Digital Appendix 1

Environmental variables used in environmental niche modeling

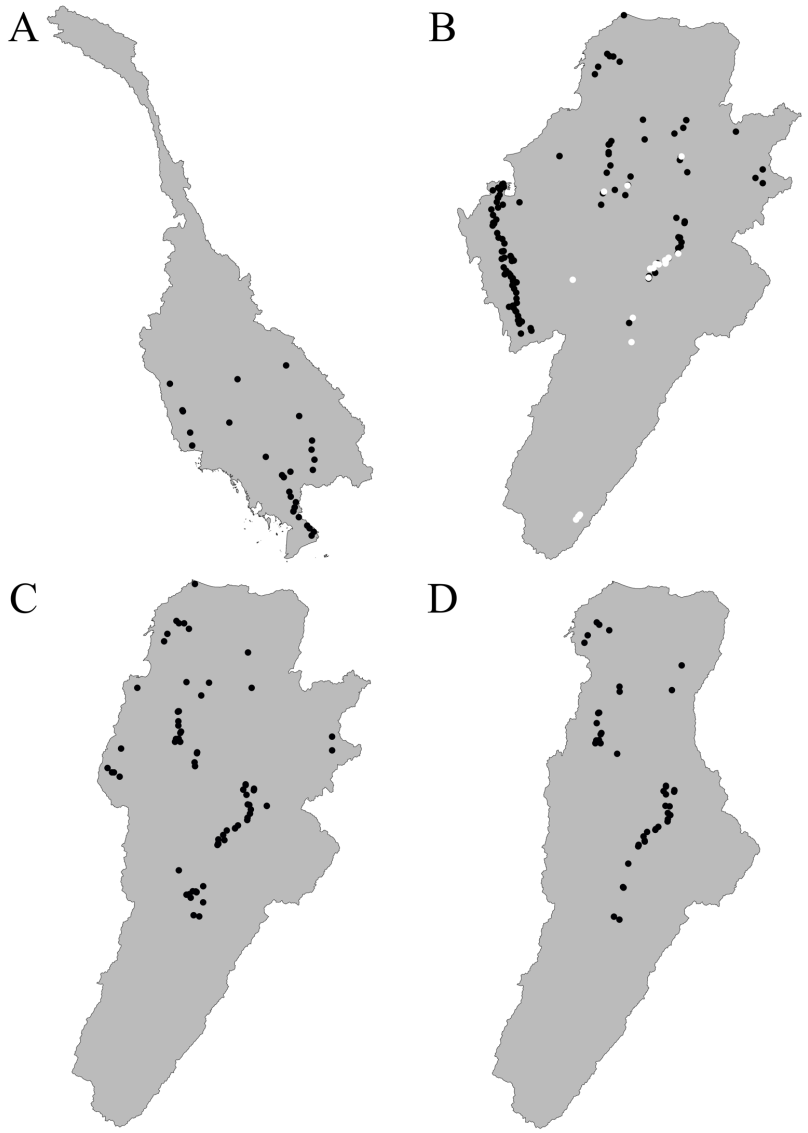
Variable name	Variable explanation	Unit
elevation_01	Minimum elevation	m
elevation_02	Maximum elevation	m
elevation_03	Elevation range	m
elevation_04	Average elevation	m
flow_acc_01	Number of upstream stream grid cells	count
flow_acc_02	Number of upstream catchment grid cells	count
hydroclim_averagesum_01	Annual Mean Upstream Temperature	°C * 10
Hydroclim_averagesum_02	Mean Upstream Diurnal Range (Mean of monthly (max temp - min temp))	°C * 10
hydroclim_averagesum_03	Upstream Isothermality (hydro_02 / hydro_07) (* 100)	* 100
hydroclim_averagesum_04	Upstream Temperature Seasonality (standard deviation * 100)	°C * 10
hydroclim_averagesum_05	Maximum Upstream Temperature of Warmest Month	°C * 10
hydroclim_averagesum_06	Minimum Upstream Temperature of Coldest Month	°C * 10
hydroclim_averagesum_07	Upstream Temperature Annual Range (hydro_05 - hydro_06)	°C * 10
hydroclim_averagesum_08	Mean Upstream Temperature of Wettest Quarter	°C * 10
hydroclim_averagesum_09	Mean Upstream Temperature of Driest Quarter	°C * 10
hydroclim_averagesum_10	Mean Upstream Temperature of Warmest Quarter	°C * 10
hydroclim_averagesum_11	Mean Upstream Temperature of Coldest Quarter	°C * 10
hydroclim_averagesum_12	Annual Upstream Precipitation	mm
hydroclim_averagesum_13	Upstream Precipitation of Wettest Month	mm
hydroclim_averagesum_14	Upstream Precipitation of Driest Month	mm
hydroclim_averagesum_15	Upstream Precipitation Seasonality (Coefficient of Variation)	* 100
hydroclim_averagesum_16	Upstream Precipitation of Wettest Quarter	mm
hydroclim_averagesum_17	Upstream Precipitation of Driest Quarter	mm
hydroclim_averagesum_18	Upstream Precipitation of Warmest Quarter	mm
hydroclim_averagesum_19	Upstream Precipitation of Coldest Quarter	mm
landcover_average_01	Evergreen/deciduous needleleaf trees	%
landcover_average_02	Evergreen broadleaf trees	%

landcover_average_03	Deciduous broadleaf trees	%
landcover_average_04	Mixed/other trees	%
landcover_average_05	Shrubs	%
landcover_average_06	Herbaceous vegetation	%
landcover_average_07	Cultivated and managed vegetation	%
landcover_average_08	Regularly flooded shrub/herbaceous vegetation	%
landcover_average_12	Open water	%
monthly_prec_sum_01	Sum of monthly precipitation for January	mm
monthly_prec_sum_02	Sum of monthly precipitation for February	mm
monthly_prec_sum_03	Sum of monthly precipitation for March	mm
monthly_prec_sum_04	Sum of monthly precipitation for April	mm
monthly_prec_sum_05	Sum of monthly precipitation for May	mm
monthly_prec_sum_06	Sum of monthly precipitation for June	mm
monthly_prec_sum_07	Sum of monthly precipitation for July	mm
monthly_prec_sum_08	Sum of monthly precipitation for August	mm
monthly_prec_sum_09	Sum of monthly precipitation for September	mm
monthly_prec_sum_10	Sum of monthly precipitation for October	mm
monthly_prec_sum_11	Sum of monthly precipitation for November	mm
monthly_prec_sum_12	Sum of monthly precipitation for December	mm
slope_01	Minimum slope	° * 100
slope_02	Maximum slope	° * 100
slope_03	Slope range	° * 100
slope_04	Average slope	° * 100
soil_maximum_01	Soil organic carbon	g/kg
soil_maximum_02	Soil pH in H2O	pH * 10
soil_maximum_03	Sand content mass fraction	%
soil_maximum_04	Silt content mass fraction	%
soil_maximum_05	Clay content mass fraction	%
soil_maximum_06	Coarse fragments (> 2 mm fraction) volumetric	%
soil_maximum_07	Cation exchange capacity	cmol/kg
soil_maximum_08	Bulk density of the fine earth fraction	kg/m3
soil_maximum_09	Depth to bedrock (R horizon) up to maximum 240 cm	cm
soil_maximum_10	Probability of occurrence (0-100 %) of R horizon	%
soil_minimum_01	Soil organic carbon	g/kg
soil_minimum_02	Soil pH in H2O	pH * 10
soil_minimum_03	Sand content mass fraction	%
soil_minimum_04	Silt content mass fraction	%
soil_minimum_05	Clay content mass fraction	%

soil_minimum_06	Coarse fragments (> 2 mm fraction) volumetric	%
soil_minimum_07	Cation exchange capacity	cmol/kg
soil_minimum_08	Bulk density of the fine earth fraction	kg/m3
soil_minimum_09	Depth to bedrock (R horizon) up to maximum 240 cm	cm
soil_minimum_10	Probability of occurrence (0-100 %) of R horizon	%
mediafolk	Streamflow	m3/s

Digital Appendix 2

Accessible areas or mobility (M). **A.** M for *P. hypophthalmus* (Mekong and Chao Phraya basin). **B.** M *for A. pardalis* (black dots) and non-native area of *P. hypophthalmus* (white dots) (Magdalena-Cauca, Atrato, Sinú, and Catatumbo basins). **C.** M for *S. cuspicaudus* (Magdalena, Cauca and Catatumbo basin). **D.** M for *P. magdaleniatum* (Magdalena and Cauca basin)



Digital Appendix 3

Georeferenced records for the species *P. hypophthalmus* for the native and introduction zone of in Colombia

Native range		Introduction range	
Latitude	Longitude	Latitude	Longitude
105.9639	13.5453	-74.1164	6.7841
106.0231	12.6198	-74.3204	6.6475
106.0959	13.0875	-74.1068	6.7586
103.8692	13.2169	-74.1054	6.7669
104.6117	12.3811	-75.1853	7.9821
104.9462	11.6209	-74.1028	6.7763
105.2448	11.1438	-74.7733	8.0873
105.0115	11.3974	-75.6297	2.3122
104.6952	12.2850	-75.6276	2.3134
104.9963	12.5377	-75.6345	2.3113
105.9863	13.9615	-75.6053	2.3426
100.0518	15.3460	-75.6737	2.2562
102.5756	16.7653	-73.8306	8.5966
105.3966	15.0822	-73.8875	6.9007
100.4069	14.3256	-74.0562	6.8279
100.0778	15.2961	-74.1080	6.7703
104.7994	17.3958	-74.1110	6.7269
102.2000	14.7833	-74.3783	6.6380
99.4806	16.5579	-74.4053	6.4800
100.5012	13.7337	-74.7046	5.3548
105.1300	10.7211	-74.2805	6.7217
105.1983	10.9125	-74.2805	6.7217
105.3810	10.4609	-74.2280	6.7115
105.7629	10.0758	-74.6813	5.7797
105.9660	9.6176	-75.7315	6.4438
106.0660	9.7904		
105.8690	9.9524		
105.1888	10.9044		
105.1870	10.9040		
105.1311	10.7289		
105.1373	10.7382		

Digital Appendix 4.
Georeferenced records of *P. magdaleniatum*

Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
5.2026	-74.7330	6.4802	-74.4057	7.1875	-73.9292	10.0320	-75.3444
5.2542	-74.8292	8.3118	-75.1370	7.3875	-73.9208	10.1625	-75.2875
5.7603	-74.6615	6.5076	-74.3983	7.4443	-73.9626	10.3875	-75.1292
5.7708	-74.6708	6.5788	-74.2926	7.5375	-73.9208	8.4349	-75.0611
6.1792	-74.5792	7.4443	-73.9626	8.0955	-74.7728	8.3340	-75.0903
6.4972	-74.3981	5.7603	-74.6615	8.6300	-75.1300	8.3292	-75.1375
6.5007	-74.4006	6.7684	-74.1061	9.1792	-74.7292	8.3085	-75.1411
6.5076	-74.3983	6.4972	-74.3981	9.2667	-74.7321	8.2792	-75.0625
6.5788	-74.2926	6.5643	-74.2909	9.6375	-73.6458	8.4579	-75.0483
6.6542	-74.3125	6.7324	-74.2500	10.2502	-74.9111	8.2792	-75.1542
6.7684	-74.1061	6.8208	-74.0542	10.3470	-75.0859	8.8125	-75.0875
6.7817	-74.1006	6.9144	-73.8924	9.2062	-73.8164	8.8125	-75.0958
6.9542	-73.8875	7.0260	-73.8445	7.4617	-73.7743		
7.0625	-73.8875	7.5245	-73.9200	7.4336	-73.7779		
7.4519	-73.7729	7.1788	-73.8568	8.8042	-75.1042		

Digital Appendix 5

Georeferenced records of *S. cuspicaudus*

Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
9.2207	-73.8154	10.3465	-74.9948	7.7458	-76.2208	6.6542	-74.3125
8.5625	-75.0958	7.0987	-73.8296	7.7458	-76.2542	6.4972	-74.3981
5.2542	-74.8292	10.3470	-75.0859	7.6708	-76.1208	8.6375	-75.0958
8.3694	-72.4106	7.4617	-73.7743	7.8226	-76.3327	5.4792	-74.6625
6.5076	-74.3983	7.4336	-73.7779	8.8125	-75.0875	7.1600	-73.5500
6.5007	-74.4006	7.4519	-73.7729	8.8125	-75.0958	10.2502	-74.9111
6.9542	-73.8875	8.3118	-75.1370	8.8042	-75.1042	6.5100	-74.4000
8.3118	-75.1370	6.5076	-74.3983	8.4349	-75.0611	9.2208	-75.8125
8.0961	-74.7672	7.4443	-73.9626	8.3340	-75.0903	10.1625	-75.2875
11.0322	-74.8063	7.1625	-73.5510	8.3292	-75.1375	10.3875	-75.1292
5.6542	-74.7792	5.7603	-74.6615	8.3085	-75.1411	5.6125	-74.9542
7.1625	-73.5510	6.7684	-74.1061	8.2792	-75.0625	5.6211	-74.9051
5.7603	-74.6615	6.4972	-74.3981	8.4579	-75.0483	5.5597	-74.8801
7.1865	-73.8842	8.0962	-74.7672	8.2792	-75.1542	5.6725	-74.8442
8.1300	-72.4100	5.2335	-74.7307	7.1788	-73.8568	5.6692	-74.7925
9.0875	-74.6958	9.3208	-74.9542	8.1613	-76.0958	5.6583	-74.7767
7.4443	-73.9626	6.5643	-74.2909	7.1620	-73.5510	5.7603	-74.6615
6.4792	-74.4125	6.7324	-74.2500	6.5770	-74.3970	11.0322	-74.8063
6.7684	-74.1061	6.8208	-74.0542	7.3548	-73.9057	6.4972	-74.3981
8.0875	-74.7708	6.9144	-73.8924	10.2502	-74.9111	7.4443	-73.9626
7.9208	-74.8125	7.0260	-73.8445	8.0792	-74.7708	7.8542	-74.8042
9.8375	-73.8792	7.5245	-73.9200	7.1625	-73.5510	6.7739	-74.1041
7.5375	-73.9208	10.0320	-75.3444	6.7684	-74.1061	9.3103	-74.5600
7.1625	-73.5510						

Digital Appendix 6

Georeferenced records of *A. pardalis*

Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
7.7042	-77.0375	8.0841	-76.9398	8.8125	-75.0875	7.8722	-77.0360
8.3694	-72.4106	7.9208	-74.8125	8.8125	-75.0958	7.9239	-77.0095
5.5042	-76.6375	8.3125	-75.1375	8.8042	-75.1042	8.0147	-76.9997
5.6958	-76.6625	6.4873	-74.3967	7.1788	-73.8568	8.0147	-76.9997
7.7542	-76.9542	5.6922	-76.6630	5.6750	-76.6638	8.0147	-76.9997
5.7125	-76.6208	5.6830	-76.6711	5.6754	-76.6642	8.0625	-76.9359
7.8789	-77.0405	10.2502	-74.9111	5.6957	-76.6617	8.2458	-74.7208
8.2208	-72.5375	10.3470	-75.0859	5.7354	-76.6885	8.8937	-74.4746
9.2307	-73.7487	7.3891	-77.1317	5.7543	-76.6731	7.7534	-75.2351
8.0042	-77.1292	7.0987	-73.8296	5.8125	-76.6875	8.0961	-74.7672
6.7708	-76.7958	8.9958	-73.9542	5.8875	-76.7208	7.4378	-77.1222
6.3982	-76.7133	7.4378	-77.1222	5.8986	-76.7325	5.6922	-76.6630
7.7534	-75.2351	6.9375	-76.9708	5.9907	-76.7799	10.3470	-75.0859
8.0125	-74.9958	5.9528	-76.7648	6.7790	-76.7612	6.4873	-74.3967
7.9542	-75.2042	7.4617	-73.7743	6.0396	-76.7094	7.0987	-73.8296
8.8937	-74.4746	7.4336	-73.7779	6.1156	-76.7155	6.5076	-74.3983
5.8958	-76.7292	7.4519	-73.7729	6.2180	-76.7193	7.1701	-73.8622
6.5995	-76.8940	8.3118	-75.1370	6.2863	-76.7565	6.8581	-76.8192
8.0507	-77.0351	7.1701	-73.8622	6.3458	-76.7875	6.4256	-76.7633
5.9708	-76.8458	6.5076	-74.3983	6.3983	-76.7690	6.3982	-76.7133
5.9875	-76.7792	6.8581	-76.8192	6.4230	-76.7781	8.3118	-75.1370
6.3875	-76.7458	6.4256	-76.7633	6.4708	-76.7792	8.3208	-73.7292
7.1701	-73.8622	6.3982	-76.7133	6.4958	-76.8125	8.1108	-76.9639
6.3875	-76.7542	8.6375	-75.1042	6.5268	-76.8224	7.8814	-77.0386
6.4625	-74.4042	8.6013	-75.9643	6.5547	-76.8466	7.8006	-77.0597
8.1300	-72.4100	6.9959	-73.8876	6.5608	-76.8806	8.0507	-77.0351
7.1625	-73.8625	7.7958	-76.6625	6.6605	-76.9390	5.9528	-76.7648
5.6892	-74.7462	7.8006	-77.0597	6.8072	-76.9733	10.3408	-75.0231
8.0875	-74.7708	7.8814	-77.0386	6.8297	-76.9271	8.6042	-75.9625
7.1865	-73.8842	8.1108	-76.9639	6.9448	-76.9394	9.0292	-72.8792
6.8292	-76.8042	6.5643	-74.2909	7.0770	-76.9259	8.4390	-75.0731
6.4256	-76.7633	6.7324	-74.2500	7.1542	-76.9625	5.5542	-76.4542
8.0961	-74.7672	6.8208	-74.0542	7.1784	-77.0289	6.5375	-76.9208
8.6708	-75.1042	6.9144	-73.8924	7.2590	-77.0523	8.8650	-75.0563
8.5337	-73.8592	7.0260	-73.8445	7.4205	-77.1076	8.5884	-73.8394
9.2375	-74.5042	7.5245	-73.9200	7.4292	-77.1042	5.5990	-76.4677
8.3118	-75.1370	10.0320	-75.3444	7.4940	-77.0677	6.4901	-74.3992

6.5076	-74.3983	10.1625	-75.2875	7.5729	-77.1251	11.0625	-74.8375
6.8581	-76.8192	10.3875	-75.1292	7.6708	-77.1542	9.0957	-73.7991
7.8789	-77.0405	8.3694	-72.4106	9.2292	-73.7458		

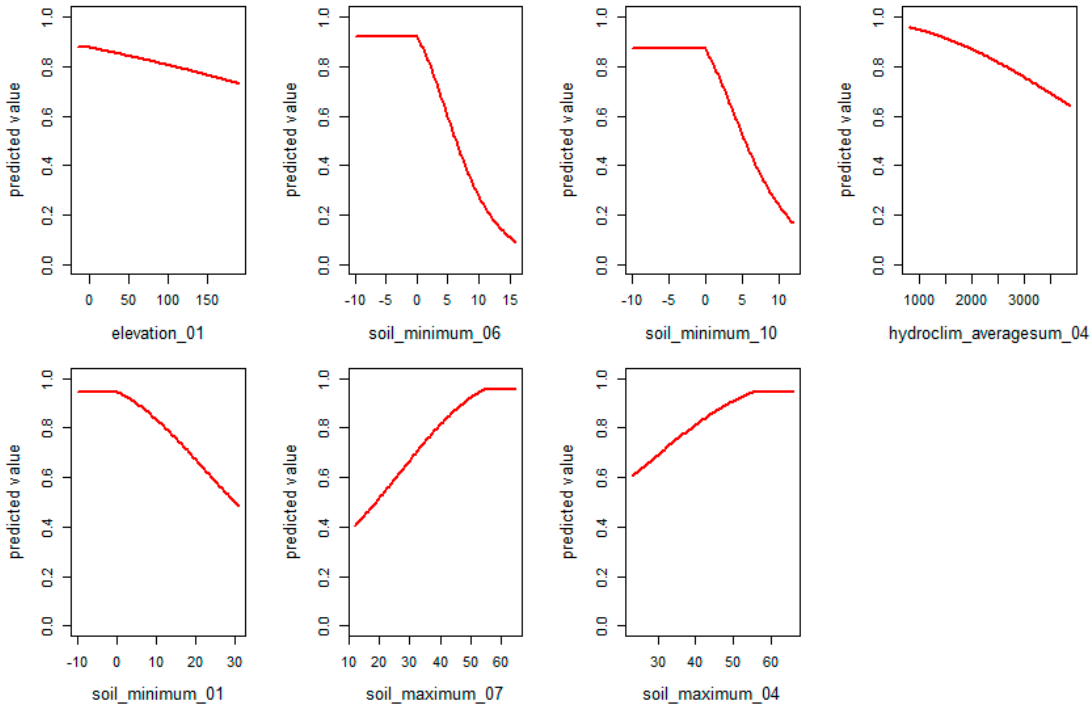
Digital Appendix 7

Variables that contributed to the final model of *P. hypophthalmus* based on the value of the importance permutation

Variable	Variable explanation	Percent contribution
elevation_01	Minimum elevation	49.8527
soil_minimum_06	Coarse fragments (> 2 mm fraction) volumetric	23.5133
soil_minimum_10	Probability of occurrence (0-100%) of R horizon	11.7466
hydroclim_averagesum_04	Upstream Temperature Seasonality (standard deviation *100)	9.5433
soil_minimum_01	Soil organic carbon	2.6587
soil_maximum_07	Cation exchange capacity	1.5604
soil_maximum_04	Silt content mass fraction	1.1251

Digital Appendix 8

Response curves of the variables that contributed to the model of the species *P. hypophthalmus*



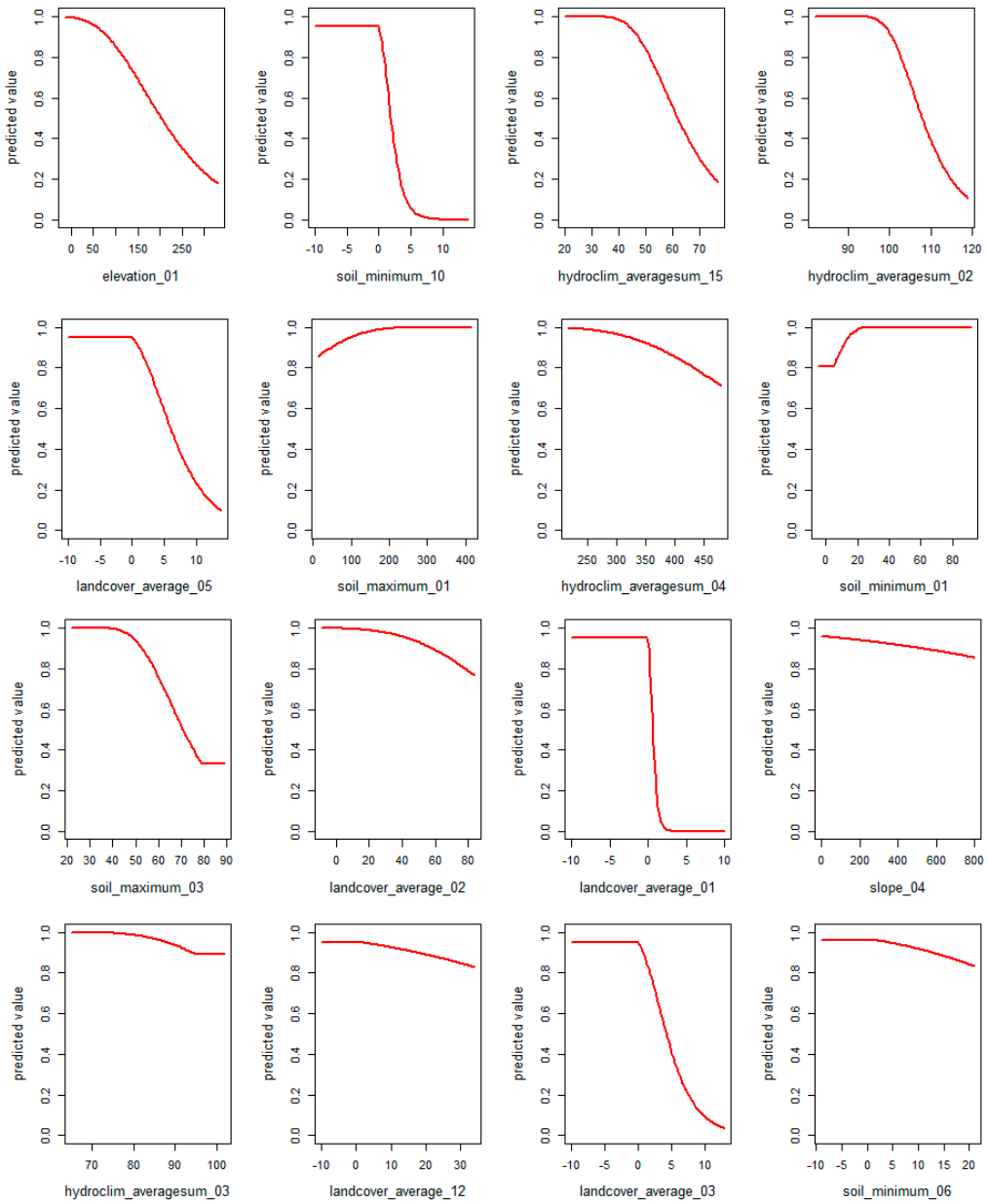
Digital Appendix 9

Variables that contributed to the final model of *P. magdaleniatum* based on the value of the importance permutation

Variable	Variable explanation	Percent contribution
elevation_01	Minimum elevation	47.5003
soil_minimum_10	Probability of occurrence (0-100 %) of R horizon	18.9277
hydroclim_averagesum_15	Upstream Precipitation Seasonality (Coefficient of Variation)	9.0128
hydroclim_averagesum_02	Mean Upstream Diurnal Range (Mean of monthly (max temp - min temp))	7.0887
landcover_average_05	Shrubs	3.7189
soil_maximum_01	Soil organic carbon	3.4765
hydroclim_averagesum_04	Upstream Temperature Seasonality (standard deviation * 100)	2.0401
soil_minimum_01	Soil organic carbon	1.8353
soil_maximum_03	Sand content mass fraction	1.76
landcover_average_02	Evergreen broadleaf trees	1.7436
landcover_average_01	Evergreen/deciduous needleleaf trees	0.893
slope_04	Average slope	0.7156
hydroclim_averagesum_03	Upstream Isothermality (hydro_02 / hydro_07) (* 100)	0.5426
landcover_average_12	Open water	0.2857
landcover_average_03	Deciduous broadleaf trees	0.2559
soil_minimum_06	Coarse fragments (> 2 mm fraction) volumetric	0.2034

Digital Appendix 10

Response curves of the variables that contributed to the model of the species *P. magdaleniatum*



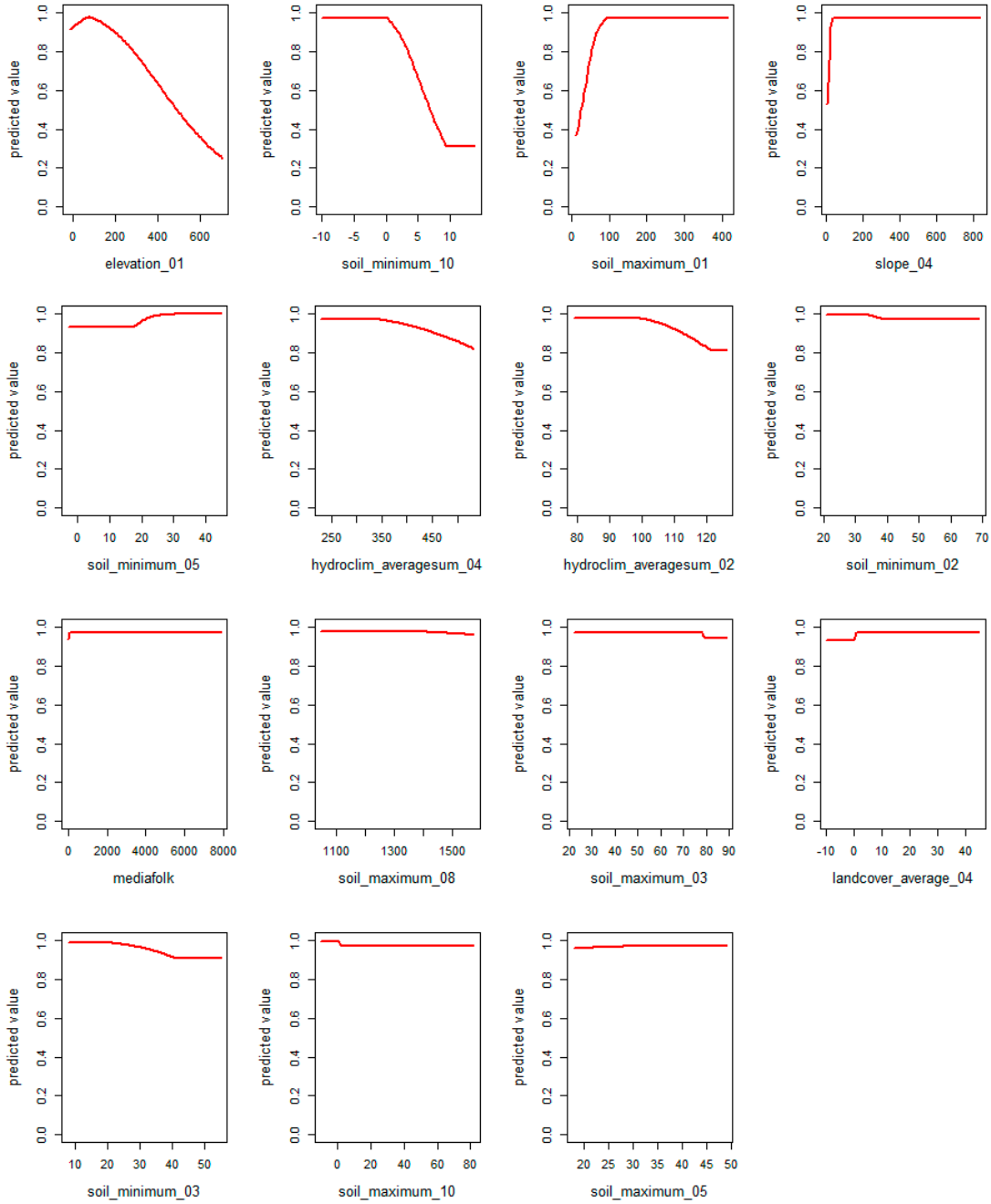
Digital Appendix 11

Variables that contributed to the final model of *S. cuspicaudus* based on the value of the importance permutation

Variable	Variable explanation	Percent contribution
elevation_01	Minimum elevation	61.8331
soil_minimum_10	Probability of occurrence (0-100 %) of R horizon	9.837
soil_maximum_01	Soil organic carbon	9.8152
slope_04	Average slope	6.0114
soil_minimum_05	Clay content mass fraction	5.1597
hydroclim_averagesum_04	Upstream Temperature Seasonality (standard deviation * 100)	3.5176
hydroclim_averagesum_02	Mean Upstream Diurnal Range (Mean of monthly (max temp - min temp))	1.7957
soil_minimum_02	Soil pH in H2O	0.6285
mediafolk	Streamflow	0.3272
soil_maximum_08	Bulk density of the fine earth fraction	0.2484
soil_maximum_03	Sand content mass fraction	0.2465
landcover_average_04	Mixed/other trees	0.2376
soil_minimum_03	Sand content mass fraction	0.1683
soil_maximum_10	Probability of occurrence (0-100 %) of R horizon	0.12
soil_maximum_05	Clay content mass fraction	0.0539

Digital Appendix 12

Response curves of the variables that contributed to the model of the species *S. cuspicaudus*



Digital Appendix 13

Variables that contributed to the final model of *A. pardalis* based on the value of the importance permutation

Variable	Variable explanation	Percent contribution
elevation_01	Minimum elevation	58.8089
hydroclim_averagesum_06	Minimum Upstream Temperature of Coldest Month	11.9937
hydroclim_averagesum_15	Upstream Precipitation Seasonality (Coefficient of Variation)	6.9171
soil_minimum_10	Probability of occurrence (0-100 %) of R horizon	6.0104
monthly_prec_sum_04	Sum of monthly precipitation for April	3.0816
soil_maximum_02	Soil pH in H2O	2.3993
hydroclim_averagesum_07	Upstream Temperature Annual Range (hydro_05 - hydro_06)	2.0699
soil_minimum_06	Coarse fragments (> 2 mm fraction) volumetric	1.9703
soil_maximum_01	Soil organic carbon	1.3554
landcover_average_12	Open water	1.2704
soil_maximum_06	Coarse fragments (> 2 mm fraction) volumetric	1.2606
soil_maximum_08	Bulk density of the fine earth fraction	1.0683
slope_04	Average slope	0.5654
soil_minimum_08	Bulk density of the fine earth fraction	0.3632
elevation_02	Maximum elevation	0.3295
soil_minimum_01	Soil organic carbon	0.2481
hydroclim_averagesum_09	Mean Upstream Temperature of Driest Quarter	0.1842
monthly_prec_sum_03	Sum of monthly precipitation for March	0.0696
landcover_average_07	Cultivated and managed vegetation	0.0342

Digital Appendix 14

*a*Response curves of the variables that contributed to the model of the species *A. pardalis*