

Oregon Outdoor Ornamental Nursery Scenario

This scenario is one of a suite of scenarios intended to represent outdoor ornamental nursery scenarios in the United States. It should be noted that nurseries are diverse and represent a range of topographic, cultivation, and plant types. Scenarios, when possible have been developed to represent conservative nursery practices that will yield “high-end” runoff, but not unrealistic of actual nurseries in the area. Similarly, selection of curve numbers are based on best available data from TR-55 until further calibration can be performed using regional runoff data, which at the time of scenario development is generally unavailable for nurseries. Figure 1 provides an overview of available curve numbers from TR-55 in order to provide context to the relative magnitude of the curve number used in this scenario. The closest curve number that could be associated with outdoor nurseries is for “farmsteads”, due to similar cover conditions. Curve numbers are generally among the highest available, exceeded primarily by soils in poor condition.

This scenario is parameterized to generally represent outdoor ornamental nursery production in Oregon. The scenario nominally represents outdoor ornamental nurseries in Clackamas County, OR since it is the county with the most number of acres in production in the region. In 2002, the state of Oregon ranked 3rd in the U.S. for total number of ornamental nursery acres in the outdoors (i.e., not under glass), with nearly 41,000 acres in the open (USDA 2002a). Approximately 30% (12,652 acres) of the total acreage is located in Clackamas County. Nurseries in the area are predominantly wholesale in nature (R. Regan, personal communication). Clackamas County ranks number 2 in the U.S. with approximately 21,900 acres of outdoor nurseries in the county according to the 2002 USDA census of agriculture (USDA 2002a). The total value of agricultural products sold in Clackamas Co. in 2002 was approximately 332 million dollars, of which approximately 78% of the revenue was generated from the sale of Christmas tree, nursery, and greenhouse crops. Clackamas County produces a large volume of nursery stock and ranks number 2 in the U.S. for nursery stock production (USDA, 2002b). MLRAs 1, 2, and 3 dominate western Oregon; however the majority of Clackamas County is located in MLRA 2.

Plants cultivated by outdoor nurseries are diverse. For this scenario, crop parameters have been selected when possible to be representative of typical outdoor nursery practices in Oregon. In general, this scenario represents outdoor broadleaf evergreens, including production of ornamentals such as rhododendrons. The county produces a number of trees and shrubs, including both deciduous and evergreen varieties. According to the USDA 2003 nursery crops summary (USDA, 2004b), the largest category of nursery production in Oregon is broadleaf evergreens (approximately 19 million specimens sold). In Clackamas county, broadleaf shrubs are “balled-&-burlapped” in wholesale nurseries (R. Regan, personal communication). Irrigation is often used. Methods are primarily overhead sprinkler irrigation. Irrigation is applied mainly during May to September at a maximum rate of 5 cm per day (R. Regan, personal

communication). For this scenario, emergence, maturity, and harvest dates have been set to represent an evergreen crop.

Metfile W24229 is the closest meteorological station to Clackamas County, OR and is within approximately 34 miles of the county centroid. Its data were collected in Portland, Oregon located in the northwestern part of the state. The station is located approximately six meters above mean sea level (AMSL). Portland receives an average rainfall of 37 inches (NOAA, 2006).

Exact locations and geographic extent of nurseries in the region are not available; therefore soils were selected based on soil recommendations from a local extension agent, the geographic extent of the listed soils in the area, the drainage group, slope, and erodibility. In developing this scenario, preference was given to selecting a benchmark soil that is in hydrologic group “C” or “D”, and is capable of supporting outdoor nurseries (EPA, 2004). Woodburn silt loam was recommended by a local expert as a representative soil for nurseries in the region (R. Regan, personal communication). Additionally, the Woodburn series was selected for this scenario since it is of large extent in the region (USDA, 2006a) and is the most common benchmark soil in Clackamas County that is also in hydrologic group C. According to the official soil series description, Woodburn soils are used for growing berries, orchards, cannery crops, grain, hay and pasture.

Woodburn is a Hydrologic Group C soil and represents approximately 3.5% of the soils in Clackamas County. Woodburn soils have a USLE K factor of 0.32, which is common to roughly 15 other soils in Clackamas County. The majority of soils in Clackamas county have a pH lower than Woodburn soils. However, soil pH is not currently a PRZM input parameter and is not expected to often affect chemical fate in the acidic range. Woodburn soils have an A horizon from 0 to 17 inches (0-43 cm) deep, a B horizon from 17 to 54 inches (43-137 cm) deep, and a C horizon from 54 to 92 inches (137-234deep. (USDA, 2006b).

Table 1. PRZM 3.12 Climate and Time Parameters for Clackamas County, Oregon – Ornamental Nurseries.		
Parameter	Value	Source/Comments
Starting Date	Jan. 1, 1961	Meteorological File Portland, OR (W24229)
Ending Date	Dec. 31, 1990	Meteorological File Portland, OR (W24229)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1. Value represents most of western Oregon.
Snowmelt Factor (SFAC)	0.16	PRZM Manual Table 5-1. Max of the min range of values for mixed coniferous/deciduous open areas.
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998) Set to guidance default for free draining soils.

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Clackamas County, Oregon – Ornamental Nurseries.		
Parameter	Value	Source/Comments
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.32	USDA NRCS Soil Data Mart (http://soildatamart.nrcs.usda.gov/) Value listed for Woodburn silt loam.
USLE LS Factor (USLELS)	0.3	LS equation (Haan and Barfield, 1978) LS value for 2% slope and 400' slope length
USLE P Factor (USLEP)	1.0	Set to 1.0 for orchards as per PRZM Scenario Guidance (EPA, 2004).
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA, 1999)
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2%	R. Regan, OSE Extension. Slopes for nurseries are mostly less than 2%. USDA NRCS Soil Data Mart (http://soildatamart.nrcs.usda.gov/). PRZM Scenario Guidance (EPA, 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2	Irrigation from May to September. R. Regan (OSU Extension).
Irrigation Type (IRTYP)	3	3 = over canopy sprinkler. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005); R. Regan (OSU Extension).
Leaching Factor (FLEACH)	0.1	Default value. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.5	Default value. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005), and R. Regan (OSU Extension).
Maximum Rate at which Irrigation is Applied (RATEAP)	0.1	Default value. Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). Set based on cropping curve number.

Table 3. PRZM 3.12 Crop Parameters for Clackamas County, Oregon – Ornamental Nurseries.		
Parameter	Value	Source/Comments
Initial Crop (INICRP)	1	Default value
Initial Surface Condition (ISCOND)	2	2 = cover crop. R. Regan (OSU Extension). In-row cropping - temporary, seasonal cover predominates (Occasionally fallow between harvest and planting - it varies). There is extensive cover cropping, or rotational cover crops during non-production years.
Number of Different Crops (NDC)	1	Set to number of crops in simulation. Default value.
Number of Cropping Periods (NCPDS)	30	Set to weather data in meteorological file: Portland, OR (W24229)
Maximum rainfall interception storage of crop (CINTCP)	0.1	Table 5-4 PRZM manual, light density crops (EPA, 1998). Canopy coverage averages about 40% (R. Regan, OSU Extension)
Maximum Active Root Depth (AMXDR)	46 cm	R. Regan, OSE Extension.

Parameter	Value	Source/Comments
Maximum Canopy Coverage (COVMAX)	40%	Canopy coverage averages about 40% over the life of the crop for most trees and shrubs. For trees after two years, it ranges from 40-60%. (R. Regan, OSU Extension)
Maximum Canopy Height (HTMAX)	91 cm (3ft)	Height varies widely as many different cultivars are grown. Trees may be several feet tall (R. Regan, OSE Extension.)
Soil Surface Condition After Harvest (ICNAH)	2	2 = cover crop. R. Regan (OSU Extension). In-row cropping - temporary, seasonal cover predominates (Occasionally fallow between harvest and planting - it varies). There is extensive cover cropping, or rotational cover crops during non-production years.
Date of Crop Emergence (EMD, EMM, IYREM)	01/01/61	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/01/61	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12/61	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Maximum Dry Weight (WFMAX)	0.0	Not used in scenario
SCS Curve Number (CN)	82, 82, 82	TR-55, Table 2-2c (USDA 1986). Value for farmsteads, buildings, lanes, driveways, and surrounding lots. Hydrologic Group D.
Manning's N Value (MNGN)	0.023	RUSLE Project; A12GFGFN for Portland, OR vineyards with No Till (Soil disturbance is limited to a planting operation) and light cover (cover code 5). These data were used to approximate values for nurseries in Oregon as no data for ornamental nurseries were included in the project.
USLE C Factor (USLEC)	0.040 - 0.104	RUSLE Project; A12GFGFN for Portland, OR vineyards with No Till (Soil disturbance is limited to a planting operation) and light cover (cover code 5). These data were used to approximate values for nurseries in Oregon as no data for ornamental nurseries were included in the project. Note: RUSLE dates and C factors from the RUSLE project have been reordered and tied to emergence dates.

Parameter	Value	Source/Comments
Total Soil Depth (CORED)	152 cm	NRCS Soil Data Mart (SDM) (http://soildatamart.nrcs.usda.gov)
Number of Horizons (NHORIZ)	4	NRCS Soil Data Mart (SDM) (http://soildatamart.nrcs.usda.gov). Top horizon spans scenario horizons 1 and 2 in order to conform to PRZM input requirements. PRZM Scenario Guidance (EPA, 2004).
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 31 cm (HORIZN = 2) 55 cm (HORIZN = 3) 56 cm (HORIZN = 4)	NRCS Soil Data Mart (SDM) (http://soildatamart.nrcs.usda.gov). Top horizon spans scenario horizons 1 and 2 in order to conform to PRZM input requirements. PRZM Scenario Guidance (EPA, 2004).
Bulk Density (BD)	1.30 g/cm ³ (HORIZN = 1) 1.30 g/cm ³ (HORIZN = 2) 1.30 g/cm ³ (HORIZN = 3) 1.40 g/cm ³ (HORIZN = 4)	NRCS Soil Data Mart (SDM) (http://soildatamart.nrcs.usda.gov). Midpoint of the reported range. PRZM Scenario Guidance (EPA, 2004).

Initial Water Content (THETO)	0.277 cm ³ /cm ³ (HORIZN =1) 0.277 cm ³ /cm ³ (HORIZN =2) 0.306 cm ³ /cm ³ (HORIZN =3) 0.282 cm ³ /cm ³ (HORIZN =4)	NRCS Soil Data Mart (SDM); values are mean 1/3-bar water contents of Woodburn silt loam soils. (EPA, 2004).
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1.0 cm (HORIZN = 2) 5 cm (HORIZN = 3) 4 cm (HORIZN = 4)	NRCS Soil Data Mart (SDM) (http://soildatamart.nrcs.usda.gov). PRZM Scenario Guidance (EPA, 2004).
Field Capacity (THEFC)	0.277 cm ³ /cm ³ (HORIZN =1) 0.277 cm ³ /cm ³ (HORIZN =2) 0.306 cm ³ /cm ³ (HORIZN =3) 0.282 cm ³ /cm ³ (HORIZN =4)	NRCS Soil Data Mart (SDM); values are mean 1/3-bar water contents of Woodburn silt loam soils. (EPA, 2004).
Wilting Point (THEWP)	0.125 cm ³ /cm ³ (HORIZN =1) 0.125 cm ³ /cm ³ (HORIZN =2) 0.163 cm ³ /cm ³ (HORIZN =3) 0.129 cm ³ /cm ³ (HORIZN =4)	NRCS Soil Data Mart (SDM); values are mean 15-bar water contents of Woodburn silt loam soils. PRZM Scenario Guidance (EPA, 2004).
Organic Carbon Content (OC)	2.32% (HORIZN = 1) 2.32% (HORIZN = 2) 1.02% (HORIZN = 3) 0.15% (HORIZN = 4)	NRCS SDM; mean %OM / 1.724. PRZM Scenario Guidance (EPA, 2004).

Sensitive Parameter Uncertainties

Meteorological File

As characterized above, Metfile W24229 (Portland, OR) is the closest metfile to Clackamas County, which was used to represent this scenario. The metfile is located approximately 34 miles from the center of Clackamas County and is generally representative of the area.

Slope

The scenario USLELS value was calculated with the Haan and Barfield equation (1978) using a 2% slope and an assumed 400-foot slope length, as per PRZM scenario development guidance (EPA, 2004). The woodburn series has slopes ranging from 0 to 15%, however discussions with a local extension agent indicated nurseries slopes generally do not exceed 2 percent. This scenario may underestimate runoff for nurseries located on slopes greater than 2 percent.

USLE C Factor and Manning's N Value

The RUSLE Project does not include data for ornamental nursery crops. Therefore, USLE C Factor and Manning's N values were selected from data on Oregon vineyards with no till and light cover due to the similarities between conditions. A local extension agent confirmed that cover is used during the growing season. Of the available locations, Portland Oregon has the most similar meteorological conditions and cover as this scenario.

Soil Data

No geospatial data were available to determine the exact locations and geographic extent of nurseries in the region. The USGS GIRAS Landuse/Landcover data for the Conterminous United States includes a nurseries classification; however the data are generally 25 years old at the time of this scenario development and preliminary review of the data indicates that nurseries are not well represented. This is likely due to the resolution of the data (30 m) and age of the data set (based on 1970's and 80's imagery). As a result, soils were selected based on soil recommendations of local experts, the geographic extent of the listed soils in the area, the drainage group, slope, and erodibility. The soil selected is a hydrologic group C soil.

Crop Parameters

Outdoor ornamental nurseries are highly diverse in the numbers, sizes, and types of plants grown. Ornamental nurseries also vary in the cultivation methods which can range from potted plants (container operations) to field nurseries that may harvest and package plants as bare root or balled and burlapped. This scenario has been parameterized to be representative of the most "typical" nursery plants in the area (see description above). Runoff and erosion may be over or underestimated depending on the type of nursery modeled and a sensitivity analysis has high value in this regard.

Curve Number

The curve number is the most sensitive parameter in PRZM scenarios. The curve number for this scenario was based on TR-55 (Table 2-2c). Nurseries can be covered in roads, wooded areas, field borders, and buildings. Therefore the curve number closest to this scenario was the value for a hydrologic group C soil representative of farmsteads, buildings, lanes, driveways, and surrounding lots. Runoff and erosion may be under or over-estimated for alternative nursery operations and model validation has high value in this regard. Based on preliminary investigation, no runoff data are available for validating runoff from outdoor nursery operations in this geographic area.

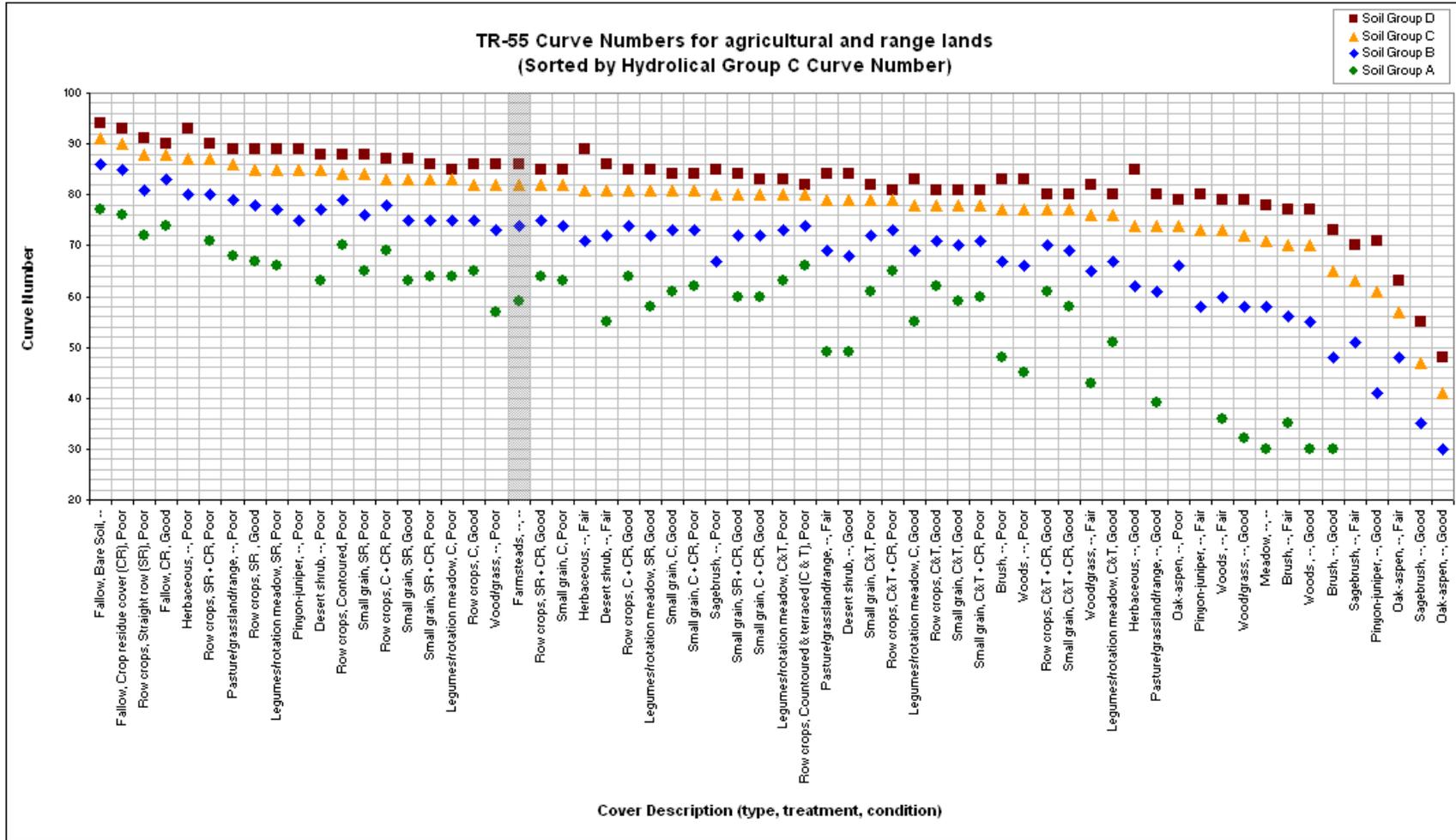


Figure 1. TR-55 (USDA, 1986) Farmstead curve number used for scenario development relative to other available cover types, soil treatments, and conditions.

Table 5. Soils of Clackamas County, Oregon Ranked by Area^{a,b}. Includes Soils Comprising Greater than 1% of Total Soil Acres.

Soil	Total Acres	% Area	Hydrologic Group	Erodibility	Slope	pH	OM	Sand	Silt	Clay
Jory	53167	8.3%	B	0.28-0.32	2-60	5.5-5.8	3-4.5	18.7-24.5	47.8-52	23.5-33.5
Alspaugh	38978	6.1%	C	0.28	2-50	5.8	5	35.4	33.6	31
Highcamp	35393	5.5%	B	0.24	5-90	5.6	6	42.7	43.3	14
Aschoff	33750	5.3%	B	0.24	5-90	5.8	9.5	46.8	44.7	8.5
Klickitat	30175	4.7%	B	0.24	5-60	5.3	4.5	39.2	37.3	23.5
Fernwood	29730	4.7%	B	0.24	5-90	5.6	6	43.2	38.8	18
Aloha	28578	4.5%	C	0.32	0-6	5.8	2.5	13.6	68.9	17.5
Zygore	22639	3.5%	B	0.24	5-90	5.8	12.5	44.8	41.2	14
Woodburn	21945	3.4%	C	0.32	0-15	6.1	4	14	71	15
Bornstedt	20610	3.2%	C	0.32	0-30	5.6	3.5	9.4	67.1	23.5
Cazadero	20538	3.2%	C	0.28	0-20	5.6	3.5	18.7	47.8	33.5
Saum	19924	3.1%	B	0.32	3-60	5.8	3	24.2	51.8	24
Cascade	16747	2.6%	C	0.37	3-60	5.6	5-5.5	11.2-13.7	67.3-69.3	17-21.5
Wilhoit	16516	2.6%	B	0.24	5-30	5.6	6	39.8	37.7	22.5
Xerochrepts	14606	2.3%	C/D	0.28-0.43	0-60	5.6	2-3.5	24.8-41.6	37.4-52.7	21-22.5
Kinzel	14384	2.3%	B	0.28	5-90	5	11.5	14	71	15
Kinney	13837	2.2%	B	0.28	3-50	5.8	6	39.8	37.7	22.5
Cottrell	12956	2.0%	C	0.24	2-30	5.6	3.5	20	49	31
Bull Run	12534	2.0%	B	0.32	3-60	5.6	8	13.9	70.1	16
Salem	10586	1.7%	B	0.28	0-12	6.1	4	29.1	53.4	17.5
Molalla	8996	1.4%	B	0.24	2-30	5.8	5	39.8	37.7	22.5
Hardscrabble	8859	1.4%	D	0.24	2-20	5.6	4	24.1	51.4	24.5
Latourell	7731	1.2%	B	0.37	0-30	5.8	2.5	45.3	43.2	11.5
Springwater	6577	1.0%	C	0.28	2-60	5.8	5	39.2	37.3	23.5
Powell	6515	1.0%	C	0.37	0-30	5.6	5	11.2	66.8	22
Willamette	6281	1.0%	B	0.28-0.32	0-15	6.1	4-5	9.4-9.5	67.1-68	22.5-23.5

Notes:

^a pH, OM, Sand, Silt, and Clay are based on representative values from USDA Soil Data Mart.

^b Table excludes areas for water, urban land, and sand/gravel pits.

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