Supplemental Material

Table 1: Species-specific parameter values for LANDIS-II.

Species	Longevity (years)	Sexual Maturity (years)	Shade Tolerance (1-5)	Fire Tolerance (1-5)	Effective Seed Dispersal Distance (m)	Maximum Seed Dispersal Distance (m)
Abies grandis	300	20	4	2	54	100
Acer macrophyllum	150	20	2	2	15	120
Alnus rubra	100	10	2	2	50	100
Fraxinus latifolia	150	30	3	2	5	300
Pinus ponderosa	600	16	2	5	37	120
Pseudotsuga menziesii	750	25	3	3	100	1500
Quercus garryana	500	20	2	4	6	400
Thuja plicata	1000	25	5	2	100	122
Tsuga heterophylla	400	30	5	1	100	1600

Species	Vegetative reproduction probability (0-1)	Minimum age of sprouting	Maximum age of sprouting	Post-fire Regeneration
Abies grandis	0	0	0	None
Acer macrophyllum	0.7	0	100	resprout
Alnus rubra	0.7	0	10	resprout
Fraxinus latifolia	0.7	0	100	resprout
Pinus ponderosa	0	0	3	None
Pseudotsuga menziesii	0	0	0	None
Quercus garryana	0.7	0	200	resprout
Thuja plicata	0.5	0	200	None
Tsuga heterophylla	0.3	0	2	None

Table 2: Species-specific parameter values for the Century Succession extension of LANDIS-II.

Species	**Functional Type**	**N Fixation**	**Growing Degree Days Min**	**Growing Degree Days Max**	**Minimum Jan Temp deg C**	**Max Drought**	**Leaf Longevity**	**Epicormic Sprouting**
Abies grandis	2	N	500	2450	-9	0.8	6	N
Acer macrophyllum	1	N	900	3100	-25	0.7	1	Y
Alnus rubra	1	Y	600	2200	-24	0.8	1	Y
Fraxinus latifolia	1	N	150	2400	-22	0.7	1	N
Pinus ponderosa	2	N	800	3900	-41	0.9	4.5	N
Pseudotsuga menziesii	2	N	500	2500	-37	0.8	4.8	N
Quercus garryana	3	N	1400	2600	-34	0.9	1	Y
Thuja plicata	2	N	500	2000	-36	0.7	8.9	N
Tsuga heterophylla	2	N	500	1900	-31	0.7	1.6	N

Species	**Leaf Lignin**	**Fine Root Lignin**	**Wood Lignin**	**Coarse Root Lignin**	**Leaf C:N**	**Fine Root C:N**	**Wood C:N**	**Coarse Root C:N**	**Litter C:N**
Abies grandis	0.25	**0.22**	**0.35**	**0.35**	**42**	**27**	**500**	**170**	**77**
Acer macrophyllum	0.192	**0.224**	**0.25**	**0.26**	**20**	**30**	**440**	**90**	**62**
Alnus rubra	0.117	0.151	0.25	0.19	23	25	50	50	24
Fraxinus latifolia	0.122	0.159	0.25	0.2	24	38	400	90	55
Pinus ponderosa	0.28	0.233	0.35	0.277	43	47	380	284	85
Pseudotsuga menziesii	0.155	0.296	0.269	0.323	42	52	455	214	68
Quercus garryana	0.176	0.22	0.14	0.26	32	63	63	62	33
Thuja plicata	0.18	0.205	0.293	0.245	53	29	80	38	100
Tsuga heterophylla	0.191	0.216	0.288	0.245	46	50	380	313	37

Table 3: Functional group parameters for the Century Succession extension of LANDIS-II.

Functional Group Name	Index	PPDF1 T-Mean	PPDF2 T-Max	PPDF3 T-Shape	PPDF4-T-Shape	FCFRAC Leaf	BTOLAI	KLAI	MAXLAI
Hdwd_mesic	1	18.5	40.0	5.0	0.8	0.3	0.004	1000	4.0
Hdwd_dry	3	22.0	40.0	1.0	3.0	0.3	0.007	1000	4.0
Conifers	2	18.0	40.0	5.0	0.7	0.2	0.004	5000	12.0

Functional Group Name	Index	PPRPTS2	PPRPTS3	Wood Decay Rate	Monthly Wood Mortality	Mortality Age Shape	Leaf Drop Month
Hdwd_mesic	1	1.0	0.8	0.4	0.0024	10	10
Hdwd_dry	3	1.0	0.4	0.3	0.0024	15	10
Conifers	2	1.0	0.8	0.4	0.0015	15	10

Table 4: Ecoregion parameters for the Century Succession extension of LANDIS-II.

Initial Ecoregion Parameters

Name	SOM1 C Surf	SOM1 N Surf	SOM1 C Soil	SOM1 N Soil	SOM2 C	SOM2 N	SOM3 C	SOM3 N	Minrl N
Eco1	267	7	226.8	18.9	4158	207.9	3175.2	317.5	0.306
Eco2	2064	52	137.2	11.4	2514.6	125.7	1920.2	192	0.476

	Soil Depth	% Clay	% Sand	Field Cap	Wilt Point	StormF Frac	BaseF Frac	Drain	Atm N dep	Atm N intercept	Latitude
Eco1	100	0.035	0.823	0.069	0.034	0.01	0.14	0.9	0.0044	0.0343	47.0
Eco2	100	0.023	0.630	0.100	0.059	0.00	0.10	0.7	0.0044	0.0343	47.0

Ecoregion Parameters cont.	Decay Surf	Decay SOM1	Decay SOM2	Decay SOM3	Denitrifi
Eco1	0.3	0.2	0.025	0.00008	0.01
Eco2	0.3	0.7	0.060	0.00001	0.01

Table 5: Species productivity parameters for the Century Succession extension of LANDIS-II.

Monthly Max NPP (g m^{-2} month^{-1})

	Eco1	**Eco2**
Abies grandis	400	400
Acer macrophyllum	300	300
Alnus rubra	400	400
Fraxinus latifolia	400	400
Pinus ponderosa	300	300
Pseudotsuga menziesii	350	350
Quercus garryana	200	200
Thuja plicata	300	300
Tsuga heterophylla	300	300

Maximum Biomass (g m^{-2})

	Eco1	**Eco2**
Abies grandis	50000	50000
Acer macrophyllum	50000	50000
Alnus rubra	50000	50000
Fraxinus latifolia	50000	50000
Pinus ponderosa	60000	60000
Pseudotsuga menziesii	100000	100000
Quercus garryana	15000	15000
Thuja plicata	70000	70000
Tsuga heterophylla	100000	100000

Table 6: Kolmogrov-Smirnov test results for comparison of year 2100 probability of oak occurrence for three treatments (burn-only, thin-only, thin-and-burn) against the control under each climate scenario. Climate scenarios include projections from two general circulation models (CCSM and CNRM), driven by two emission scenarios (moderate (RCP 4.5) and high (RCP 8.5) emissions). For each treatment n=7386.

Climate Scenario	Treatment	D Statistic	*p*-value
CNRM 4.5	Thin-only	0.0927	<0.001
	Thin-and-Burn	0.0737	<0.001
	Burn-only	0.019	0.141
CCSM 4.5	Thin-only	0.0961	<0.001
	Thin-and-Burn	0.0639	<0.001
	Burn-only	0.0198	0.112
CNRM 8.5	Thin-only	0.0699	<0.001
	Thin-and-Burn	0.0491	<0.001
	Burn-only	0.0149	0.386
CCSM 8.5	Thin-only	0.0649	<0.001
	Thin-and-Burn	0.0426	<0.001
	Burn-only	0.0175	0.210

Table 7: Year 2100 mean oak carbon stocks within the 708 ha oak restoration area. The No Oak Restoration treatment under baseline climate had the landscape-scale thin and burn treatment. For each treatment n=25 replicate simulations.

Treatment	Climate Scenario	Mean oak C (g m^{-2})	Standard Error
No Oak Restoration	Baseline	9.34	0.94
Oak Restoration	Baseline	54.44	1.42
Oak Restoration	CNRM 4.5	51.34	1.28
Oak Restoration	CCSM 4.5	51.42	1.06
Oak Restoration	CNRM 8.5	52.30	1.48
Oak Restoration	CCSM 8.5	49.06	1.00

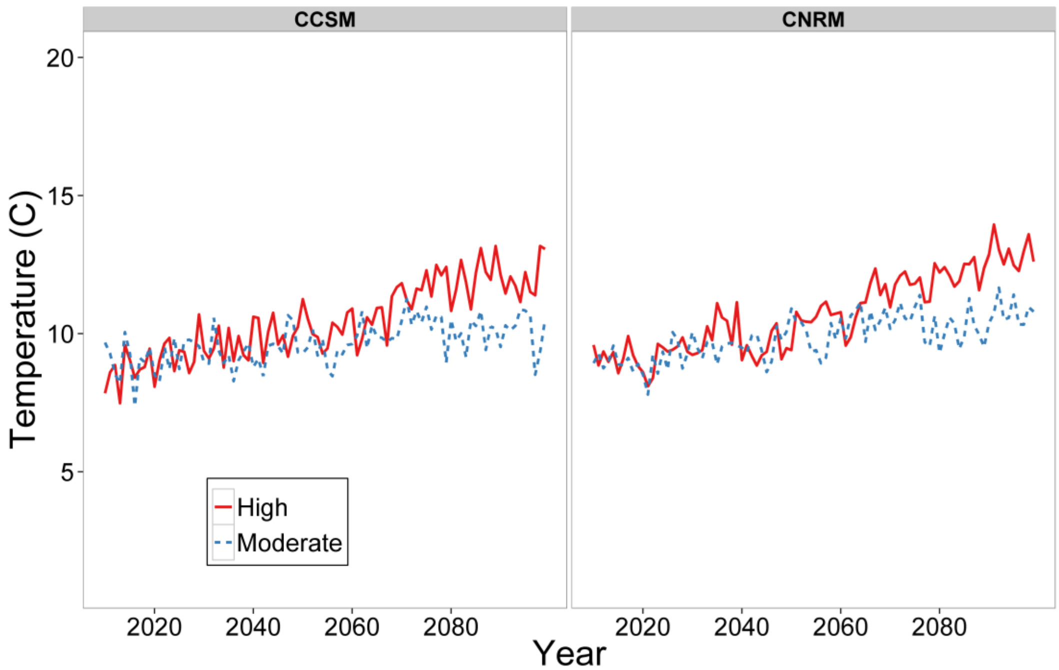

Figure 1: Projected mean annual temperature in degrees Celsius under two general circulation models (CCSM and CNRM), driven by two emission scenarios (moderate (RCP 4.5) and high (RCP 8.5) emissions).

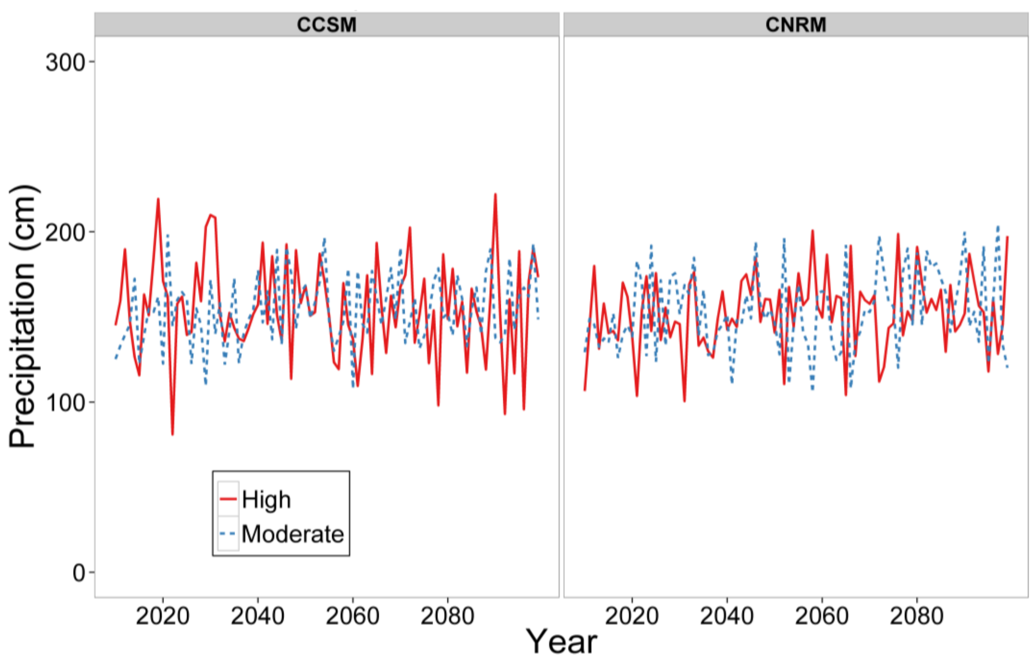

Figure 2: Projected mean annual precipitation (cm) under two general circulation models (CCSM and CNRM), driven by two emission scenarios (moderate (RCP 4.5) and high (RCP 8.5) emissions).

References for LANDIS-II Parameters

Apple, M., Tiekotter, K., Snow, M., Young, J., Soeldner, A., Phillips, D., Tingey, D., Bond, B.J., 2002. Needle anatomy changes with increasing tree age in Douglas-fir. Tree Physiol. 22, 129-136.

Balster, N.J., Marshall, J.D., 2000. Decreased needle longevity of fertilized Douglas-fir and grand fir in the northern Rockies. Tree Physiol. 20, 1191-1197.

Burns, R.M., Honkala, B.H. (Eds.), 1990a. Silvics of North America Volume 1: Conifers. U.S. Department of Agriculture, Forest Service, Washington D.C.

Burns, R.M., Honkala, B.H. (Eds.), 1990b. Silvics of North America Volume 2: Hardwoods. U.S. Department of Agriculture, Forest Service, Washington D.C.

Burton, P.J., Cumming, S.G., 1995. Potential effects of climatic change on some western Canadian forests, based on phenological enhancements to a patch model of forest succession. Water, Air and Soil Pollution 82, 401-414.

Chen, H., Harmon, M.E., Griffiths, R.P., 2001. Decomposition and nitrogen release from decomposing woody roots in coniferous forests of the Pacific Northwest: a chronosequence approach. Can. J. For. Res. 31, 246-260.

Chen, H., Harmon, M.E., Sexton, J., Fasth, B., 2002. Fine-root decomposition and N dynamics in coniferous forests of the Pacific Northwest, U.S.A. Can. J. For. Res. 32, 320-331.

Cross, A., Perakis, S.S., 2011. Tree species and soil nutrient profiles in old-growth forests of the Oregon coast range. Can. J. For. Res. 41, 195-210.

Fryer, Janet L., 2011. *Acer macrophyllum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at http://www.fs.fed.us/database/feis/ (Accessed July 22, 2013).

Gucker, Corey L., 2007. *Quercus garryana*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at http://www.fs.fed.us/database/feis/ (Accessed July 22, 2013).

Habeck, R. J., 1992. *Pinus ponderosa* var. ponderosa. In: Fire Effects Information System, [Online].U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at http://www.fe.fed.us/database/feis/ (Accessed July 22, 2013).

Hamdan, K., Schmidt, M., 2012. The influence of bigleaf maple on chemical properties of throughfall, stemflow, and forest floor in coniferous forest in the Pacific Northwest. Can. J. For. Res. 42, 868-878.

Harlow, B.A., Duursma, R.A., Marshall, J.D., 2005. Leaf longevity of western red cedar (*Thuja plicata*) increases with depth in the canopy. Tree Physiol. 25, 557-562.

Harrington, C.A., 2006. Biology and ecology of red alder in: Deal, R.L., Harrington, C.A. (Eds), Red Alder: A State of Knowledge. US Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland OR, pp. 21-50.

Heath, B., Sollins, P., Perry, D.A., Cromack, K. Jr., 1987. Asymbiotic nitrogen fixation in litter from Pacific Northwest forests. Can. J. For. Res. 18, 68-74.

LANDFIRE. LANDFIRE Mean Fire Return Interval layer, 2013. U.S. Department of Interior, Geological Survey. Available online at http://landfire.cr.usgs.gov/viewer/ (Accessed October 2014).

Lee, J.J., Weber, D.E., 1983. Effects of sulfuric acid rain on decomposition rate and chemical element content of hardwood leaf litter. Can. J. Bot. 61, 872-879

Metherell, A.K., Harding, L.A., Cole, C.V., Parton, W.J., 1993. CENTURY soil organic matter model environment technical documentation Agroecosystem Version 4.0. USDA-ARS, Fort Collins, CO.

Moore, T.R., Trofymow, J.A., Prescott, C.E., Fyles, J., Titus, B.D., CIDET Working Group, 2006. Patterns of carbon, nitrogen, and phosphorus dynamics in decomposing foliar litter in Canadian forests. Ecosystems 9, 46-62.

NADP, 2012. National Atmospheric Deposition Program/National Trends Network 2012 Annual & seasonal data summary for site WA21 Part 1: summary of sample validity and completeness criteria. NADP Program Office, Illinois State Water Survey, 2204 Griffith Dr., Champaign, IL. Available online at nadp.sws.uiuc.deu/NTN/ntnData.aspx . (Accessed 1 April2014).

NRCS, 2013. The PLANTS Database. U.S. Department of Agriculture, Natural Resources Conservation Service. Greensboro, NC. Available online at http://plants.usda.gov. Accessed 1 January 2014

NRCS, 2013. Web Soil Survey. U.S. Department of Agriculture, Natural Resources Conservation Service. Available online at http://websoilsurvey.nrcs.usda.gov. Accessed 1 October 2013.

Schowalter, T.D, Zhang, Y.L., Sabin, T.E., 1998. Decomposition and nutrient dynamics of oak Quercus spp. Logs after five years of decomposition. Ecography 21, 3-10.

Thompson, R.S., Anderson, K.H., Bartlein, P.J., 1999. Atlas of relations between climatic parameters and distributions of important trees and shrubs in North America – Introductions and conifers: U.S. Geological Survey Professional Paper 1650-A. Available online at http://pubs.usgs.gov/pp/p1650-a/. Accessed 8 January 2014.

Thompson, R.S., Anderson, K.H., Bartlein, P.J., 1999. Atlas of relations between climatic parameters and distributions of important trees and shrubs in North America – Hardwoods: U.S.Geological Survey professional Paper 1650-B. Available online at http://pubs.usgs.gov/pp/p1650-b/. Accessed 8 January 2014.

Valachovic, Y.S., Caldwell, B.A., Cromack, K. Jr., Griffiths, R.P., 2004. Leaf litter chemistry controls on decomposition of Pacific Northwest trees and woody shrubs. Can. J. For. Res. 23, 2131-2147.

White, M.A., Thornton, P.E., Running, S.W., Nemani, R.R., 2000. Parameterization and sensitivity analysis of the BIOME-BGC terrestrial ecosystem model: net primary production controls. Earth Interact. 4, 1, 85.