The Willamette Valley (Oregon) Prairie Plant Trait Dataset

Citation Clark, D., Wilson, M. V. (2018). The Willamette Valley (Oregon) Prairie Plant Trait Dataset (Version 1) [Data set]. Oregon State University
https://doi.org/10.7267/6q182r738

Access to dataset at Oregon State University ScholarsArchive:
https://ir.library.oregonstate.edu/concern/datasets/6q182r738

Author Information:

Co-investigator Contact Information
Name: Clark, Deborah
Institution: Oregon State University
Address: Corvallis, OR 97333
Email: Deborah.clark@lifetime.oregonstate.edu

Co-investigator Contact Information
Name: Wilson, Mark V.
Institution: Oregon State University
Address: Corvallis, OR 97333
Email: wilsonm@science.oregonstate.edu

Background Restoration of native habitats is a crucial strategy for biological conservation. Progress in the successful restoration of native habitats is slowed, however, by our limited ability to generalize and predict species responses to restoration management treatments. The scientific literature contains numerous studies describing the effects of restoration management treatments on vegetation, but the studies are often species-specific and site-specific. General patterns, which are necessary to develop predictions of the effects of management, are therefore difficult to identify.

One promising approach to address the issue of species-specific results is using plant traits as a common language to characterize plant responses rather than using taxonomic identity. Functional plant traits are well-defined characteristics that relate to plant species' patterns of establishment, growth and resource allocation, and that evolved in response to abiotic environmental conditions and interactions with other species. Thus, functional plant traits are those that strongly influence a plant's performance.

Traits are universal (i.e. all plants have traits), whereas plant species differ according to geographic location. As a result, focusing on species taxonomic identity hinders our ability to make ecological generalizations beyond sites with similar species composition. For example, restoration studies generally describe the responses of particular species to management treatments. It is difficult to generalize or compare these results to other results with different species.

Overcoming this limitation requires simplification of species taxonomic identities to a more general measure, such as plant traits. Relatively few studies have investigated the use of plant traits for predicting the effects of management and restoration of native habitats. A plant trait approach would allow us to develop models that show relationships between plant traits and plant species responses to restoration treatments, thus allowing the results of vegetation responses to management treatments to be reported or modeled as plant traits rather than by species names. Moreover, these trait–response relationships could also provide insight into the actual causes of vegetation change to restoration treatments (Clark, D.L., Wilson, M.V., Roberts, R., Dunwiddie, P.W., Stanley, A., and Kaye, T.N. 2012. Plant traits – a tool for restoration? Applied Vegetation Science 15:449-458).

The Willamette Valley (Oregon) Prairie Plant Trait Dataset is a compilation of plant traits of species important in upland prairies, wetland prairies, vernal pools, emergent wetlands, and in the restoration of prairies and wetlands of the Willamette Valley of Oregon. These species are also found widely throughout the Pacific Northwest.

The dataset contains more than 6600 data points on 187 species. Three types of plant trait data are included in the dataset: quantitative, categorical, and text. Sources of plant trait data include direct measurements in the field or in the laboratory, or gathered from the published literature, including local floras, references books and databases.

Laboratory measurements include measurements of plant growth under standardized growth chamber conditions. The use of standardized conditions allows integration of results with those in the scientific literature. Standardized growth chamber conditions include specifications for germination media, transfer of germinants, pot size, growing media, nutrient solutions, growing illumination and temperatures, and dates of harvest. Growth chamber procedures followed the general recommendations of the Integrated Screening Programme (Hendry, G.A.F. and Grime, J.P. (eds) 1993. Methods in Comparative Plant Ecology: A Laboratory Manual. Chapman and Hall, London).

Detailed protocols for the following quantitative measurements (listed below) can be found in *Clark, D.L. and Wilson, M.V. 2005. Restoring prairies: A synthesis of studies on vegetation and invasive species in support of effective management (Year two) Progress Report II Order NO. HEP040027,* which is accessible at OSU ScholarsArchives (https://ir.library.oregonstate.edu/concern/technical_reports/v692tc350) or at Cascadia Prairie Oak Partnership Technical Library (https://cascadiaprairieoak.org/technical-library).

a. Protocol for measuring plant traits for seedlings under standardized conditions based on Hendry and Grime 1993.
b. Protocol for measuring seed mass.
c. Protocol for measuring seed dimensions.
d. Protocol for germinating seeds
e. Seed germination requirements for target species

Several quantitative plant trait values were calculated from the raw growth chamber data. The calculations for these plants traits are described in the file *Willamette Valley (Oregon) Prairie Plant Trait Descriptions*, one of the dataset files.

People involved with sample collection, processing, analysis and/or submission:
Rachel E. Roberts, Department of Botany and Plant Pathology, Oregon State

University, Corvallis, Oregon, was instrumental in the laboratory plant trait data collection.

Date of data collection: 2005-2008

Geographic location of data collection: Willamette Valley, Oregon, USA

Information about funding sources that supported the collection of the data:

- Northwest Conservation Fund of the Priscilla Bullitt Collins Trust
- The Nature Conservancy (TNC)
- Bureau of Land Management (Eugene District), US Department of the Interior, Order No. HEP040027

Links to publications that use the plant trait data: The following publications are accessible at OSU ScholarsArchives (ir.library.oregonstate.edu) or at Cascadia Prairie Oak Partnership Technical Library (https://cascadiaprairieoak.org/technical-library) (Use title or url below in search box).

- Clark, D.L., Wilson, M., Roberts, R., Dunwiddie, P.W., Stanley, A., and Kaye, T.N. 2012. Plant traits – A tool for restoration? Applied Vegetation Science 15:449-458 (https://ir.library.oregonstate.edu/concern/articles/1g05fh73j)
- Roberts, R.E., Clark, D.L., and Wilson, M.V. 2010. Traits, neighbors, and species performance in prairie restoration. Applied Vegetation Science 13: 270-279 (https://ir.library.oregonstate.edu/concern/articles/qr46r5697)
- Wilson, M.V., Clark, D.L. and Roberts, R.E. 2005. Predicting field establishment rates from standardized plant traits - Year two of Restoring prairies: A synthesis of studies on vegetation and invasive species in support of effective management Order No. HEP040027 (https://ir.library.oregonstate.edu/concern/technical_reports/v692tc350)

Funding sources that supported collection of plant trait data:

- Northwest Conservation Fund of the Priscilla Bullitt Collins Trust
- The Nature Conservancy
- Bureau of Land Management (Eugene District), US Department of the Interior, Order No. HEP040027

Overview of dataset files: The dataset is comprised of six files, five of which are spreadsheets. *Traits.csv* is a compilation of the other four spreadsheets: *Species.csv*, *TraitNames.csv*, *Choices.csv*, and *Citations.csv*.

1. Filename: Willamette Valley (Oregon) Prairie Plant Trait Descriptions.pdf
   Short description: Table of plant trait descriptions and explanations
2. Filename: Species.csv
   Short description: Scientific name of plant species
3. Filename: TraitNames.csv
   Short description: Trait name and data type
4. Filename: Choices.csv

Short description: Choices within categorical traits
5. Filename: Citations.csv
   Short description: Citation of publication sources
6. Filename: Traits.csv
   Short description: Matrix of species, traits, values for quantitative traits, measurement units, category choice for categorical traits, text for text traits, and citations for publication sources of traits values

TABLE 1. Description of plant traits used in The Willamette Valley (Oregon) Prairie Plant Trait Dataset with notes, trait types, and categories for categorical traits. The information has been compiled from several sources principally, *Hendry, G.A.F. and Grime, J.P. (eds) 1993. Methods in Comparative Plant Ecology: A Laboratory Manual. Chapman and Hall, London; Weiher, E., et al. 1999, Challenging Theophrastus: A common core list of plant traits for functional ecology. Journal of Vegetation Science 10 (5): 609-620; Cornelissen, J. H. C., et al. 2003. A handbook of protocols for standardized and easy measurement of plant functional traits worldwide. Australian Journal of Botany 51:335–380*.
The abbreviations used are: A = area, M = dry mass, L = leaf, R = root, S = shoot (leaf + stem), T=total plant; subscripts 1 and 2 indicate initial time (7 days) and time 2 (21 days) of measurement, respectively. Data type: C=categorical, Q=quantitative, T=text. "Standard" indicates measurements made using standardized conditions of Hendry and Grime 1993.

Plant trait name	Trait Notes	Trait Type	Choice (if categorical trait)
Authority		T	
Breeding	Breeding system	C	mixed allogamy autogamy apomixis
Clonality	Ability of a plant to reproduce itself vegetatively, thereby producing new ramets and expanding horizontally. Ecological function: Associated with competitive vigor; the ability to exploit patches rich in key resources (e.g., nutrients, water, light) and space acquisition. Clonality can promote persistence after environmental disturbances. Clonality may also be an effective means of sort-distance migration in lieu of poor seed dispersal or seedling regeneration.	C	clonal aboveground clonal belowgr. short clonal other clonal bulbs or corms clonal rhizomes clonal abovegr. short clonal belowgr. long clonal abovegr. long clonal tubers non-clonal unknown

	Clonal organs, especially belowground ones, may also serve as storage organs and the distinction between both functions is often unclear.		
Code	Four-letter code used to name plants (https://plants.usda.gov/plants_tutorial.pdf)	T	
Common_name	Common name of plant species 1. USDA NRCS Plants Database https://plants.sc.egov.usda.gov/java/ 2. Oregon Plant Atlas http://www.oregonflora.org/atlas.php	T	
Diaspore_feature	Main morphological features of seed or propagule as it might relate to dispersal	C	mucilage minute pappus or hair balloon wing elaiosome hook or barb fleshy fruit none awn
Dispersal_mode	Main mode of seed dispersal; *Self* includes ballistic mode. Ecological function: Mode of dispersal has consequences for the distances it can cover, the routes it can travel and the places it can up in. May be associated with seed longevity in soil seed bank.	C	combination water animal wind self unassisted
Dispersal_peak_month	Month in which the most seed dispersal occur (Jan = 1, Feb = 2 …)	Q	
Dormancy_break_mech	Primary method of breaking seed dormancy Ecological function: Associated with longevity in seed bank, season of germination, range of temperatures at which a species' seed will germinate.	C	not fire light after-ripening fire not dormant not stratification stratification not light scarification not scarification not after-ripening
Family		T	
Flowering_peak_	Month in which the most flowers appear;	Q	

month	(Jan = 1, Feb = 2 …)		
Germination_peak_ month	Month in which the most seed germination occurs (Jan = 1, Feb = 2 …)	Q	
Germination_ rate	The proportion of seed (%) that germinate under suitable conditions. Ecological function: Associated with seedling establishment	Q	
Growth_form_Corn	From J. H. C. Cornelissen, P. Castro Diez and R. Hunt 1996. *Seedling growth, allocation and leaf attributes in a wide range of woody plant species and types*. Journal of Ecology 84:755-765.	C	climber or scrambler cushion erect leafy long basal other palmoid prostrate semi-basal short basal short succulent tall succulent tussock
Growth_form_std		C	dicot forb fern graminoid monocot forb shrub suffrutescent tree vine
Habit	The categories *evergreen* and *deciduous* refer only to woody species.	C	evergreen deciduous herbaceous
Habitat_main	A single category was chosen for each species, even for broadly distributed species.	C	riparian upland prairie wetland prairie wetland woodland
Height_max	Plant height (cm) measured near the end of the growing season, as the difference between the elevation of the highest photosynthetic tissue in the canopy and at the base of the plant. Ecological function: Associated with competitive vigor, whole	Q	

	plant fecundity, and with the time intervals plant species are generally give to grow between disturbances. There are also important trade-offs between plant height and tolerance or avoidance of environmental (climatic, nutrient) stress. Height tends to correlate allometrically with other size traits in broad interspecific comparisons, e.g., aboveground biomass, rooting depth, lateral spread and leaf size.		
LAR_standard	Leaf area ratio: The allocation of leaf area to unit amounts of total dry weight over the periods 7-21 days after germination. L_A / T_M (mm^2/mg) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*	Q	
Leaf_area_21d	Leaf area of 21 day old seedling L_A (mm^2) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*	Q	
Leaf_division		C	simple compound
Leaf_margin		C	toothed lobed entire
Leaf_shape		T	
Life_form	Based on the Raunkiaer classification system of plant form defined a) by a single principal characteristic: the relation of the perennating tissue to the ground surface. Perennating issue is the meristematic tissue that remains inactive during the winter or dry season and then resumes growth with return of a favorable season Or b) by canopy structure and canopy height. Ch Chamaephyte, perennating buds above the soil but <25 cm	C	phanerophyte chamaephyte hemicryptophyte geophyte therophyte

	G Geophyte, perennating buds buried within the soil H Hemicryptophyte, perennating buds at the soil surface T Therophyte, perennating structure is the seed (annuals) Ecological function: Associated with plant strategy, climatic factors, and responses to disturbance.		
Life_form_exp	Life forms expanded Ch=chamaephyte G=geophyte H=hemicryptophyte T=therophyte Suff mstem=suffrutescent multiple leaf-bearing stems Mstem= multiple leaf-bearing stems Sstem bas=One leaf-bearing stem with basal leaves Sstem cau=One leaf-bearing stem with cauline leaves	C	Ch suff mstem G bulb H mstem H sstem H sstem bas H sstem cau T mstem T sstem bas T sstem cau
LMR_standard	Leaf Mass Ratio: The allocation of leaf dry weight to unit amounts of total dry weight over the period 7-21 days after germination. L_M / T_M (mg/mg) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*	Q	
Longevity_plant	(years)	Q	
Mass aboveground timed	Aboveground mass at a given time period (g)	Q	
Mass_aboveground_ 21d	Oven-dried aboveground biomass of seedling measured 21 days after germination. S_M (mg) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)* Ecological function	Q	

	Correlated with competitive ability and fecundity.		
Mass_root_21d	Root mass of 21 day seedling: Oven-dried belowground biomass measured 21 days after germination R_M (mg) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)* Ecological function: Correlated with competitive ability and fecundity.	Q	
Mass_seed	Average oven-dried seed mass (mg) Ecological function: Small seeds tend to be dispersed further away from adult plant. Related to dispersal distance, establishment success, and fecundity.	Q	
Nitrogen_fixing		C	Yes No
Perenniality	Ecological function: Associated with plant longevity, space-holding ability, and disturbance tolerance.	C	annual annual/biennial biennial facultative perennial perennial
Pollination_mode		C	wind self bird water insect mixed none
Propagation_mode		C	seed and vegetative vegetative seed
Ps_pathway	Photosynthetic pathway	C	C3 C4 CAM
Reproductive_ sched	Reproductive schedule	C	monocarpy polycarpy
RGR_seedling	Relative growth rate	Q	

	Values gathered from scientific publications (measurements units varied)		
RGR_standard	Relative growth rate: The innate rate of increase in total dry weight per plant over a period 7-21 day after germination. $(\log_e T_{M2} - \log_e T_{M1}) / (t_2 - t_1)$ Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*	Q	
Root_system		C	fibrous tap
RSA_standard	Root-shoot allometry: Ratio of root relative growth rate to shoot relative growth rate. Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*	Q	
Seed_bank	Seeds are persistent in soil.	C	yes no
Seed_length	Measurements in (mm)	Q	
Seed_longevity	Measurement in (years)	Q	
Seed_shape	Dispersule shape is the variance of its three dimensions, i.e., the length, the width and the thickness of the dispersule, after each of these values has been divided by the largest of the three values. (mm^3) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)* Ecological function: Small dispersules with low shape values (relatively spherical) tend to be buried deeper in the soil and live longer in the seed bank. Associated with dispersal distance.	Q	

Seed_viability	Viability measured other than by germination. Measurement in (%)	Q	
SLA_standard	Specific leaf area: SLA is the allocation of leaf area to unit amounts of leaf dry weight over the period 7-21 days after germination. L_A / L_M (mm^2/mg) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)* Ecological function: SLA is often a good positive correlate of potential relative growth rate or mass-based maximum photosynthetic rate. Lower values tend to correspond with relatively high investments in leaf 'defenses" particularly structural ones, and long leaf lifespan.	Q	
Status_Federal	Status of plant species under the Federal Endangered Species Act (as of 2008)	C	Threatened Endangered Candidate Proposed none
Status_ONHIC	Status of plant species under the Oregon Natural Heritage Information Center, Oregon State University, Corvallis, OR (as of 2008)	C	List 1 List 2 List 3 List 4 none
Status_State	Status of plant species under the Oregon Endangered Species Act (as of 2008)	C	Endangered Threatened Candidate none
Stem_arrangement		C	single upright multiple upright creeping
Taxonomic_group		C	dicot monocot gymnosperm non-seed_vascular
ULR_standard	Unit leaf rate: The rate of dry matter production per unit leaf over the period 7-21	Q	

	days after germination. $(T_{M2} - T_{M1} / t_2 - t_1)$ x $(\log_e L_{A2} - \log_e L_{A1} / L_{A2} - L_{A1})$ (mg/mm²/day) Direct measurements made in our lab under standardized conditions (Hendry and Grime 1993)*		
Wetland_Indicator_Status	Wetland indicator status for Region 9 (from US Fish and Wildlife Service, 1988), which indicate probability of occurring in different wetland types. (functional group is based on suite of traits, rather than a single trait).	C	OBL FACW+ FACW FACW- FAC+ FAC FAC- FACU+ FACU FACU- UPL NI NL
Where_native		C	Willamette Valley Other North America South America Europe Asia Eurasia Africa Cosmopolitan

Hendry, G.A.F. and Grime, J.P. (eds) 1993. Methods in Comparative Plant Ecology: A Laboratory Manual. Chapman and Hall, London.

**Weiher, E., van der Werf, A., Thompson, K., Roderick, M., Garnier, E., Eriksson, O. 1999, Challenging Theophrastus: A common core list of plant traits for functional ecology. Journal of Vegetation Science 10 (5): 609-620.*

***Cornelissen, J. H. C., et al. 2003. A handbook of protocols for standardized and easy measurement of plant functional traits worldwide. Australian Journal of Botany 51:335–380.*