

## SUPPLEMENTARY INFORMATION

### Exploring climate-disease connections in geopolitical versus ecological regions: the case of West Nile virus in the United States

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**Table S1.** Heterogeneity of politically bounded regions: comparison of land overlap and characteristics between NOAA climate regions and EPA ecoregions

<b>NOAA climate region</b>	<b>EPA ecoregions encompassed</b>	<b>Ecoregion characteristics</b>
Ohio Valley	Eastern Temperate Forests	moderate precipitation, warm, humid, temperate
	Great Plains	varied precipitation, extreme temperatures, high winds
Southeast	Eastern Temperate Forests	moderate precipitation, warm, humid, temperate
	Tropical Wet Forests	high precipitation, mild temperatures year-round, low elevation
Northeast	Eastern Temperate Forests	moderate precipitation, warm, humid, temperate
	Northern Forests	varied precipitation; long, cold winters; short, warm summers
South	Eastern Temperate Forests	moderate precipitation, warm, humid, temperate
	Great Plains	varied precipitation, extreme temperatures, high winds
	North American Deserts	arid to semi-arid, seasonal temperature extremes

**Table S1, Continued.** Heterogeneity of politically bounded regions: comparison of land overlap and characteristics between NOAA climate regions and EPA ecoregions

<b>NOAA climate region</b>	<b>EPA ecoregions encompassed</b>	<b>Ecoregion characteristics</b>
Upper Midwest	Eastern Temperate Forests	moderate precipitation, warm, humid, temperate
	Northern Forests	varied precipitation; long, cold winters; short, warm summers
	Great Plains	varied precipitation, extreme temperatures, high winds
Northern Rockies and Plains	Great Plains	varied precipitation, extreme temperatures, high winds
	North American Deserts	arid to semi-arid, seasonal temperature extremes
	Northwestern Forested Mountains	varied precipitation and temperatures; varied elevation
Southwest	Great Plains	varied precipitation, extreme temperatures, high winds
	North American Deserts	arid to semi-arid, seasonal temperature extremes
	Northwestern Forested Mountains	moderate precipitation, warm, humid, temperate
	Southern Semiarid Highlands	semi-arid, high elevation
	Temperate Sierras	mountainous, varied
Northwest	North American Deserts	varied precipitation, extreme temperatures, high winds
	Northwestern Forested Mountains	moderate precipitation, warm, humid, temperate
	Marine West Coast Forest	varied precipitation; long, cold winters; short, warm summers
West	North American Deserts	varied precipitation, extreme temperatures, high winds
	Northwestern Forested Mountains	arid to semi-arid, seasonal temperature extremes
	Marine West Coast Forest	varied precipitation and temperatures; varied elevation
	Mediterranean California	hot, dry summers; mild winters; variable precipitation

**Table S2.** Total WNND cases from 2005-2019; mean annual WNND incidence averaged from 2005-2019 (cases per 100,000 population per year); average population rounded to the nearest 1,000 averaged from 2005-2019; maximum, minimum, and mean surface air temperatures (°C) averaged from 2005-2019; and precipitation (mm/year) averaged from 2005-2019 for NOAA climate regions (a) and EPA ecoregions (b)

<b>a) NOAA climate regions</b>	<b>Total cases</b>	<b>Mean annual incidence</b>	<b>Population</b>	<b>Maximum temperature</b>	<b>Minimum temperature</b>	<b>Mean temperature</b>	<b>Precipitation</b>
<b>Northeast</b>	1,350	0.14	62,276,000	13.9	3.1	8.5	1232
<b>Northern Rockies and Plains</b>	1,425	1.92	4,961,000	13.3	-0.2	6.5	537
<b>Northwest</b>	348	0.19	12,445,000	14.1	1.7	7.9	859
<b>Ohio Valley</b>	2,166	0.29	49,532,000	18.2	6.6	12.4	1204
<b>South</b>	4,743	0.74	43,176,000	23.9	10.5	17.2	954
<b>Southeast</b>	806	0.09	56,745,000	23.6	11.5	17.5	1325
<b>Southwest</b>	2,145	0.86	16,693,000	19.5	3.8	11.6	374
<b>Upper Midwest</b>	1,172	0.32	24,117,000	12.4	1.2	6.8	869
<b>West</b>	3,977	0.65	40,616,000	20.2	5.7	12.9	445
<b>b) EPA ecoregions</b>	<b>Total cases</b>	<b>Mean annual incidence</b>	<b>Population</b>	<b>Maximum temperature</b>	<b>Minimum temperature</b>	<b>Mean temperature</b>	<b>Precipitation</b>
<b>North American Deserts</b>	2,674	0.86	20,872,000	18.8	3.9	11.4	314
<b>Mediterranean California</b>	3,175	0.68	31,086,000	22.2	8.4	15.3	513
<b>Southern Semiarid Highlands</b>	18	0.57	212,000	24.9	8.2	16.6	360
<b>Temperate Sierras</b>	15	0.32	310,000	21.9	5.4	13.6	399
<b>Tropical Wet Forests</b>	7	0.01	6,174,000	29.1	19.5	24.3	1388
<b>Northern Forests</b>	81	0.08	6,686,000	11.2	-0.1	5.6	985
<b>Northwestern Forested Mountains</b>	418	0.26	10,849,000	13.0	0.3	6.7	841
<b>Marine West Coast Forest</b>	15	0.02	4,645,000	15.9	5.8	10.8	1874
<b>Eastern Temperate Forests</b>	6,860	0.24	187,400,000	19.7	8.1	13.9	1247
<b>Great Plains</b>	4,921	0.77	42,960,000	17.9	4.3	11.1	653

**Table S3.** Spearman’s rank correlation coefficients between annual climate drivers and WNND incidence from 2005-2019 for NOAA climate regions (a) and EPA ecoregions (b)

a) NOAA climate regions	Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
Northeast	0.48*	0.23*	0.45*	0.20*	0.50*	0.25*	-0.07	0.01
Northern Rockies and Plains	0.35	0.13	0.37	0.14	0.39	0.15	-0.36	0.13
Northwest	0.32	0.11	0.09	0.01	0.20	0.04	-0.11	0.01
Ohio Valley	0.51*	0.26*	0.49*	0.24*	0.50*	0.25*	-0.52**	0.27**
South	0.22	0.05	0.31	0.09	0.28	0.08	-0.21	0.04
Southeast	0.41	0.17	0.56**	0.31**	0.51*	0.26*	0.03	0.00
Southwest	0.15	0.02	0.24	0.06	0.07	0.00	0.30	0.09
Upper Midwest	0.68**	0.46**	0.70**	0.49**	0.68**	0.47**	-0.24	0.06
West	0.64**	0.41**	0.72**	0.52**	0.72**	0.52**	-0.05	0.00
b) EPA ecoregions	Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
North American Deserts	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08
Mediterranean California	0.75**	0.57**	0.74**	0.54**	0.80**	0.63**	-0.10	0.01
Southern Semiarid Highlands	-0.33	0.11	-0.29	0.08	-0.37	0.14	0.04	0.00
Temperate Sierras	-0.57**	0.32**	-0.35	0.13	-0.52**	0.27**	0.61**	0.38**
Tropical Wet Forests	-0.16	0.03	-0.66**	0.44**	-0.51*	0.26*	-0.50*	0.25*
Northern Forests	0.32	0.10	0.44	0.19	0.36	0.13	0.05	0.00
Northwestern Forested Mountains	0.49*	0.24*	0.24	0.06	0.33	0.11	-0.25	0.06
Marine West Coast Forest	0.28	0.08	0.23	0.05	0.20	0.04	0.01	0.00
Eastern Temperate Forests	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08
Great Plains	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04

Note: \*p<0.1, \*\*p<0.05

**Table S4.** Tables enabling comparison of Spearman’s rank correlations between annual climate drivers and WNND incidence from 2005-2019 for NOAA climate regions and their overlapping EPA ecoregions, partitioned into sub-tables (a-i) for each NOAA climate region

**Note:** \*p<0.1, \*\*p<0.05

**a. Northeast NOAA region and overlapping EPA ecoregions**

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Northeast</b>	0.48*	0.23*	0.45*	0.20*	0.50*	0.25*	-0.07	0.01
<b>EPA ecoregions</b>	<b>Northern Forests</b>	0.32	0.10	0.44	0.19	0.36	0.13	0.05	0.00
	<b>Eastern Temperate Forests</b>	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08

**b. Northern Rockies and Plains NOAA region and overlapping EPA ecoregions**

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Northern Rockies and Plains</b>	0.35	0.13	0.37	0.14	0.39	0.15	-0.36	0.13
<b>EPA ecoregions</b>	<b>Great Plains</b>	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04
	<b>North American Deserts</b>	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08
	<b>Northwestern Forested Mountains</b>	0.49*	0.24*	0.24	0.06	0.33	0.11	-0.25	0.06

**c. Northwest NOAA region and overlapping EPA ecoregions**

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Northwest</b>	0.32	0.11	0.09	0.01	0.20	0.04	-0.11	0.01
	<b>North American Deserts</b>	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08
<b>EPA ecoregions</b>	<b>Northwestern Forested Mountains</b>	0.49*	0.24*	0.24	0.06	0.33	0.11	-0.25	0.06
	<b>Marine West Coast Forest</b>	0.28	0.08	0.23	0.05	0.20	0.04	0.01	0.00

**d. Ohio Valley NOAA region and overlapping EPA ecoregions**

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Ohio Valley</b>	0.51*	0.26*	0.49*	0.24*	0.50*	0.25*	-0.52**	0.27**
	<b>Eastern Temperate Forests</b>	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08
<b>EPA ecoregions</b>	<b>Great Plains</b>	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04



e. South NOAA region and overlapping EPA ecoregions

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>South</b>	0.22	0.05	0.31	0.09	0.28	0.08	-0.21	0.04
	<b>Eastern Temperate Forests</b>	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08
<b>EPA ecoregions</b>	<b>Great Plains</b>	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04
	<b>North American Deserts</b>	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08

f. Southeast NOAA region and overlapping EPA ecoregions

		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Southeast</b>	0.41	0.17	0.56**	0.31**	0.51*	0.26*	0.03	0.00
	<b>Eastern Temperate Forests</b>	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08
<b>EPA ecoregions</b>	<b>Tropical Wet Forests</b>	-0.16	0.03	-0.66**	0.44**	-0.51*	0.26*	-0.50*	0.25*

**g. Southwest NOAA region and overlapping EPA ecoregions**

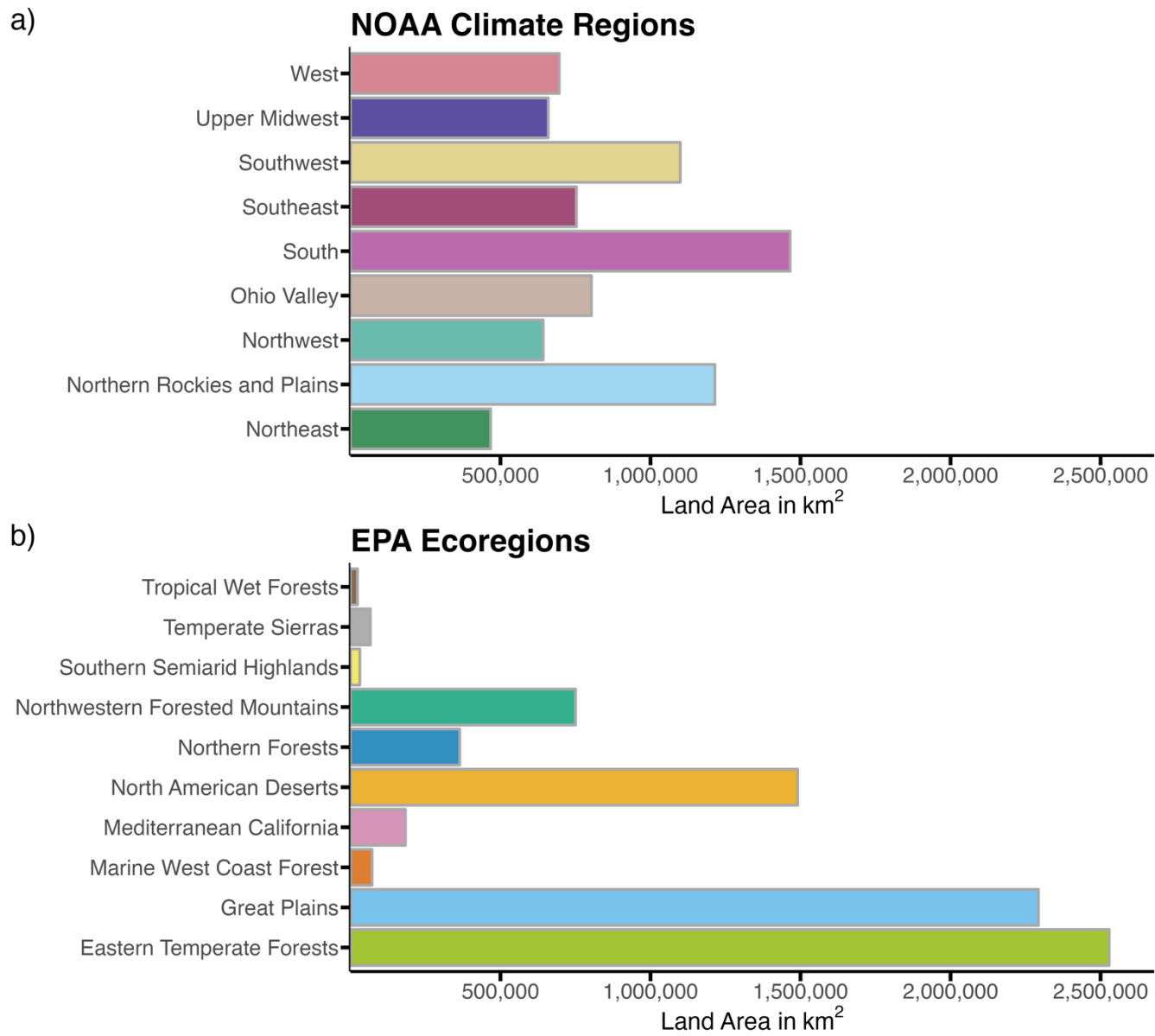
		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Southwest</b>	0.15	0.02	0.24	0.06	0.07	0.00	0.30	0.09
	<b>Great Plains</b>	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04
	<b>North American Deserts</b>	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08
<b>EPA ecoregions</b>	<b>Northwestern Forested Mountains</b>	0.49*	0.24*	0.24	0.06	0.33	0.11	-0.25	0.06
	<b>Southern Semiarid Highlands</b>	-0.33	0.11	-0.29	0.08	-0.37	0.14	0.04	0.00
	<b>Temperate Sierras</b>	-0.57**	0.32**	-0.35	0.13	-0.52**	0.27**	0.61**	0.38**

**h. Upper Midwest NOAA region and overlapping EPA ecoregions**

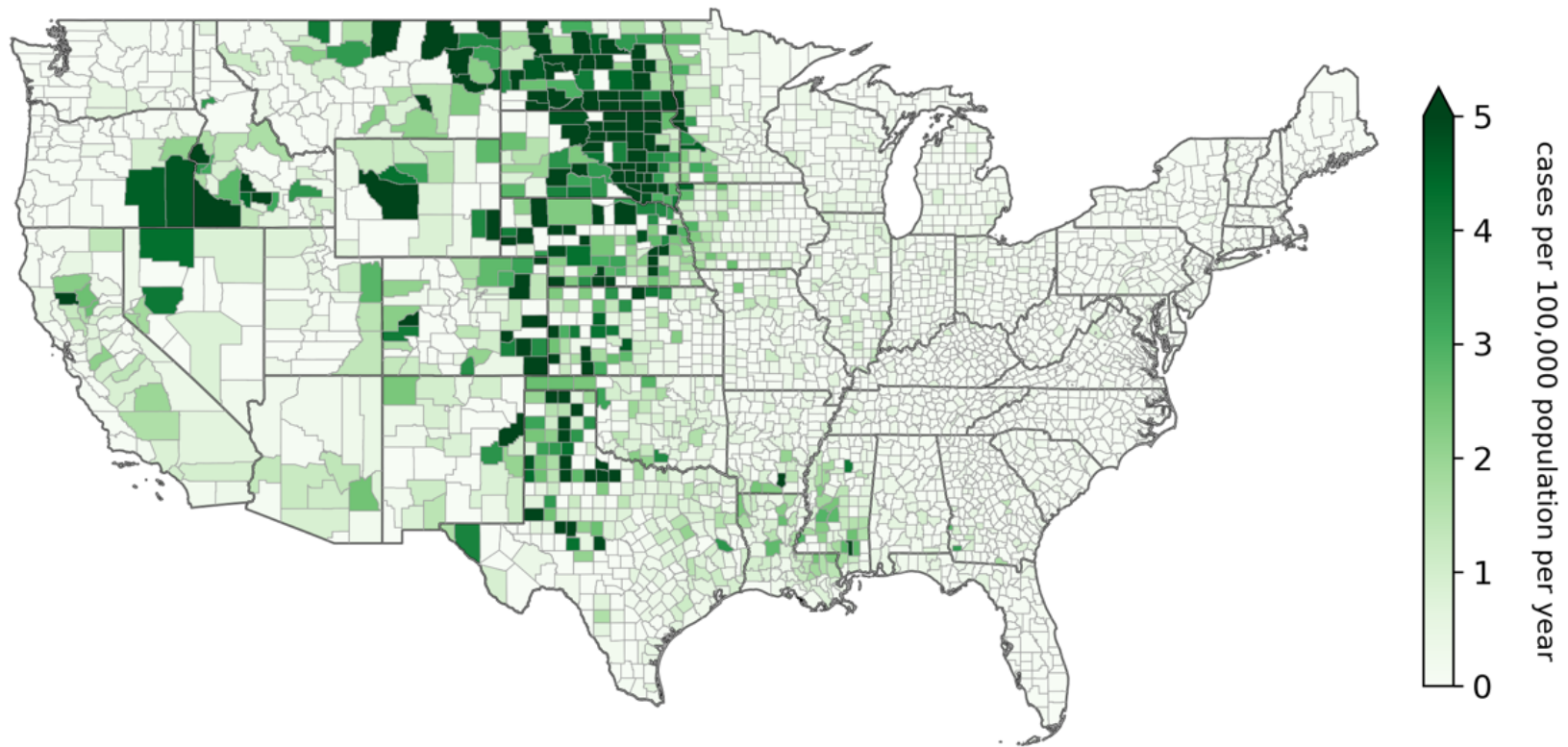
		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>Upper Midwest</b>	0.68**	0.46**	0.70**	0.49**	0.68**	0.47**	-0.24	0.06
	<b>Eastern Temperate Forests</b>	0.58**	0.34**	0.60**	0.36**	0.55**	0.31**	-0.28	0.08
<b>EPA ecoregions</b>	<b>Northern Forests</b>	0.32	0.10	0.44	0.19	0.36	0.13	0.05	0.00
	<b>Great Plains</b>	0.36	0.13	0.41	0.17	0.46*	0.22*	-0.19	0.04

**i. West NOAA region and overlapping EPA ecoregions**

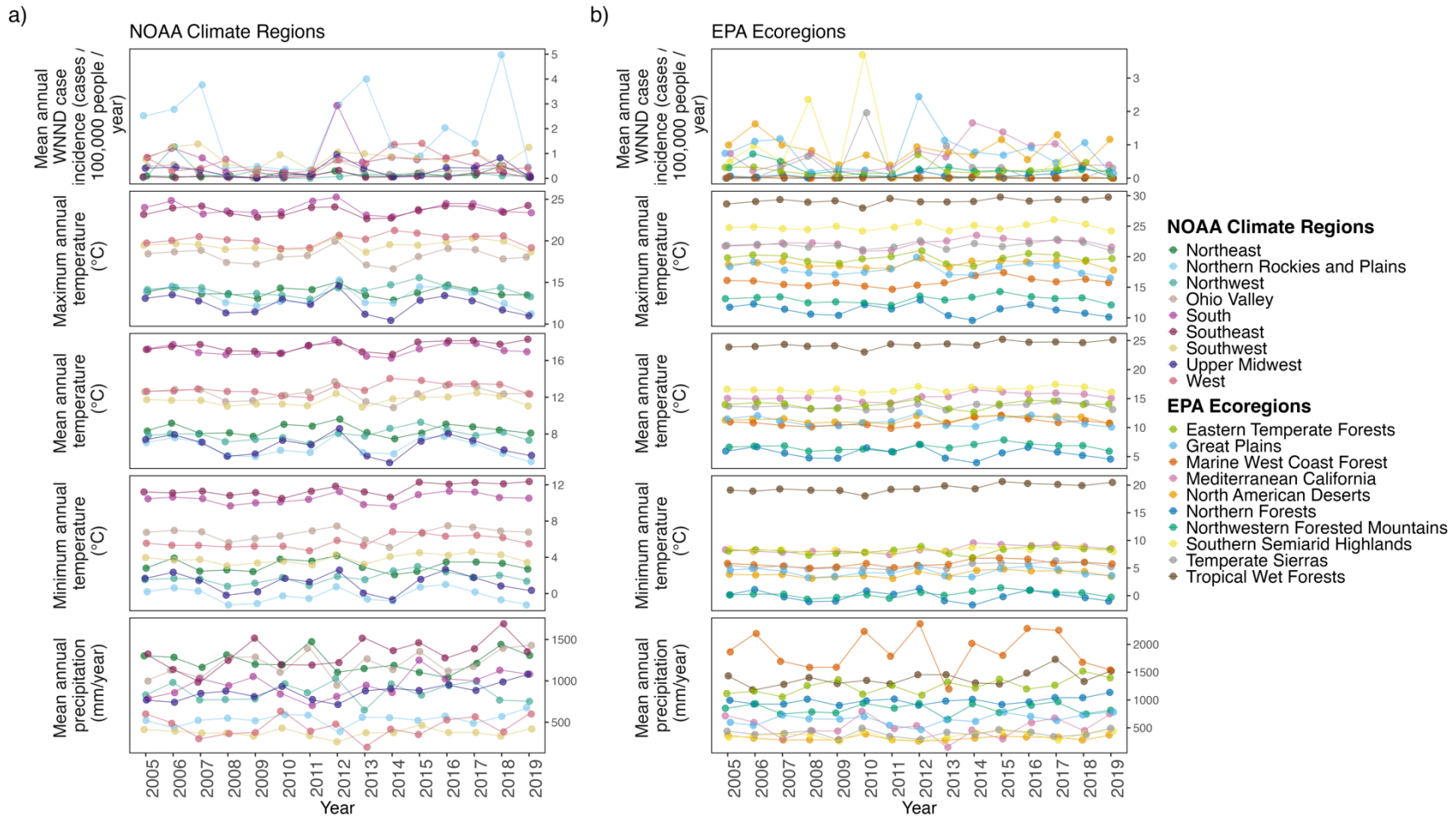
		Maximum temperature		Minimum temperature		Mean temperature		Precipitation	
		r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>	r	R <sup>2</sup>
<b>NOAA climate region</b>	<b>West</b>	0.64**	0.41**	0.72**	0.52**	0.72**	0.52**	-0.05	0.00
	<b>North American Deserts</b>	0.23	0.05	0.24	0.06	0.22	0.05	0.28	0.08
	<b>Northwestern Forested Mountains</b>	0.49*	0.24*	0.24	0.06	0.33	0.11	-0.25	0.06
<b>EPA ecoregions</b>	<b>Marine West Coast Forest</b>	0.28	0.08	0.23	0.05	0.20	0.04	0.01	0.00
	<b>Mediterranean California</b>	0.75**	0.57**	0.74**	0.54**	0.80**	0.63**	-0.10	0.01



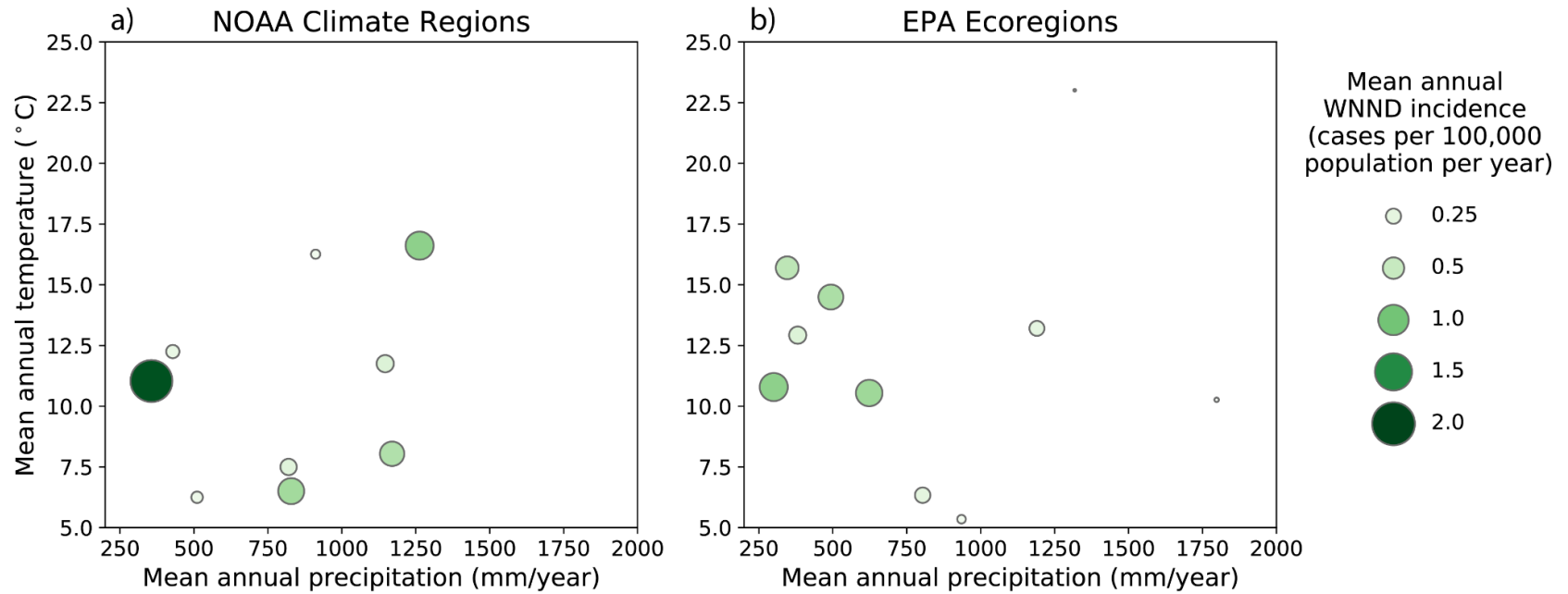
**Figure S1.** Comparison of total land area (km<sup>2</sup>) in NOAA climate regions (a) and EPA ecoregions (b).



**Figure S2.** Map of mean annual WNND incidence (cases per 100,000 population per year) from 2005-2019 by US county. While the geographical distribution of high incidence counties is widespread, there is a general “V” shape of higher incidence stretching throughout the central US from the Canadian border to west-central Texas.



**Figure S3.** Time series of yearly WNNd case incidence (cases per 100,000 population), maximum annual temperature (°C), mean annual temperature (°C), minimum annual temperature (°C), and mean annual precipitation (mm/year) in NOAA climate regions (a) and EPA ecoregions (b).



**Figure S4.** Mean annual WNND incidence (2005-2019) for NOAA climate regions (a) and EPA ecoregions (b) as both size and darkness of plotted circles. Mean annual temperature in degrees Celsius is represented on the y-axes and mean annual precipitation in millimeters per year is represented on the x-axes. Ecoregions with lower mean annual precipitation and moderate mean annual temperatures have the greatest WNND, whereas NOAA regions do not exhibit a clear pattern.