

Database Code: TP103

Title: Species interactions during succession in the western Cascade Range of Oregon, 1990 to present

Abstract:

The factors that contribute to plant species establishment and decline following disturbance determine the rates and patterns of successional change of a system. In this long-term field experiment, we test the commonly held assumption that competition for space or resources by dominant species determines the outcome of succession. Specifically, we examine the population- and community-level consequences of removing one or more potentially dominant species from the post-disturbance community after clearcut logging and burning of a mature/old-growth Douglas-fir forest. Experimental treatments include: (1) removal of early-seral annual, *Senecio sylvaticus*, or perennial, *Epilobium angustifolium*—or both—to test the influences of these early-seral dominants on subsequent community development; (2) removal of all species except *Senecio* or *Epilobium*, to test whether the decline of these early-seral dominants is driven by competitive displacement; or (3) removal of shade-tolerant forest species that dominate subsequent stages of succession—*Rubus ursinus* or *Berberis nervosa* plus *Gaultheria shallon*—to test the influences of these long-lived perennials on understory development. The experiment is a randomized block design comprising eight removal treatments plus a control replicated in each of 25 blocks. Removal (reduction in competition) is achieved by removing seedlings or vegetative stems annually from a treatment area of 2.5 x 2.5 m. Sample plots (1 x 1 m) centered within these are used to estimate cover of all vascular plant species and, for the first 8 yr of the experiment, stem density and height, facilitating estimates of above-ground biomass. Pre-harvest data were collected in 1990, logging/burning occurred in 1991, and removal treatments and post-treatment sampling were initiated in 1992. Six of the nine experimental treatments were terminated between 1996 and 1998, with loss of early-seral *Senecio* and *Epilobium* from the system. The remaining three treatments (removal of *Rubus*, removal of *Berberis* plus *Gaultheria*, and the control) have been sampled annually since 1992. All regeneration of trees within the experimental area has occurred naturally. In September 2018, the study site partially burned during the larger Terwilliger Fire on the Willamette National Forest. In 2019, plots were assessed for burn severity. Species' removals were terminated, but cover measurements continue in the plots.

Keywords: Clearcut logging; Clearcutting; Community dynamics; Competition; Disturbance; Long-Term Ecological Research (LTER); Primary production; Slash burning; Slash/broadcast burning; Species interactions; Succession; Trophic structure; Primary production; Long-Term Ecological Research (LTER); community dynamics; trophic structure; succession; primary production; species interactions; competition; disturbance; burning; timber harvest; clearcutting;

Date data commenced: 1990-07-01

Date data terminated: 2019-07-04

Principal Investigator: Charles B. Halpern

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1. Species Cover, Density, and Biomass Measurement Data

Attribute List:

DBC CODE	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	1.0000	1.0000	number
STUDY	Y	N	char(11)	place			
YEAR	Y	N	numeric(4,0)	range	1990.0000	2019.0000	number
S DATE	N	Y	datetime	range	6/1/1990 12:00:00 AM	7/4/2019 12:00:00 AM	YYYY-MM-DD
SEASON	Y	N	char(1)	enum			

BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number
TMT	Y	N	char(1)	enum			
SPECIES	Y	N	char(6)	taxa			
STRATUM	Y	N	char(1)	enum			
COV1_4TH	N	Y	numeric(5,1)	range	0.0000	100.0000	%
COVER	N	Y	numeric(5,1)	range	0.0000	100.0000	%
DENSITYS	N	Y	numeric(6,0)	range	0.0000	3300.0000	number
DENSITYM	N	Y	numeric(6,0)	range	0.0000	105.0000	number
DBA	N	Y	numeric(5,1)	range	0.0000	100.0000	cm
HT	N	Y	numeric(5,1)	range	0.0000	145.0000	cm
HTV	N	Y	numeric(5,1)	range	0.0000	330.0000	cm
REC_NO	Y	N	numeric(4,0)	range	1.0000	1135.0000	number

2. Species Removals (counts)

Attribute List:

DBCOD	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	2.0000	2.0000	number
STUDY	N	Y	char(11)	place			
SDATE	N	Y	datetime	range	6/21/1992	8/14/1994	YYYY-MM-DD
					12:00:00	12:00:00	
					AM	AM	
RDATE	Y	Y	datetime	range	6/22/1992	5/17/1998	YYYY-MM-DD
					12:00:00	12:00:00	
					AM	AM	
SEASON	Y	Y	char(1)	enum	1.0000	3.0000	
BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number
TMT	Y	N	char(1)	enum			
SPECIES	Y	Y	char(6)	taxa			
NREMBUF	N	Y	numeric(6,0)	range	0.0000	1354.0000	number
NREMLT	N	Y	numeric(6,0)	range	0.0000	486.0000	number
NOTES	N	Y	varchar(45)	freetext			

3. Species Cover, Density, and Biomass Measurements Original Fieldsheet Format

Attribute List:

DBCOD	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	3.0000	3.0000	number
STUDY	N	Y	char(11)	place			

YEAR	Y	N	numeric(4,0)	range	1990.0000	1996.0000	number
SDATE	N	Y	datetime	range	6/21/1998	7/15/1996	YYYY-MM-DD
					12:00:00	12:00:00	
					AM	AM	
SEASON	Y	N	char(1)	enum			
BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number
TMT	Y	N	char(1)	enum			
SPECIES	Y	N	char(6)	taxa			
STRATUM	Y	Y	char(1)	enum			
LC	Y	N	numeric(3,0)	range	1.0000	165.0000	number
COV1_4TH	N	Y	numeric(5,1)	range	0.0000	100.0000	%
COVER	N	Y	numeric(5,1)	range	0.0000	100.0000	%
DENSITYYS	N	Y	numeric(6,0)	range	0.0000	3300.0000	number
DENSITYM	N	Y	numeric(6,0)	range	0.0000	120.0000	number
STEM1BV1	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM1BV2	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM2BV1	N	Y	numeric(5,1)	range	0.0000	330.0000	number
STEM2BV2	N	Y	numeric(5,1)	range	0.0000	150.0000	number
STEM3BV1	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM3BV2	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM4BV1	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM4BV2	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM5BV1	N	Y	numeric(5,1)	range	0.0000	130.0000	number
STEM5BV2	N	Y	numeric(5,1)	range	0.0000	130.0000	number

4. Species Cover, Density, and Biomass Measurements Modified Fieldsheet Format

Attribute List:

DBCOD	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	4.0000	4.0000	number
STUDY	N	Y	char(11)	place			
YEAR	Y	N	numeric(4,0)	range	1997.0000	2002.0000	number
SDATE	N	Y	datetime	range	7/4/1998	7/14/1999	YYYY-MM-DD
					12:00:00	12:00:00	
					AM	AM	
SEASON	Y	N	char(1)	enum			
BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number

TMT	Y	N	char(1)	enum			
SPECIES	Y	N	char(6)	taxa			
LC	Y	N	numeric(3,0)	range	1.0000	10.0000	number
COV1_4TH	N	Y	numeric(5,1)	range	0.0000	100.0000	%
COVER	N	Y	numeric(5,1)	range	0.0000	100.0000	%
DENSITYS	N	Y	numeric(6,0)	range	0.0000	2000.0000	number
DENSITYM	N	Y	numeric(6,0)	range	0.0000	70.0000	number
STEM1BV1	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM1BV2	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM1NO	N	Y	numeric(5,0)	range	1.0000	1000.0000	number
STEM2BV1	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM2BV2	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM2NO	N	Y	numeric(5,0)	range	1.0000	1000.0000	number
STEM3BV1	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM3BV2	N	Y	numeric(5,1)	range	0.1000	150.0000	number
STEM3NO	N	Y	numeric(5,0)	range	1.0000	1000.0000	number

5. Equations used for calculating biomass

Attribute List:

DBCODE	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	5.0000	5.0000	number
STUDY	N	Y	char(11)	place			
YEAR	Y	N	numeric(4,0)	range	1992.0000	2019.0000	number
SPECIES	Y	N	char(6)	taxa			
EQUATION	N	N	varchar(55)	freetext			
ALTEQU	Y	N	char(1)	enum			

6. Estimated biomass using measurement data and equations

Attribute List:

DBCODE	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	6.0000	6.0000	number
STUDY	N	Y	char(11)	place			
YEAR	Y	N	numeric(4,0)	range	1992.0000	2019.0000	number
SEASON	Y	N	char(1)	enum			
BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number

TMT	Y	N	char(1)	enum			
SPECIES	Y	N	char(6)	taxa			
B_VAL	Y	Y	numeric(3,0)	range	1.0000	8.0000	number
BIOMASS	N	Y	numeric(12,5)	range	0.0000	2279755.7500	g/m2

7. Assessment of 2018 burn severity

Attribute List:

DBCOD	N	N	char(5)	enum			
ENTITY	N	N	numeric(1,0)	range	7.0000	7.0000	number
STUDY	N	N	char(11)	place			
YEAR	Y	N	numeric(4,0)	range	2019.0000	2019.0000	number
SDATE	N	N	datetime	range	7/3/2019 12:00:00 AM	7/4/2019 12:00:00 AM	YYYY-MM-DD
BLOCK	Y	N	numeric(2,0)	range	1.0000	25.0000	number
PLOT	Y	N	numeric(1,0)	range	1.0000	9.0000	number
TMT	Y	N	char(1)	enum			
TREES_LIVE	N	N	numeric(2,0)	range	0.0000	12.0000	number
TREES_DEAD	N	N	numeric(2,0)	range	0.0000	11.0000	number
PROP_DEAD	N	Y	numeric(2,1)	range	0.0000	100.0000	number
PCT_BURN	N	N	numeric(3,0)	range	0.0000	100.0000	%
PCT_BURN_ADJ	N	N	numeric(3,0)	range	0.0000	100.0000	%
BURN_CLASS	N	N	char(2)	enum			
BURN_COMMENT	N	Y	char(254)	freetext			

Attributes Definitions:

ALTEQU

Alternative equation within a species for calculating biomass

B_VAL

Unique biomass value for a given year, season, block, plot, tmt, species.

BIOMASS

Estimated biomass

BLOCK

Sample block (1-25)

BURN_CLASS

Burn class

BURN_COMMENT

Description of burn conditions

COV1_4TH

Cover in the 1/4 plot

COVER

Cover in the 1 m² plot

DBA

Basal diameter

DBCOD

Database code

DENSITYM

Density of mature stems/sprouts (1 m² plot)

DENSITYS

Density of seedlings (1 m² plot)

ENTITY

Entity number

EQUATION

Explicit equation used for calculating biomass. mht = height, mcov= cover, mdb = bottom diameter

HT

Total height (including inflorescence if present)

HTV

Height of vegetative portion

LC

Line count

NOTES

Comments

NREMBUF

Number of stems removed from 75 cm buffer

NREMLT

Number of stems removed from 1 m² plot

PCT_BURN

Percentage of ground surface burned or charred within the plot

PCT_BURN_ADJ

Percentage of ground surface burned or charred within 0.5 m of the plot edge

PLOT

Sample plot w/in block (1-9)

PROP_DEAD

Proportion of trees within 2.5 m of the plot that are dead (undefined if there are no trees)

RDATE

Date of species removal (yyyymmdd)

REC_NO

Unique record number for a given year, season, block, plot, tmt, species and stratum

SDATE

Vegetation sampling date

SEASON

Sampling season (1 - 3)

SPECIES

Species acronym according to Garrison et al. 1974

STEM1BV1

Biomass parameter 1 of stem1

STEM1BV2

Biomass parameter 2 of stem1

STEM1NO

Number of stems containing the corresponding bv1 and bv2 values

STEM2BV1

Biomass parameter 1 of stem2

STEM2BV2

Biomass parameter 2 of stem2

STEM3BV1

Biomass parameter 1 of stem3

STEM3BV2

Biomass parameter 2 of stem3

STEM4BV1

Biomass parameter 1 of stem4

STEM4BV2

Biomass parameter 2 of stem4

STEM5BV1

Biomass parameter 1 of stem5

STEM5BV2

Biomass parameter 2 of stem5

STRATUM

Pre-harvest tree stratum: (O)verstory, (S)ubcanopy, (U)nderstory

STUDY

Study site location

TMT

Treatment code (A-I)

TREES_DEAD

Number of dead trees within 2.5 m of the plot

TREES_LIVE

Number of live trees within 2.5 m of the plot

YEAR

Sampling year

Enumerated Domains:

Enumerated Domain for Attribute: SEASON

Unknown season of sampling

- | | |
|---|--|
| 1 | First season of sampling per year (usually june) |
| 2 | Second season of sampling per year (usually july) |
| 3 | Third season of sampling per year (usually august) |

Enumerated Domain for Attribute: DBCODE

TP103 FSDB database code TP103

Enumerated Domain for Attribute: STRATUM

- | | |
|---|---|
| O | Overstory |
| S | Subcanopy |
| U | Understory |
| N | post-harvest (1990) or not a tree in 1990 (only recorded for trees pre-harvest) |

Enumerated Domain for Attribute: TMT

- | | |
|---|--|
| A | Control |
| B | Senecio sylvaticus removed |
| C | Epilobium angustifolium removed |
| D | Senecio sylvaticus and Epilobium angustifolium removed |
| E | Senecio sylvaticus and community removed |
| F | Epilobium angustifolium and community removed |
| G | Community removed |
| H | Rubus ursinus removed |
| I | Berberis nervosa and Gaultheria shallon removed |

Enumerated Domain for Attribute: SEASON

Unknown season of sampling

- | | |
|---|--|
| 1 | First season of sampling per year (usually june) |
| 2 | Second season of sampling per year (usually july) |
| 3 | Third season of sampling per year (usually august) |

Enumerated Domain for Attribute: DBCODE

TP103 FSDB database code TP103

Enumerated Domain for Attribute: TMT

- A Control
- B Senecio sylvaticus removed
- C Epilobium angustifolium removed
- D Senecio sylvaticus and Epilobium angustifolium removed
- E Senecio sylvaticus and community removed
- F Epilobium angustifolium and community removed
- G Community removed
- H Rubus ursinus removed
- I Berberis nervosa and Gaultheria shallon removed

Enumerated Domain for Attribute: SEASON

- Unknown season of sampling
- 1 First season of sampling per year (usually june)
- 2 Second season of sampling per year (usually july)
- 3 Third season of sampling per year (usually august)

Enumerated Domain for Attribute: DBCODE

- TP103 FSDB database code TP103

Enumerated Domain for Attribute: STRATUM

- O Overstory
- S Subcanopy
- U Understory
- N post-harvest (1990) or not a tree in 1990 (only recorded for trees pre-harvest)

Enumerated Domain for Attribute: TMT

- A Control
- B Senecio sylvaticus removed
- C Epilobium angustifolium removed
- D Senecio sylvaticus and Epilobium angustifolium removed
- E Senecio sylvaticus and community removed
- F Epilobium angustifolium and community removed
- G Community removed
- H Rubus ursinus removed
- I Berberis nervosa and Gaultheria shallon removed

Enumerated Domain for Attribute: SEASON

- Unknown season of sampling
- 1 First season of sampling per year (usually june)

- 2 Second season of sampling per year (usually july)
- 3 Third season of sampling per year (usually august)

Enumerated Domain for Attribute: DBCODE
TP103 FSDB database code TP103

- Enumerated Domain for Attribute: TMT
- A Control
 - B Senecio sylvaticus removed
 - C Epilobium angustifolium removed
 - D Senecio sylvaticus and Epilobium angustifolium removed
 - E Senecio sylvaticus and community removed
 - F Epilobium angustifolium and community removed
 - G Community removed
 - H Rubus ursinus removed
 - I Berberis nervosa and Gaultheria shallon removed

- Enumerated Domain for Attribute: ALTEQU
- 1 primary equation
 - 2 second alternative equation
 - 3 third alternative equation
 - 4 fourth alternative equation

Enumerated Domain for Attribute: DBCODE
TP103 FSDB database code TP103

- Enumerated Domain for Attribute: SEASON
- Unknown season of sampling
 - 1 First season of sampling per year (usually june)
 - 2 Second season of sampling per year (usually july)
 - 3 Third season of sampling per year (usually august)

Enumerated Domain for Attribute: DBCODE
TP103 FSDB database code TP103

- Enumerated Domain for Attribute: TMT
- A Control
 - B Senecio sylvaticus removed
 - C Epilobium angustifolium removed
 - D Senecio sylvaticus and Epilobium angustifolium removed
 - E Senecio sylvaticus and community removed
 - F Epilobium angustifolium and community removed

G	Community removed
H	Rubus ursinus removed
I	Berberis nervosa and Gaultheria shallon removed

Enumerated Domain for Attribute: DBCODE
TP103 FSDb database code TP103

Enumerated Domain for Attribute: TMT

A	Control
B	Senecio sylvaticus removed
C	Epilobium angustifolium removed
D	Senecio sylvaticus and Epilobium angustifolium removed
E	Senecio sylvaticus and community removed
F	Epilobium angustifolium and community removed
G	Community removed
H	Rubus ursinus removed
I	Berberis nervosa and Gaultheria shallon removed

Enumerated Domain for Attribute: BURN_CLASS

B	Burned
PB	Partially burned
UB	Unburned