SUPPLEMENTAL INFORMATION

Table S1 Category (Type), abbreviated name, description, source, and original resolution of predictors included in the ensemble SDMs for occupancy (climatic and topographic) and GAMs for cover (climatic, topographic, and stand attributes) of blueberry and salmonberry.

Type	Abbreviation	Description	Source & Original Resolution
Climatic	AHM	annual heat-moisture index (MAT+10)/(MAP/1000))	ClimateNA v7.50: Wang et al. 2016; Mahony et al. 2022, Original Resolution: 1km
	bFFP	the day of the year on which frost-free period begins	
	CMD	Hargreaves climatic moisture deficit (mm)	
	CMI	Hogg's climate moisture index (mm)	
	cmiJJA	summer (June-August) Hogg's climate moisture index (mm)	
	DD.0	degree-days below 0°C, chilling degree-days	
	DD.5	degree-days above 5°C, growing degree-days	
	eFFP	the day of the year on which frost-free period ends	
	EMT	extreme minimum temperature over 30 years	
	Eref	Hargreaves reference evaporation (mm)	
	MAP	mean annual precipitation (mm)	
	MAT	mean annual temperature (°C)	
	MCMT	mean coldest month temperature (°C)	
	MSP	May to September precipitation (mm)	
	MWMT	mean warmest month temperature (°C)	
	NFFD	annual number of frost-free days	
	PAS	annual precipitation as snow (mm)	
	PPT_sm	summer (Jun-Aug) precipitation (mm)	
	PPT_wt	winter (Dec-Feb) precipitation (mm)	
	SHM	summer heat-moisture index ((MWMT)/(MSP/1000))	
	Tave_sm	mean summer temperature (°C)	
	Tave_wt	mean winter temperature (°C)	
	TD	continentality; temperature difference between MWMT and MCMT (°C)	
Topographic	Eastness	sin(aspect) (radians)	Hijmans 2024; Landfire 2020 a-f; Original Resolution: 30m
	Elevation	elevation (m)	
	Northness	cos(aspect) (radians)	
	Slope	mean pixel slope (percent)	
	TPI	topographic position index	
	TRI	terrain ruggedness index	
Stand Attributes **(GAMs Only)**	Forest Type	forest type code	USDA-FS 2024a; USDA-FS 2024b; Bechtold and Patterson 2005
	Tree Cover	tree aerial canopy cover (%)	
	Stand Age Class	stand age class (50-year intervals from 0-50 to 400+)	
	Stand Size Class	stand size class	
	Shrub Cover	shrub aerial canopy cover (%)	

Table S1 References

Bechtold WA, Patterson PL (2005) The enhanced forest inventory and analysis program - national sampling design and estimation procedures. Gen. Tech. Rep. SRS-80. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC, pp. 85 p. https://doi.org/10.2737/SRS-GTR-80

Hijmans R (2023) terra: Spatial Data Analysis. R package version 1.7-29 edn. https://CRAN.R-project.org/package=terra

Landfire (2020a) CONUS Aspect (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=4 [Accessed January 23, 2025]

Landfire (2020b) CONUS Elevation (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=4 [Accessed January 23, 2025]

Landfire (2020c) CONUS Slope Percent Rise (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=4 [Accessed January 23, 2025]

Landfire (2020d) Alaska Aspect (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=1 [Accessed January 23, 2025]

Landfire (2020e) Alaska Elevation (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=1 [Accessed January 23, 2025]

Landfire (2020f) Alaska Slope Percent Rise (30 m). https://landfire.gov/data/FullExtentDownloads?field_version_target_id=31&field_theme_target_id=9&field_region_id_target_id=1 [Accessed January 23, 2025]

Mahony CR, Wang T, Hamann A, Cannon AJ (2022) A CMIP6 ensemble for downscaled monthly climate normals over North America. International Journal of Climatology 42(11):5871-5891. https://doi.org/10.1002/joc.7566

USDA Forest Service Forest Inventory and Analysis [USDA-FS] (2024a) FIA DataMart. https://research.fs.usda.gov/products/dataandtools/fia-datamart [Accessed March 3, 2025].

USDA Forest Service Forest Inventory and Analysis [USDA-FS] (2024b) Forest Inventory and Analysis national core field guide for the nationwide forest inventory, v. 9.4. https://research.fs.usda.gov/sites/default/files/2024-09/wo-v9-4_sep2024_fg_nfi_natl.pdf [Accessed March 3, 2025].

Wang, T.; Hamann, A.; Spittlehouse, D.; Carroll C. 2016. Locally Downscaled and Spatially Customizable Climate Data for Historical and Future Periods for North America. PLoS ONE 11(6): e0156720. https://10.1371/journal.pone.0156720

Table S2 Mean and standard error of relative importance values for each term retained in the ensemble SDMs for blueberry and salmonberry occurrence. See Table S1 for full term names and descriptions.

	Term	Variable Importance	
		Mean	*SE*
Blueberry	SHM	0.4396	0.0013
	Eref	0.1105	0.0006
	bFFP	0.0849	0.0004
	TD	0.0813	0.0003
	PPT_sm	0.0459	0.0002
	AHM	0.0437	0.0002
	Northness	0.0107	1.33465E-05
	Eastness	0.0107	6.10531E-06
	Slope	0.0005	2.13194E-06
	TPI	0.0003	2.29654E-06
Salmonberry	bFFP	0.2908	0.0008
	cmiJJA	0.2204	0.0008
	Eastness	0.1051	0.0001
	Northness	0.0974	0.0001
	TD	0.0614	0.0002
	Tave_sm	0.0395	0.0002
	SHM	0.0384	0.0001
	MAP	0.0222	6.10455E-05
	TRI	0.0007	4.63575E-06
	Slope	0.0007	4.04137E-06

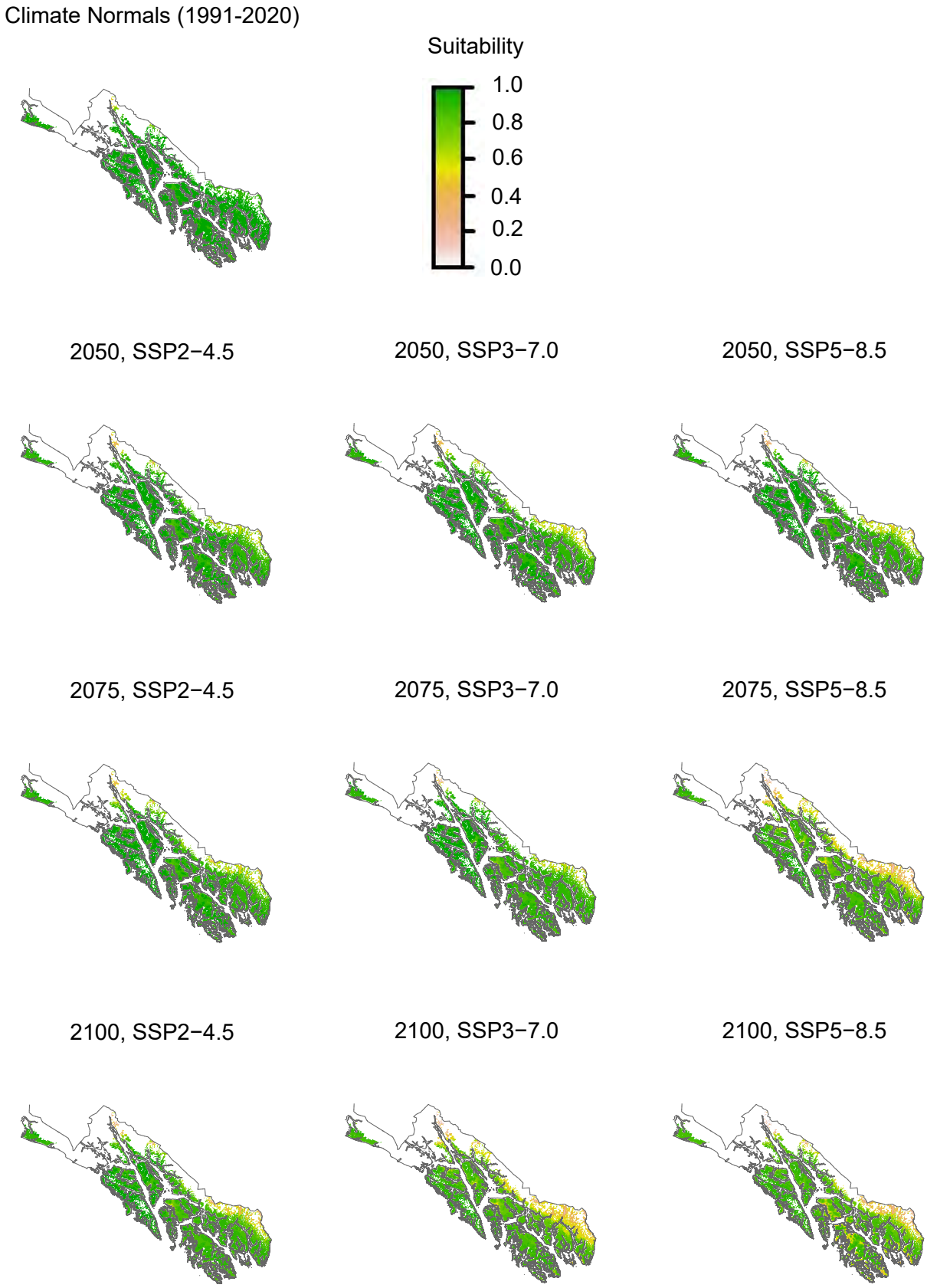

Fig S1 Maps of projected suitability for blueberry occurrence in forested areas of the Tongass National Forest under historical climate normals and each SSP for all years examined.

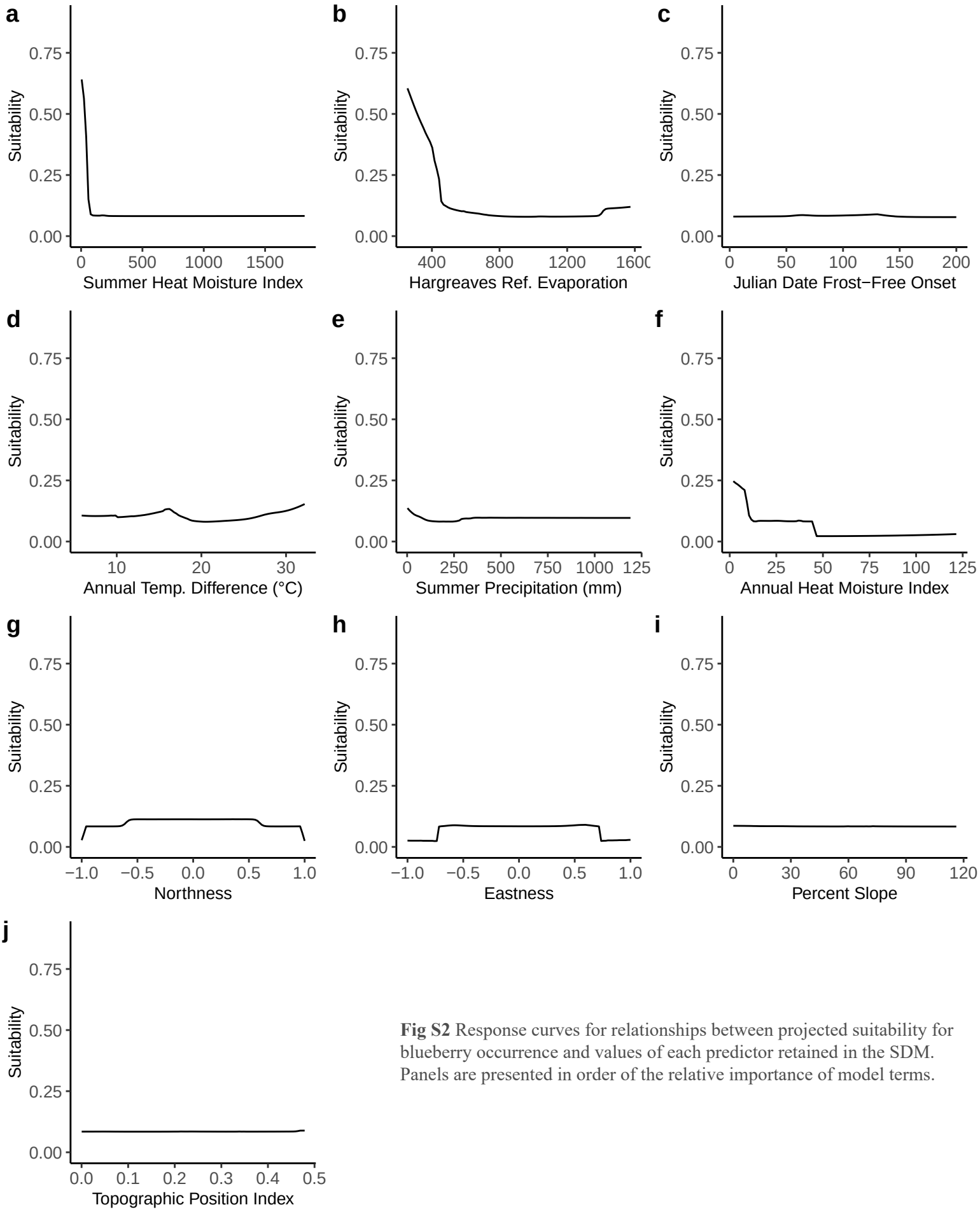

Fig S2 Response curves for relationships between projected suitability for blueberry occurrence and values of each predictor retained in the SDM. Panels are presented in order of the relative importance of model terms.

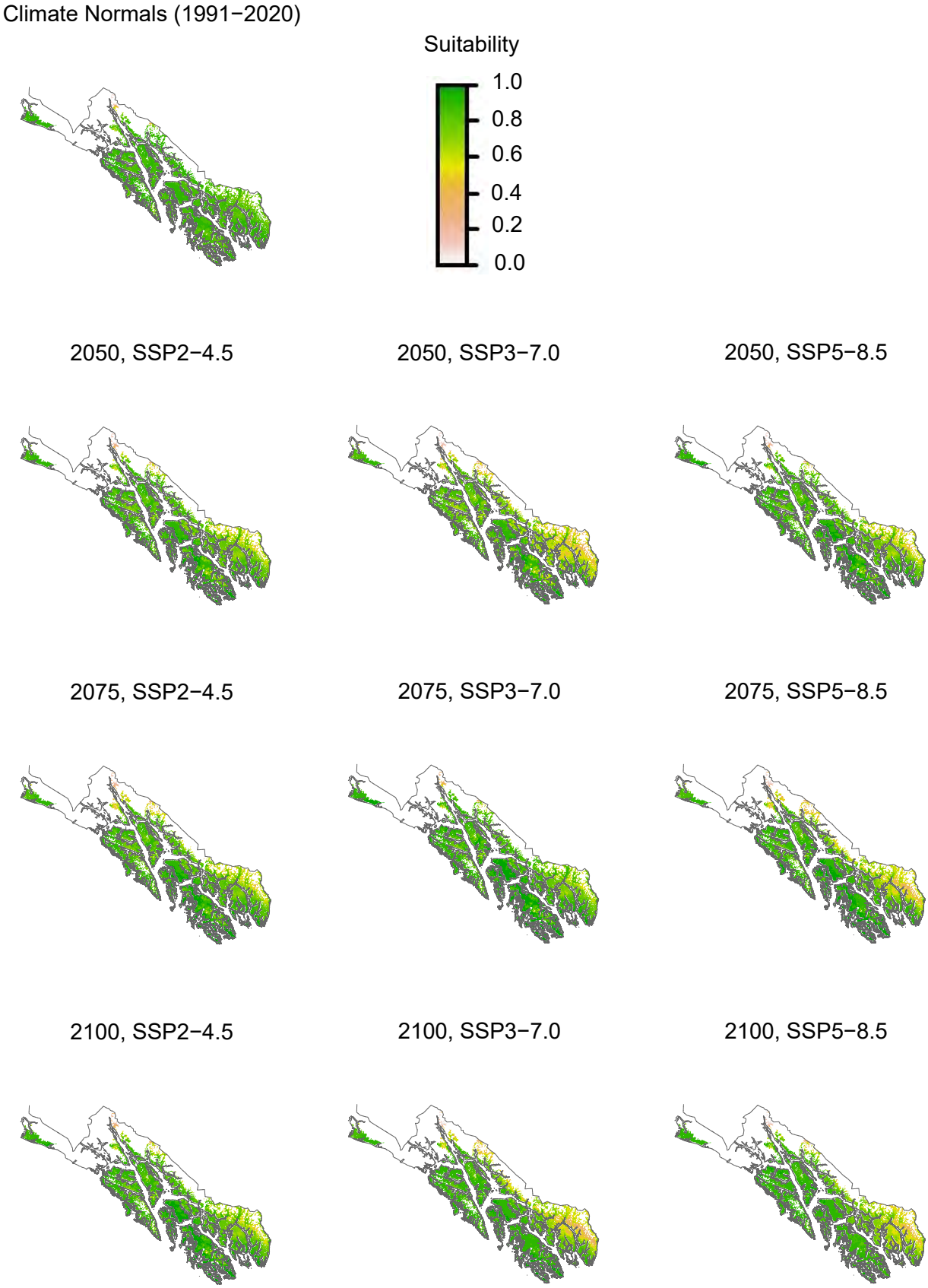

Fig S3 Maps of projected suitability for salmonberry occurrence in forested areas of the Tongass National Forest under historical climate normals and each SSP for all years examined.

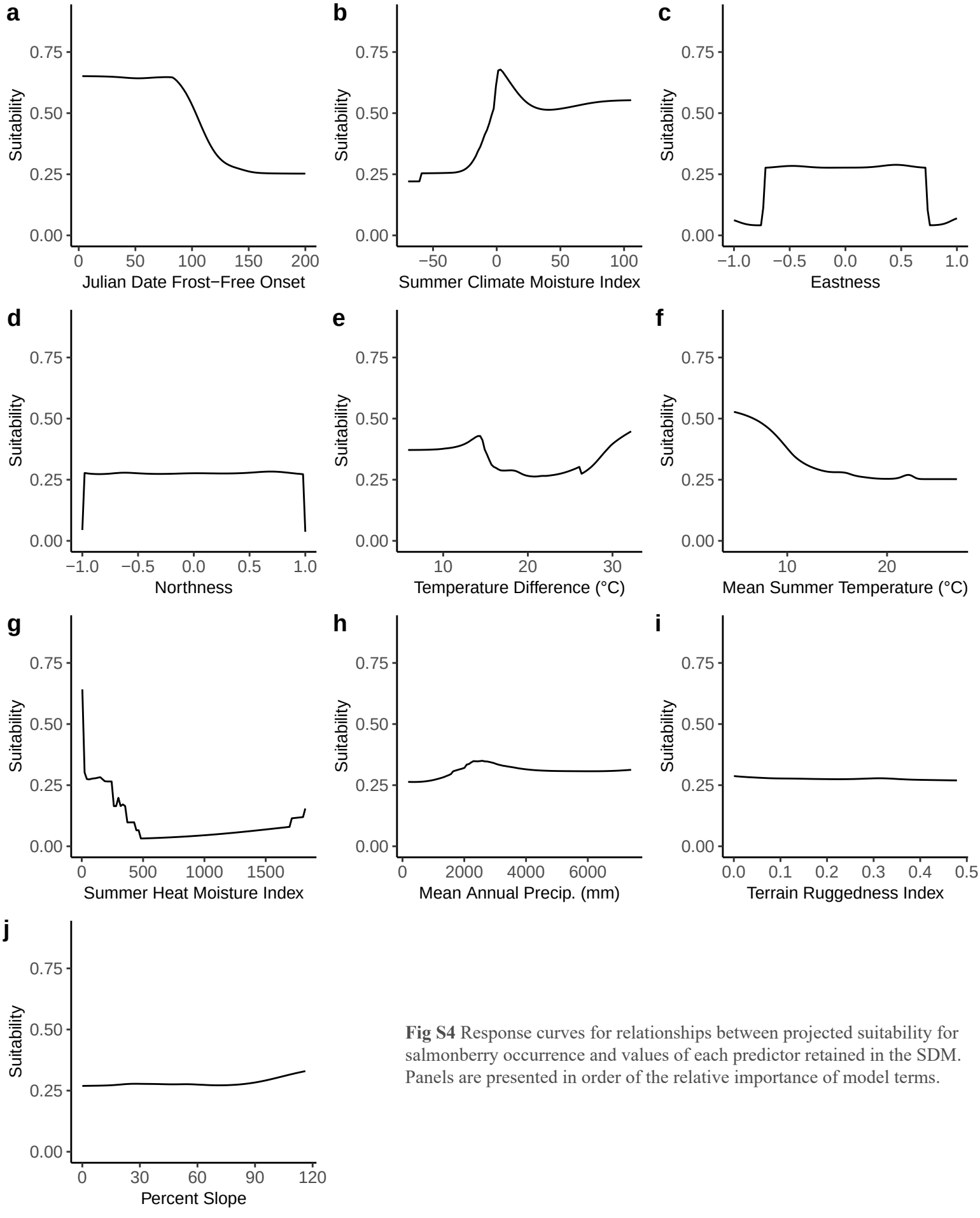

Fig S4 Response curves for relationships between projected suitability for salmonberry occurrence and values of each predictor retained in the SDM. Panels are presented in order of the relative importance of model terms.

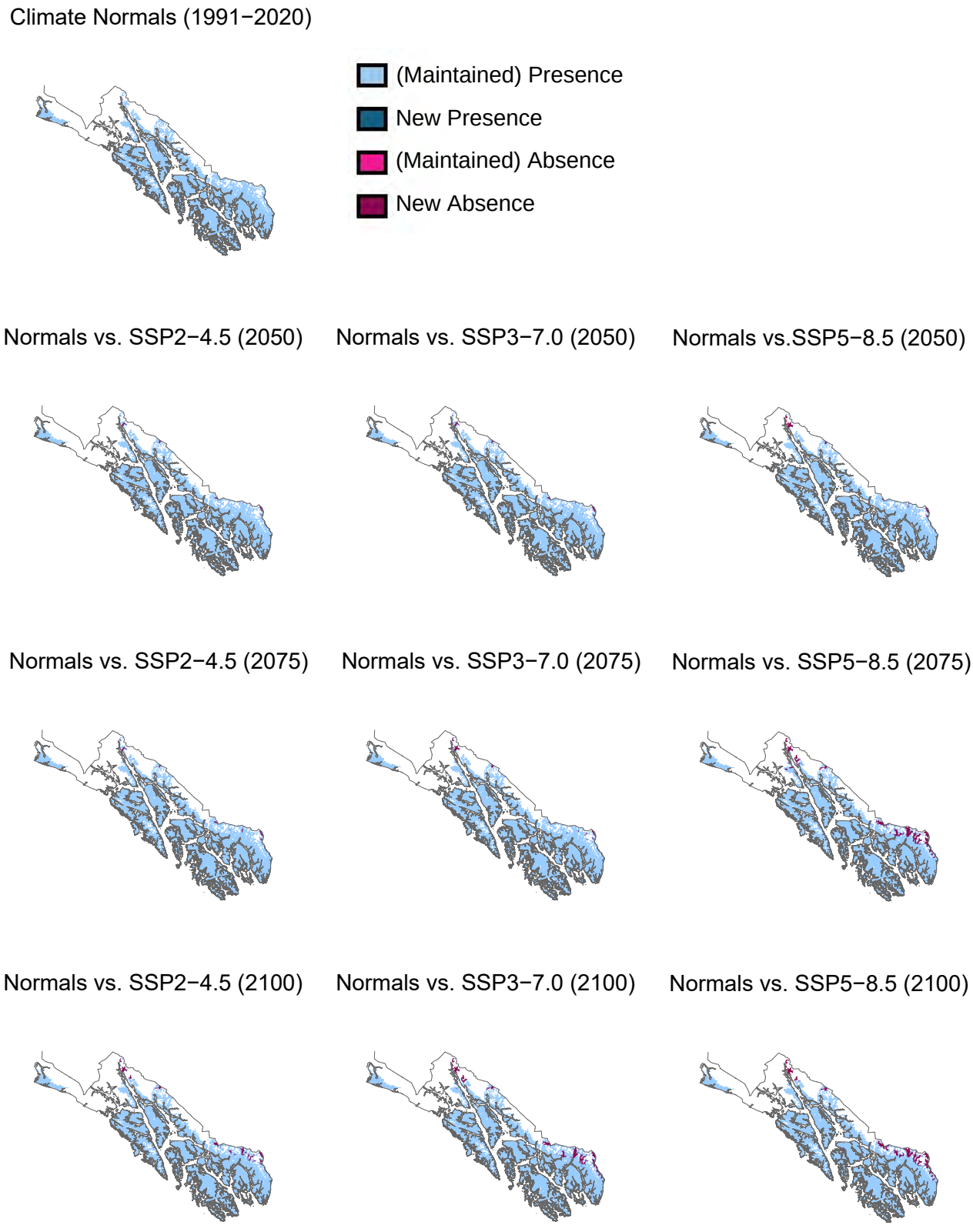

Fig S5 Maps of model projections of binary suitability for blueberry occurrence in forested areas of the Tongass National Forest under historical climate normals and differences between projected binary suitability under historical climate normals and each SSP scenario (change in binary suitability for presence under each SSP) for all years examined.

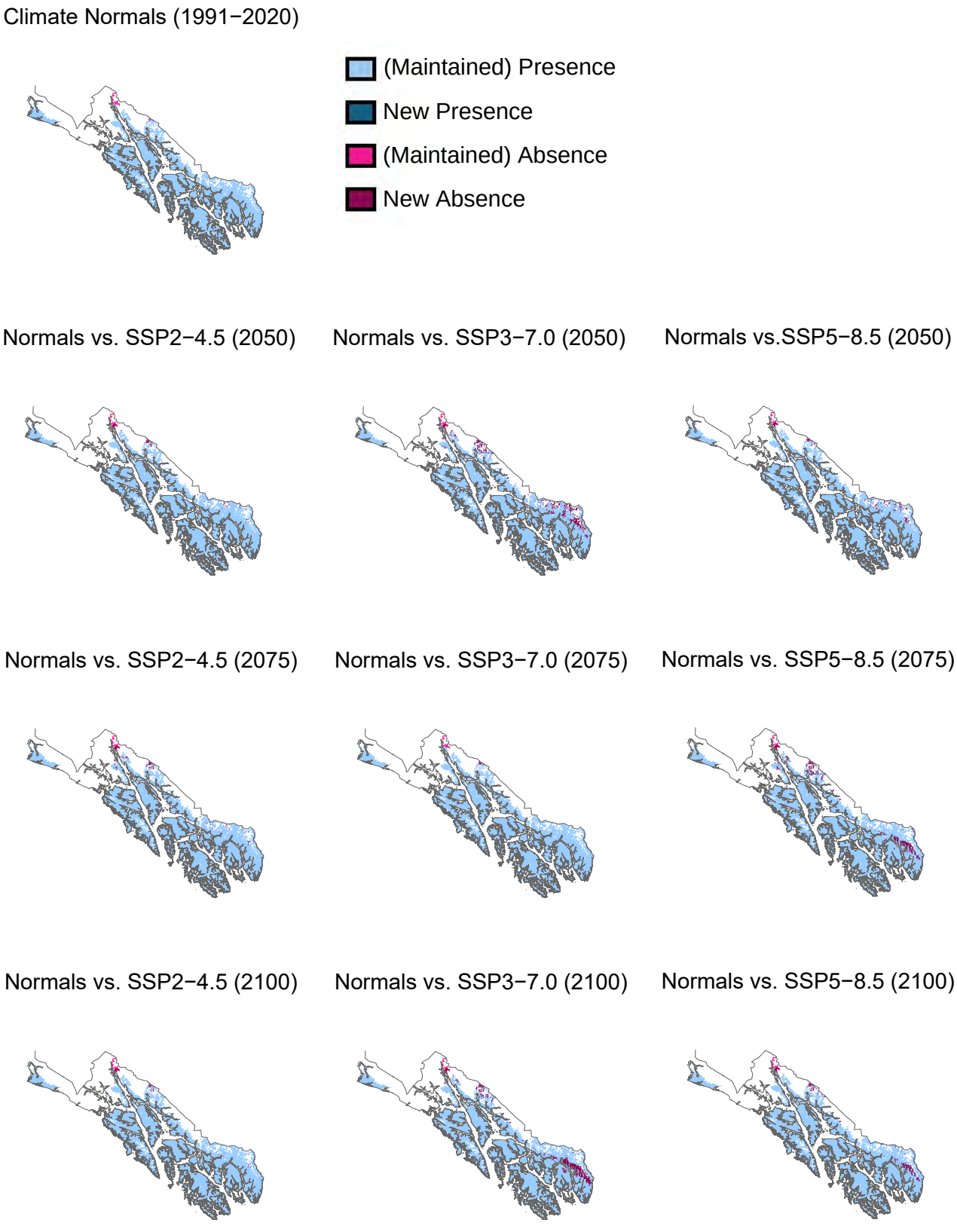

Fig S6 Maps of model projections of binary suitability for salmonberry occurrence in forested areas of the Tongass National Forest under historical climate normals and differences between projected binary suitability under historical climate normals and each SSP scenario (change in binary suitability for presence under each SSP) for all years examined.

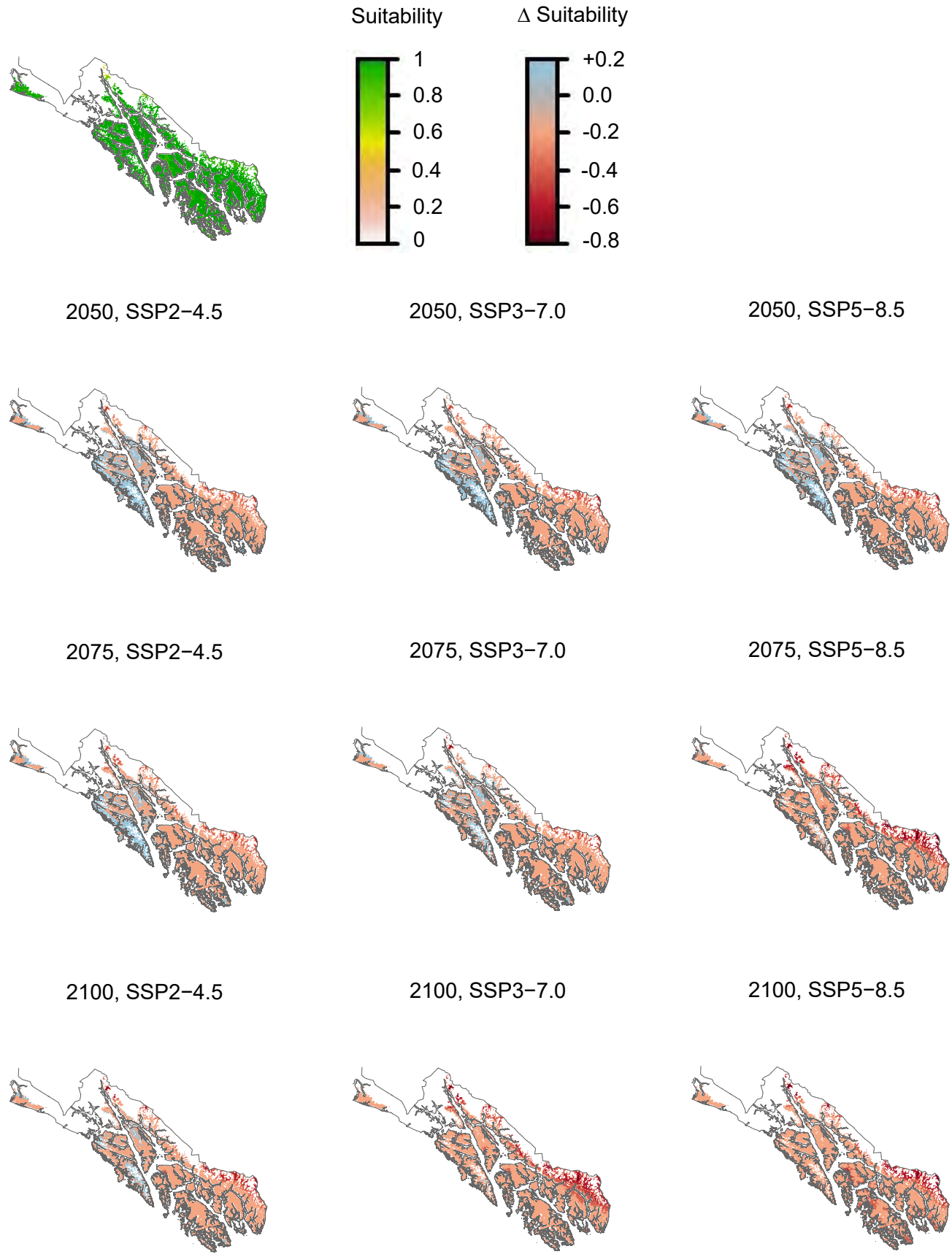

Fig S7 Maps of model projections of continuous suitability for blueberry occurrence in forested areas of the Tongass National Forest under historical climate normals (Suitability) and change in projected suitability for historical climate normals versus each SSP scenario (Δ Suitability) for all years examined.

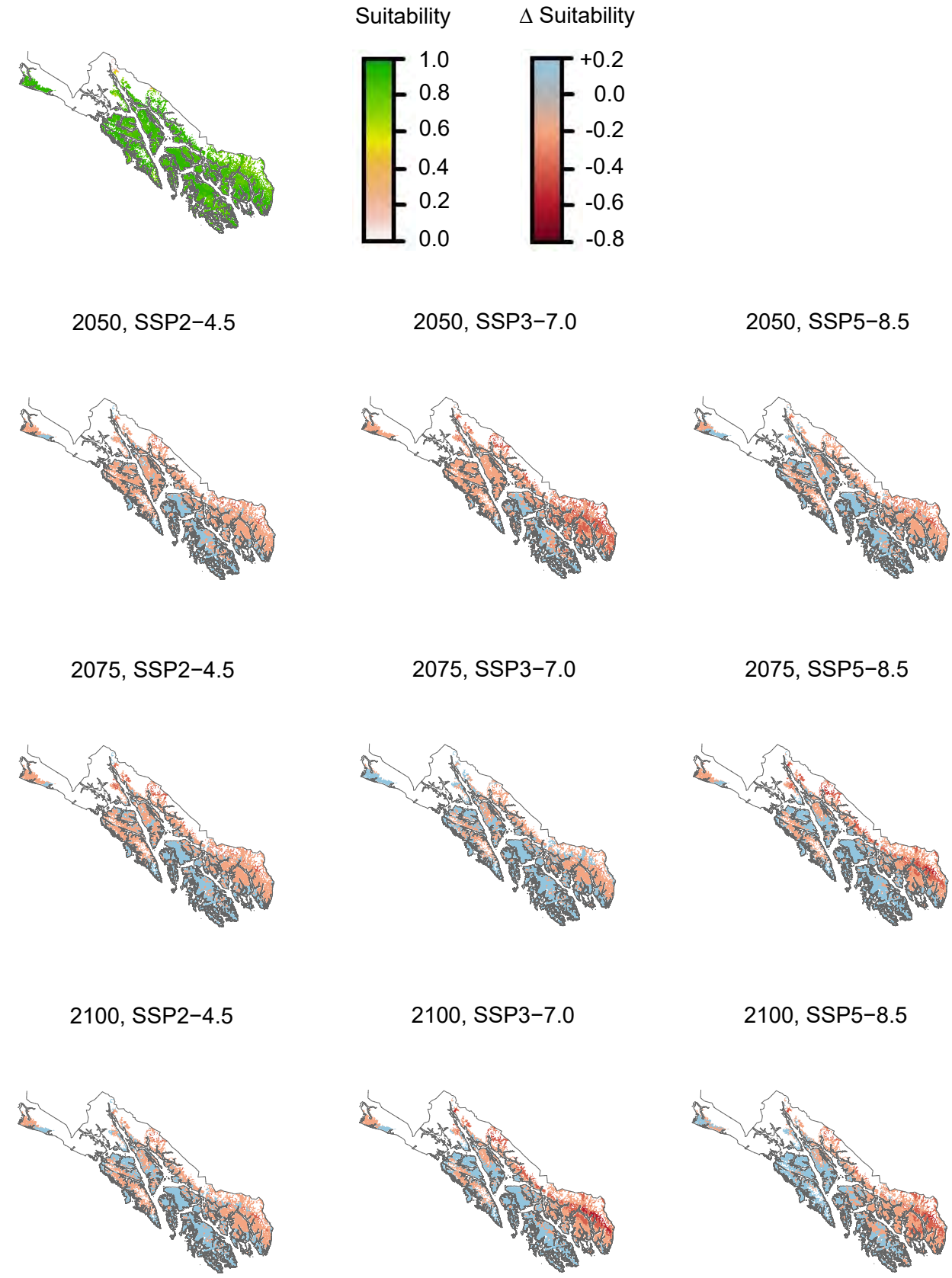

Fig S8 Maps of model projections of continuous suitability for salmonberry occurrence in forested areas of the Tongass National Forest under historical climate normals (Suitability) and change in projected suitability for historical climate normals versus each SSP scenario (Δ Suitability) for all years examined.

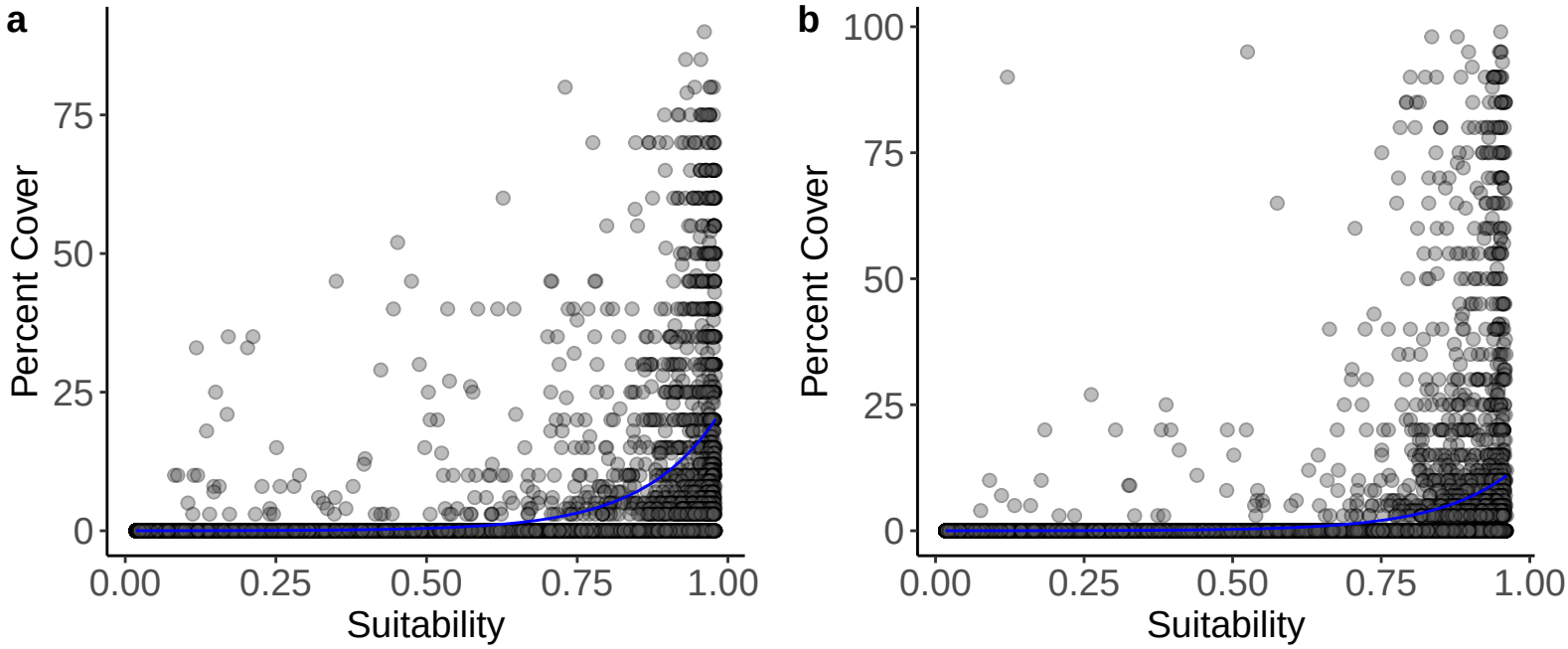

Fig S9 Suitability for occurrence projected by ensemble SDMs vs. percent aerial cover as measured by FIA crews on all western U.S. FIA plots used for model training for (a) blueberry and (b) salmonberry. Blue lines represent fitted model predictions across suitability values.

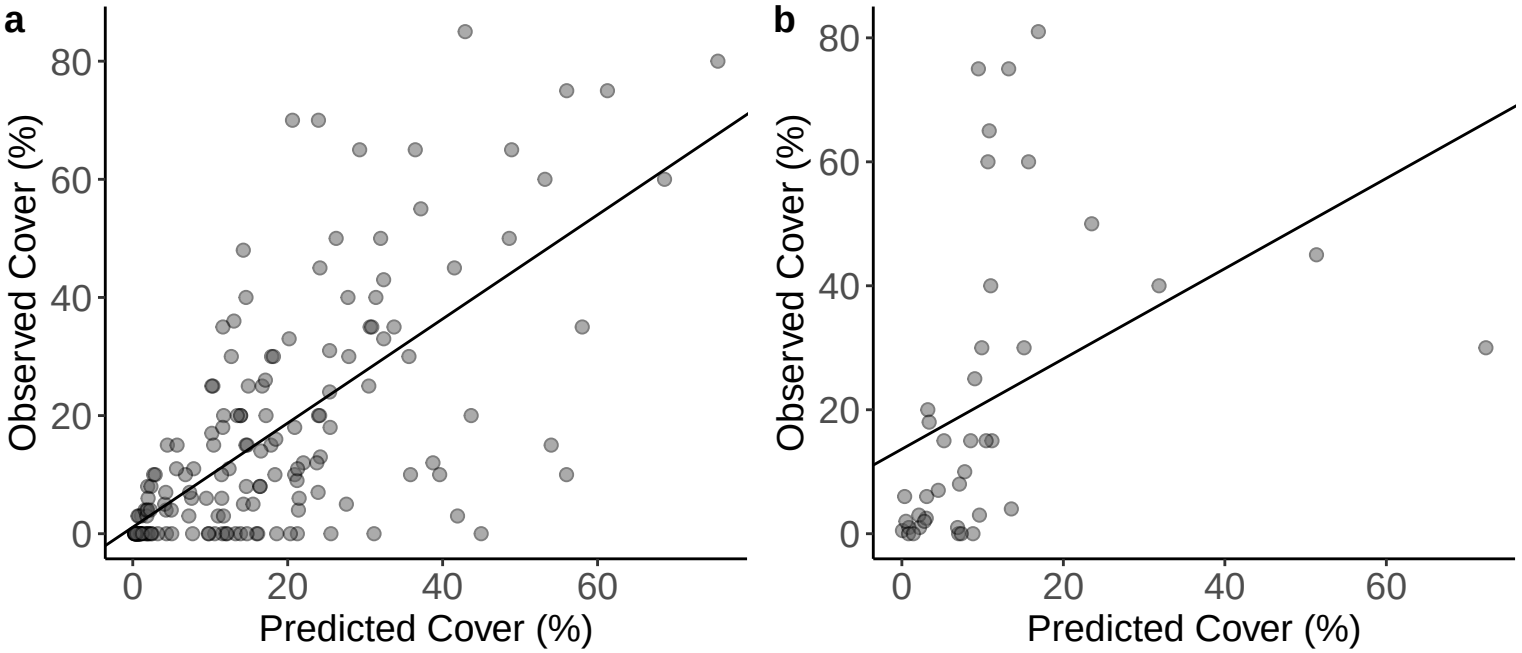

Fig S10 Model-predicted blueberry cover vs. observed blueberry cover on (a) FIA plots in southeast Alaska withheld from model training for validation and (b) AYS plots in southeast Alaska.

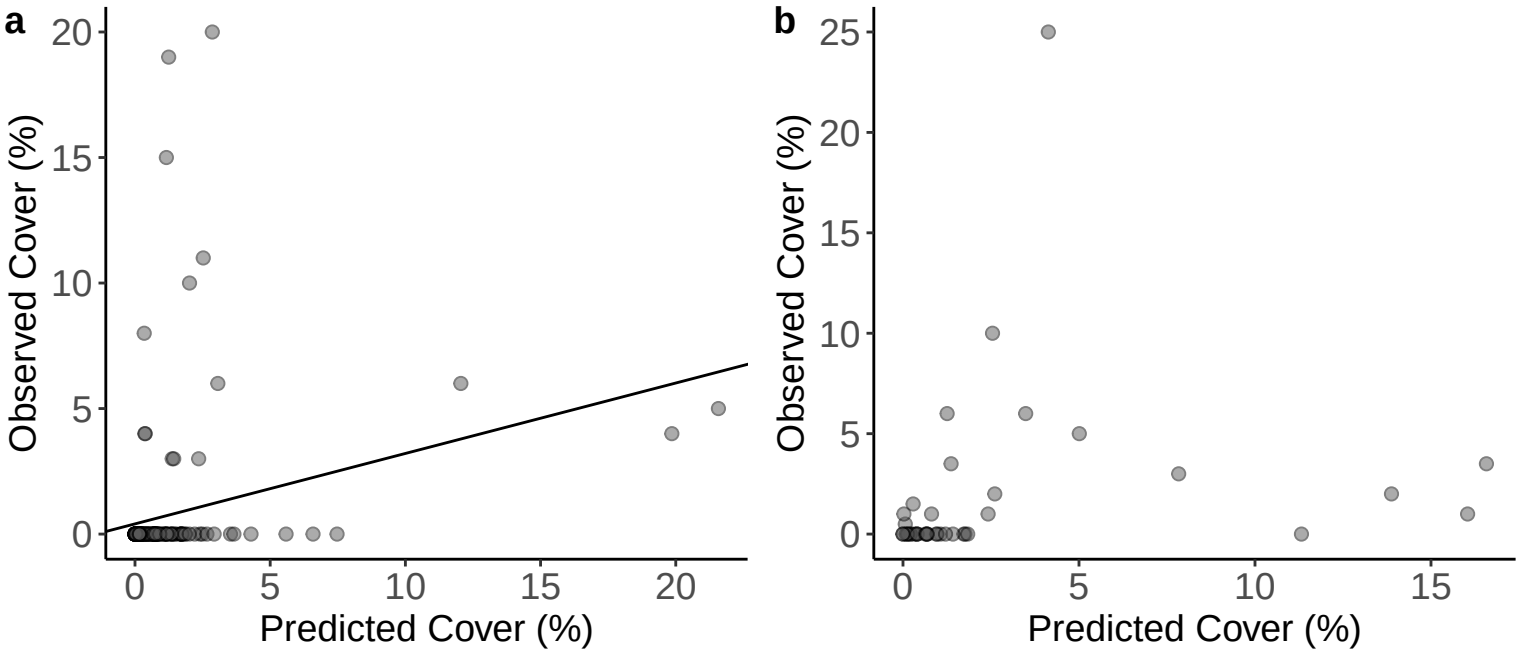

Fig S11 Model-predicted salmonberry cover vs. observed salmonberry cover on (a) FIA plots in southeast Alaska withheld from model training for validation and (b) AYS plots in southeast Alaska.

Generalized additive model for blueberry aerial cover excluding overall shrub cover as a predictor

When model term selection and GAMs were re-run without shrub cover as a predictor, model fit was poorer but still outperformed the null model, indicating that shrub cover was not solely responsible for the variation in blueberry cover explained by the model (ΔAIC: -183.473; deviance explained: 25.7%; R^2_{adj} = 0.127). Terms included in the model lacking shrub cover as a predictor generally overlapped with those in the model that included shrub cover as a predictor, though the former did not include winter mean temperature or elevation and instead included the date of the end of the frost-free period, chilling degree days <0°C, topographic roughness, and Hargreaves climatic moisture deficit (Table S3). Response plots for retained predictors are presented in Fig. S12 and comparisons of model predictions for blueberry cover vs. observed blueberry cover on FIA plots withheld for validation and AYS plots are presented in Fig. S13.

Table S3 Relative importance values of all terms retained in the final GAM for blueberry aerial cover when the overall shrub cover term was excluded from the model selection process.

Term	Relative Importance
Forest Type	0.2905
Date of End of Frost Free Period	0.2164
Stand Size Class	0.1390
Growing Degree Days >0°C	0.1194
Stand Age Class	0.0738
Tree Cover	0.0427
Topographic Roughness Index	0.0098
Climatic Moisture Defecit	0.0079

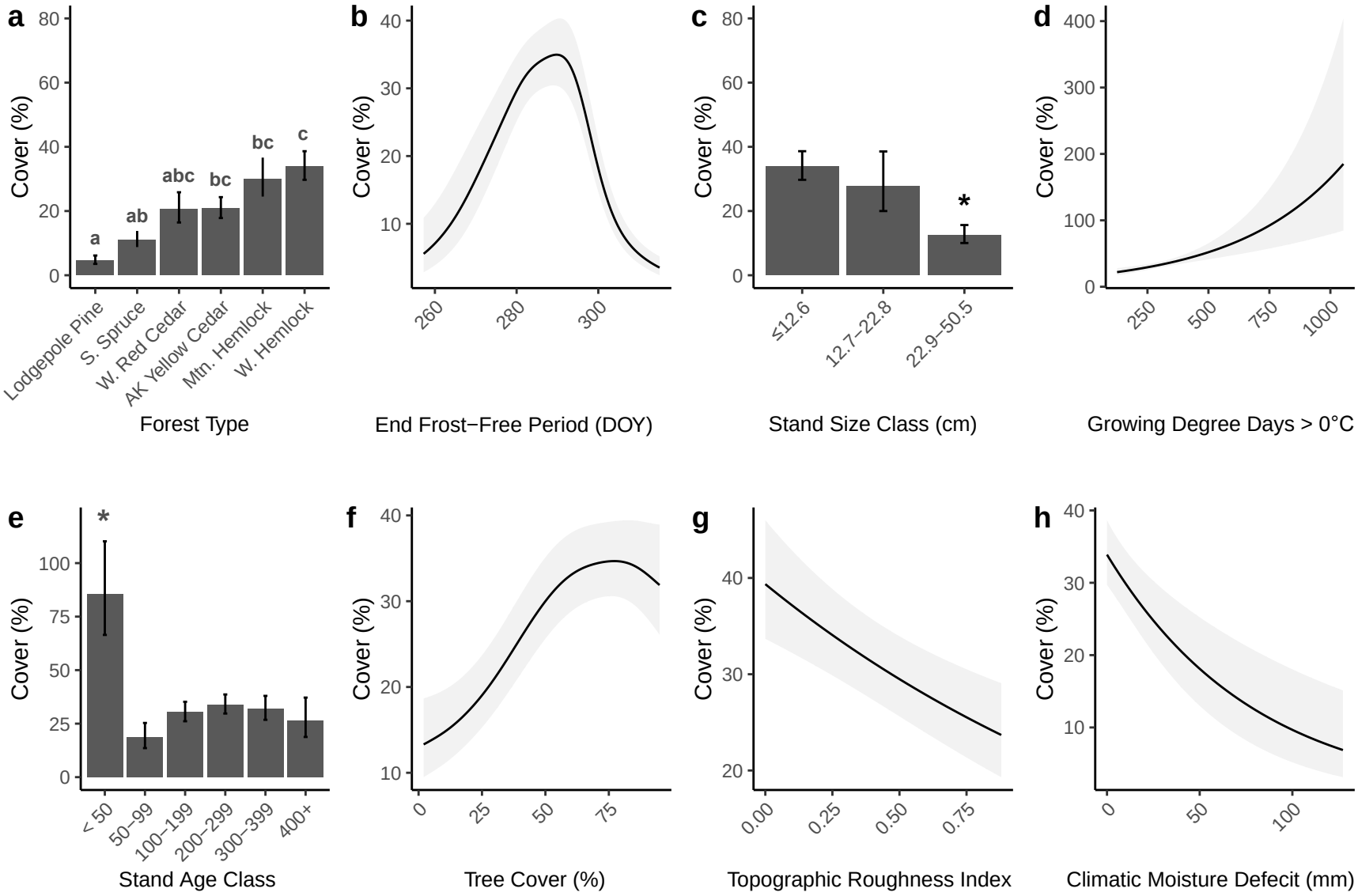

Fig S12 Response curves for projected blueberry cover (± 1 SE) across values of retained model parameters in the model lacking shrub cover as a predictor when other terms were held constant at their median (continuous predictors) or modal values (categorical predictors). Asterisks and letters indicate significant differences among levels of categorical variables at $P < 0.05$. Panels are presented in order of decreasing parameter importance in the model.

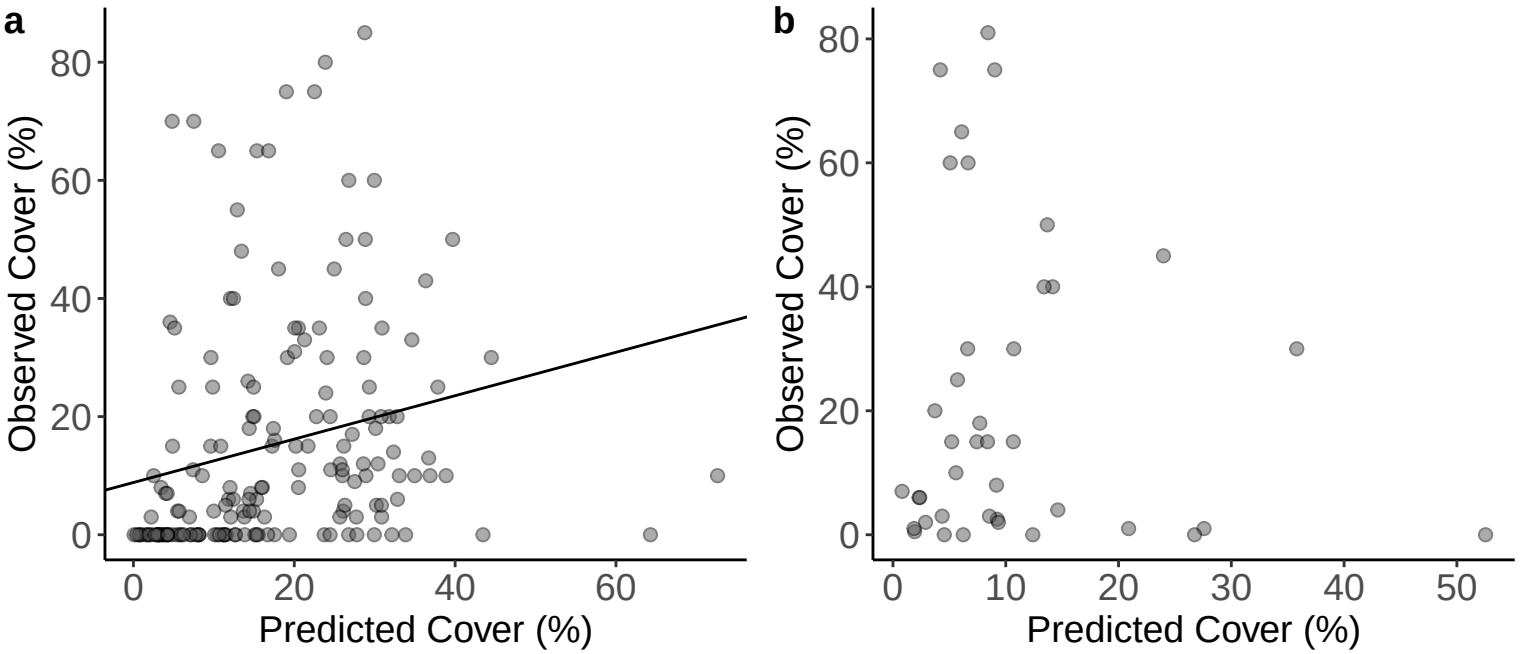

Fig S13 Model-predicted blueberry cover vs. observed blueberry cover on (a) FIA plots in southeast Alaska withheld from model training for validation and (b) AYS plots in southeast Alaska for the GAM lacking shrub cover as a predictor.