	4.8	4.8	3.9
	50	2.2	4.4	4.9	5.0	4.2
	20	2.0	4.3	5.0	5.0	4.1
Flower	80	0.0	0.0	0.0	3.0	0.8
	50	0.0	0.0	0.1	2.6	0.7
	20	0.0	0.0	0.2	1.7	0.5
Pest Tolerance	80	5.0	4.8	5.0	5.0	4.9
	50	4.7	5.0	5.0	5.0	4.9
	20	4.7	5.0	5.0	5.0	4.9
Disease Resistance	80	5.0	4.5	5.0	5.0	4.9
	50	4.8	5.0	5.0	5.0	5.0
	20	5.0	5.0	5.0	5.0	5.0
Vigor	80	2.3	4.5	4.5	3.5	3.8
	50	2.3	4.9	4.9	3.4	3.9
	20	2.0	4.8	4.2	3.8	3.7

Table A7 *Mahonia aquifolium* average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.1	1.5	2.3	2.8	2.2
	50	2.7	2.4	3.3	3.1	2.9
	20	2.1	2.1	2.6	3.0	2.4
Foliage	80	2.3	2.0	2.6	3.1	2.5
	50	3.6	3.3	3.4	3.4	3.4
	20	2.3	2.7	2.7	3.3	2.7
Flower	80	0.0	0.0	0.0	0.0	0.0
	50	0.0	0.3	0.0	0.0	0.1
	20	0.0	0.0	0.0	0.0	0.0
Pest Tolerance	80	4.3	4.8	5.0	5.0	4.8
	50	4.7	5.0	4.9	5.0	4.9
	20	4.1	3.7	5.0	5.0	4.4
Disease Resistance	80	3.3	4.3	4.4	4.3	4.0
	50	4.0	3.9	3.9	3.9	3.9
	20	3.6	3.6	3.6	4.0	3.7
Vigor	80	2.4	2.0	3.0	3.4	2.7
	50	2.9	2.9	3.9	3.6	3.3
	20	2.6	2.9	2.9	3.0	2.8

Table A8 *Osmanthus heterophyllus* 'Variegatus' average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.6	2.5	3.3	3.7	3.0
	50	2.9	2.8	3.4	3.8	3.2
	20	2.9	2.7	3.4	3.9	3.2
Foliage	80	2.9	3.4	3.9	4.1	3.6
	50	3.3	3.5	3.6	4.3	3.7
	20	3.1	3.5	3.8	4.1	3.6
Flower	80	0.0	0.0	0.0	0.0	0.0
	50	0.6	0.0	0.0	0.0	0.2
	20	0.0	0.0	0.0	0.0	0.0
Pest Tolerance	80	4.8	5.0	5.0	5.0	4.9
	50	5.0	5.0	5.0	5.0	5.0
	20	4.9	5.0	5.0	5.0	5.0
Disease Resistance	80	3.8	4.4	4.1	5.0	4.3
	50	3.9	4.4	4.9	4.8	4.5
	20	4.0	4.5	4.3	4.8	4.4
Vigor	80	3.5	2.9	3.3	3.5	3.3
	50	3.9	2.8	3.4	3.4	3.3
	20	3.9	2.8	2.9	3.6	3.3

Table A9 *Philadelphus lewisii* 'Blizzard' average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.5	1.6	2.4	2.5	2.3
	50	2.3	1.7	1.8	2.3	2.0
	20	2.3	1.8	2.3	2.4	2.2
Foliage	80	3.0	2.3	3.0	3.0	2.8
	50	2.6	2.8	2.9	2.3	2.6
	20	2.7	2.2	2.8	2.8	2.6
Flower	80	1.4	0.0	0.0	0.3	0.4
	50	1.4	0.0	0.0	0.5	0.5
	20	1.5	0.0	0.0	0.2	0.4
Pest Tolerance	80	4.9	4.1	5.0	5.0	4.8
	50	4.8	5.0	5.0	5.0	4.9
	20	5.0	5.0	5.0	4.8	5.0
Disease Resistance	80	3.7	4.3	5.0	3.3	4.1
	50	3.8	4.3	4.1	3.0	3.8
	20	3.7	4.7	4.5	3.8	4.2
Vigor	80	3.0	2.3	3.0	3.7	3.0
	50	2.6	2.4	2.8	2.9	2.7
	20	2.7	2.2	3.2	3.2	2.8

Table A10 *Philadelphus* Swan Lake® average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022. . There were not enough replicates of the *Philadelphus* Swan Lake® for a moderate treatment and are marked NA.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.3	1.4	1.8	2.0	1.8
	50	NA	NA	NA	NA	NA
	20	2.3	1.6	2.3	2.1	2.1
Foliage	80	2.8	2.3	3.0	2.3	2.6
	50	NA	NA	NA	NA	NA
	20	2.8	2.3	3.3	2.5	2.7
Flower	80	0.5	0.0	0.0	0.0	0.1
	50	NA	NA	NA	NA	NA
	20	1.0	0.0	0.0	0.0	0.3
Pest Tolerance	80	3.3	5.0	5.0	5.0	4.6
	50	NA	NA	NA	NA	NA
	20	3.5	5.0	5.0	4.3	4.4
Disease Resistance	80	4.5	2.3	2.8	2.5	3.0
	50	NA	NA	NA	NA	NA
	20	5.0	4.3	4.0	3.3	4.1
Vigor	80	2.5	1.8	3.0	3.3	2.6
	50	NA	NA	NA	NA	NA
	20	2.8	1.8	2.5	2.5	2.4

Table A11 *Rosa* 'MEIRIFTDAY' Oso Easy® Double Pink average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.8	3.3	3.7	3.1	3.4
	50	4.1	2.8	3.8	2.8	3.3
	20	4.3	3.0	3.9	2.9	3.5
Foliage	80	4.4	4.4	4.4	3.6	4.2
	50	4.5	4.1	4.4	3.9	4.2
	20	4.6	4.6	4.4	3.7	4.4
Flower	80	1.9	1.3	3.3	1.8	2.0
	50	2.4	1.4	4.3	1.5	2.4
	20	2.4	1.3	3.5	1.8	2.2
Pest Tolerance	80	4.8	4.6	4.5	4.0	4.5
	50	4.5	4.8	4.4	3.9	4.4
	20	4.9	4.8	4.6	4.1	4.6
Disease Resistance	80	4.0	4.5	4.6	3.5	4.2
	50	4.3	4.5	4.5	3.8	4.3
	20	4.1	4.6	4.8	3.8	4.3
Vigor	80	4.5	3.5	3.8	3.3	3.8
	50	4.1	3.4	3.8	3.1	3.6
	20	4.1	3.5	3.8	3.0	3.6

Table A12 *Rosa* 'Meibenbino' Petite Knock Out® average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.8	3.2	2.9	2.0	3.0
	50	3.8	3.1	2.8	2.4	3.0
	20	3.6	3.2	2.8	2.2	2.9
Foliage	80	3.6	2.8	2.8	2.0	2.8
	50	3.4	2.9	2.4	2.1	2.7
	20	3.3	3.0	2.9	2.1	2.8
Flower	80	3.5	1.3	2.0	1.4	2.0
	50	3.5	1.9	1.9	1.6	2.2
	20	3.1	1.5	2.3	1.3	2.0
Pest Tolerance	80	3.5	3.3	3.6	3.4	3.4
	50	3.6	3.3	3.0	3.4	3.3
	20	3.5	3.3	3.8	3.3	3.4
Disease Resistance	80	3.8	3.3	3.1	2.1	3.1
	50	3.9	3.1	3.5	2.5	3.3
	20	3.3	3.5	3.4	2.4	3.1
Vigor	80	2.9	2.8	2.6	2.1	2.6
	50	3.0	2.8	2.5	2.5	2.7
	20	2.9	2.9	2.5	2.3	2.6

Table A13 *Rosa* 'ChewPatout' Oso Easy® Urban Legend® average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.4	3.4	4.1	3.2	3.5
	50	3.8	3.6	4.1	3.3	3.7
	20	3.8	3.5	4.2	3.3	3.7
Foliage	80	3.4	3.4	4.1	3.3	3.5
	50	3.6	3.8	4.1	3.1	3.7
	20	3.5	3.5	3.9	3.3	3.5
Flower	80	2.1	0.9	2.5	1.3	1.7
	50	2.9	1.0	3.0	1.4	2.1
	20	2.5	1.1	2.9	1.4	2.0
Pest Tolerance	80	4.3	4.1	4.4	4.4	4.3
	50	4.4	4.0	4.1	4.0	4.1
	20	3.9	3.8	4.3	4.3	4.0
Disease Resistance	80	4.0	3.6	4.1	3.8	3.9
	50	4.0	3.9	4.1	3.5	3.9
	20	3.9	3.6	4.0	3.1	3.7
Vigor	80	3.3	4.1	3.8	3.8	3.7
	50	3.6	4.0	3.9	3.4	3.7
	20	3.0	3.6	3.9	3.6	3.5

Table A14 *Rosmarinus* 'Arp' average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	2.5	2.5	4.0	5.0	3.5
	50	2.8	4.0	5.0	5.0	3.9
	20	3.3	3.0	5.0	5.0	3.9
Foliage	80	2.0	2.0	4.0	5.0	3.3
	50	2.5	4.0	5.0	5.0	3.8
	20	3.0	2.8	5.0	5.0	3.8
Flower	80	0.0	0.0	0.0	0.0	0.0
	50	0.0	0.0	1.0	0.0	0.2
	20	0.0	0.0	0.0	3.3	0.7
Pest Tolerance	80	4.0	5.0	5.0	5.0	4.8
	50	4.5	5.0	5.0	5.0	4.8
	20	4.8	5.0	5.0	5.0	4.9
Disease Resistance	80	4.0	5.0	5.0	5.0	4.8
	50	5.0	5.0	5.0	5.0	5.0
	20	5.0	5.0	5.0	5.0	5.0
Vigor	80	2.0	4.0	5.0	5.0	4.0
	50	3.0	3.0	5.0	5.0	3.8
	20	3.8	3.3	5.0	5.0	4.1

Table A15 *Vitex* 'SMVACBD' Blue Diddley average monthly quality ratings (scale 1-5, 1= lowest, 5 = highest) at University of Washington on three ET_0 based irrigation levels in 2022.

Category	ET_0 %	Jun	Jul	Aug	Sep	AVG
Overall Appearance	80	3.8	3.8	3.5	3.4	3.6
	50	3.7	3.8	3.9	3.7	3.8
	20	3.9	3.8	3.6	3.6	3.7
Foliage	80	4.0	4.8	4.0	3.8	4.1
	50	4.1	4.4	4.6	3.9	4.3
	20	4.0	4.5	4.6	4.0	4.3
Flower	80	0.0	0.0	0.8	0.8	0.4
	50	0.0	0.0	1.5	0.9	0.6
	20	0.0	0.0	0.6	1.0	0.4
Pest Tolerance	80	4.3	4.9	5.0	5.0	4.8
	50	4.5	4.9	5.0	5.0	4.8
	20	4.4	4.6	5.0	4.7	4.7
Disease Resistance	80	4.4	5.0	5.0	4.1	4.6
	50	4.4	5.0	5.0	4.4	4.7
	20	4.4	4.9	5.0	4.6	4.7
Vigor	80	3.8	3.8	3.8	3.5	3.7
	50	3.4	4.0	3.5	3.6	3.6
	20	3.8	3.8	3.9	3.7	3.8

Appendix B. Plant Photos[1]

[1]June photos were taken before treatments began. Photos captured by A. Fron and M. Stuke.

June 2022 – Low Water

June 2022 – Moderate Water

August 2022 – Low Water

August 2022 – Moderate Water

Photo 1. *Ceanothus thrysiflorus* 'Victoria'

June 2022 – Low Water

June 2022 – High Water

September 2022 – Low Water

September 2022 – High Water

Photo 2. *Hibiscus syriacus* 'JWNWOOD4' Pink Chiffon®

June 2022 – Low Water

June 2022 – Moderate Water

August 2022 – Low Water

August 2022 – High Water

Photo 3. *Hibiscus syriacus* 'Gandini Santiago' Purple Pillar®

June 2022 – Low Water

June 2022 – High Water

September – Low Water

September – High Water

Photo 4. *Hibiscus syriacus* 'ORSTHIB5x1' Petite Pink Flamingo™

June 2022 – Low Water

June 2022 – High Water

August 2022 – Low Water

August 2022 – High Water

Photo 5. *Hydrangea quercifolia* 'Pee Wee'

June 2022 – Low Water

June 2022 – Moderate Water

September 2022 – Low Water

September 2022 – High Water

Photo 6. *Lagerstroemia* 'SMNLICBF' Center Stage® Red

June 2022- Low Water

June 2022 – Moderate WAter

September 2022 – Low Water

D. September 2022 – Moderate Water

Photo 7. *Mahonia aquifolium*

June 2022 – Low Water

June 2022 – High Water

September 2022 – Low Water

September 2022 – High Water

Photo 8. *Osmanthus heterophyllus* 'Variegatus'

A. June 2022 – Low Water

B. June 2022 – High Water

C. September 2022 – Low Water

D. September 2022 – High Water

Photo 9. *Philadelphus lewisii* 'Blizzard'

June 2022 - Low Water

B. June 2022 – Moderate Water

C. August 2022 – Low Water

D. August 2022 – High Water

Photo 10. *Philadelphus* Swan Lake®

June 2022 – Low Water

B. June 2022 – High Water

C. September 2022 - Low Water

D. September 2022 – High Water

Photo 11: *Rosa* 'MEIRIFTDAY' Oso Easy® Double Pink

June 2022 – Low Water

June 2022 – High Water

August 2022 – Low Water

August 2022 – High Water

Photo 12: *Rosa* 'Meibenbino' Petite Knock Out

Low Water – Jun 2022

Moderate Water – June 2022

Low Water – September 2022

High Water – September 2022

Photo 13: *Rosa* 'ChewPatout' Oso Easy® Urban Legend®

June 2022 – Low Water

June 2022– High Water

June 2022 – Low Water

June 2022- High Water

Photo 14. *Rosmarinus* 'Arp' – Wet winter conditions resulted in low survival and foliar chlorosis (B) but surviving plants rebounded well (C, D).

June 2022 - Low Water

June 2022 – High Water

September – Low Water

September – Moderate Water

Photo 15. *Vitex* 'SMVACBD' Blue Diddley – Some disease in higher water treatments at later dates (D).