Table S1. Hydrological variables generated from WiMMed model. In italic, variables obtained from the first and second step of variable selection procedure (correlation analysis and VIF). In black italic type, chosen variables by *VSURF variable selection* to build the regression models.

Temporal Scale	Acronym	Variable	Unit
Annual*	Dra	Direct radiation	MJ
	Evc	Evaporation cover	mm
	Eto	***Potential evapotranspiration***	mm
	Hc	Humidity covered	mm
	HSol1†	Moisture floor layer 1	mm
	HSol2ı	*Moisture floor layer 2*	mm
	Inf	***Infiltration***	mm
	Int	***Interception***	mm
	Per	*Percolation*	mm
	Rad	Radiation	MJ/m^2
	Rh	Relative humidity	%
	Sd	Snow days	Days
	Sev	***Soil evaporation***	mm
	Sn	Snowmelt	mm
	S	***Snowfall***	mm
	R	Rainfall	mm
	T	Average temperature	ºC
	TMax	Maximum temperature	ºC
	Tmin	***Minimum temperature***	ºC
Seasonal	HCa	Humidity covered	mm
	Sa	Snowfall	mm
	SDa	Snow days	Days
Autumn‡	Ra	Rainfall	mm
	Ta	Average temperature	ºC
	TMAXa	Maximum temperature	ºC
	TMINa	Minimum temperature	ºC
	ETOs	Evapotranspiration	mm
	HCs	Humidity covered	mm
	Rs	Rainfall	mm
Spring$^{\Omega}$	Ts	Average temperature	ºC
	TMAXs	Maximum temperature	ºC
	TMINs	Minimum temperature	ºC
	ETOsu	Evapotranspiration	mm
	HCsu	Humidity covered	mm
	Rsu	Rainfall	mm
Summer^{o}	Tsu	Average temperature	ºC
	TMAXsu	***Maximum temperature***	ºC
	TMINsu	Minimum temperature	ºC
	HCw	Humidity covered	mm
	Sw	Snowfall	mm
	SDw	***Snow days***	Days
Winter¶	***Rw***	***Rainfall***	mm
	Tw	Average temperature	ºC
	TMAXw	Maximum temperature	ºC
	TMINw	Minimum temperature	ºC

* Mean annual values were then computed from (October 01 to September 30).

† For the analysis of the movement of water in the soil, the soil is divided into two layers: a surface layer (layer 1; <25 cm) and a lower layer (layer 2; ≥25 cm). Moisture floor measured at layer 1.

ı Moisture floor measured at layer 2.

‡ Mean seasonal values were then computed from (20 September to 21 December).

Ω Mean seasonal values were then computed from (20 March to 21 June).

º Mean seasonal values were then computed from (21 June to 20 September).

¶ Mean seasonal values were then computed from (21 December to 20 March).

Table S2. Relative importance values for hydrological variables according to VSURF variable selection used to assess Maritime pine stands in decline process in Sierra de Baza (Andalusia-Granada).

Variable	Importance%
Average summer Maximum temperature (TMAXsu)	100
Potential evapotranspiration (Eto)	56.32
Average annual Minimum temperature (TMINa)	48.91
Soil evaporation (Sev)	44.47
Winter rainfall (Rw)	44.04
Infiltration (Inf)	41.98
Snowdays in winter (SDw)	37.08
Annual Snowfall (Sa)	36.68
Interception (Int)	32.98

Table S3. Relative importance values for hydrological variables according to VSURF variable selection used to assess Maritime pine stands in decline process in Sierra de Baza (Andalusia-Granada).

Year	RMSE	AVE	R^2	*S*	RMSECV
1984	0.0772	0.0086	0.7528	0.7296	0.1008
1985	0.1027	0.0222	0.6495	0.6434	0.1132
1986	0.0695	–0.0039	0.7316	0.7263	0.1093
1987	0.0878	0.0004	0.6610	0.6797	0.1051
1988	0.0880	–0.0214	0.6496	0.6526	0.099
1989	0.0724	0.0060	0.7583	0.8085	0.1039
1990	0.0817	–0.0054	0.6973	0.7226	0.0981
1991	0.0712	–0.0158	0.6969	0.6217	0.1046
1992	0.0769	–0.0182	0.6319	0.6050	0.0915
1993	0.0673	–0.0004	0.7759	0.7882	0.0913
1994	0.0606	–0.0023	0.8445	0.8316	0.0948
1995	0.0736	0.0247	0.6914	0.6683	0.0912
1996	0.1003	–0.0130	0.3647	0.4018	0.1138
1997	0.0639	–0.0059	0.5991	0.5379	0.0912
1998	0.0647	–0.0079	0.7129	0.6702	0.0911
1999	0.0846	–0.0147	0.4666	0.4360	0.0983
2000	0.0618	–0.0063	0.6238	0.6191	0.0856
2001	0.0787	0.0015	0.7298	0.7092	0.1083
2002	0.0692	0.0088	0.6618	0.6352	0.0801
2003	0.0554	0.0019	0.7456	0.7237	0.0814
2004	0.0607	0.0092	0.7124	0.6824	0.0846
2005	0.0537	0.0001	0.5936	0.6240	0.0848
2006	0.0565	–0.0148	0.7386	0.7210	0.0802
2007	0.0718	–0.0035	0.4719	0.4888	0.0796
2008	0.0676	0.0224	0.7250	0.6753	0.0889
2009	0.0669	0.0143	0.7489	0.7243	0.0867
2010	0.0580	–0.0011	0.7091	0.6872	0.0783
2011	0.0546	–0.0010	0.5932	0.6165	0.0788
2012	0.0576	0.0091	0.7653	0.7843	0.0774
2013	0.0655	–0.0068	0.7054	0.6852	0.0893
2014	0.1315	0.0187	0.6285	0.6200	0.1734
2015	0.0603	–0.0014	0.7640	0.7009	0.0929
2016	0.0768	–0.00009	0.7032	0.6066	0.0968
2017	0.0652	0.0112	0.7993	0.7031	0.0595

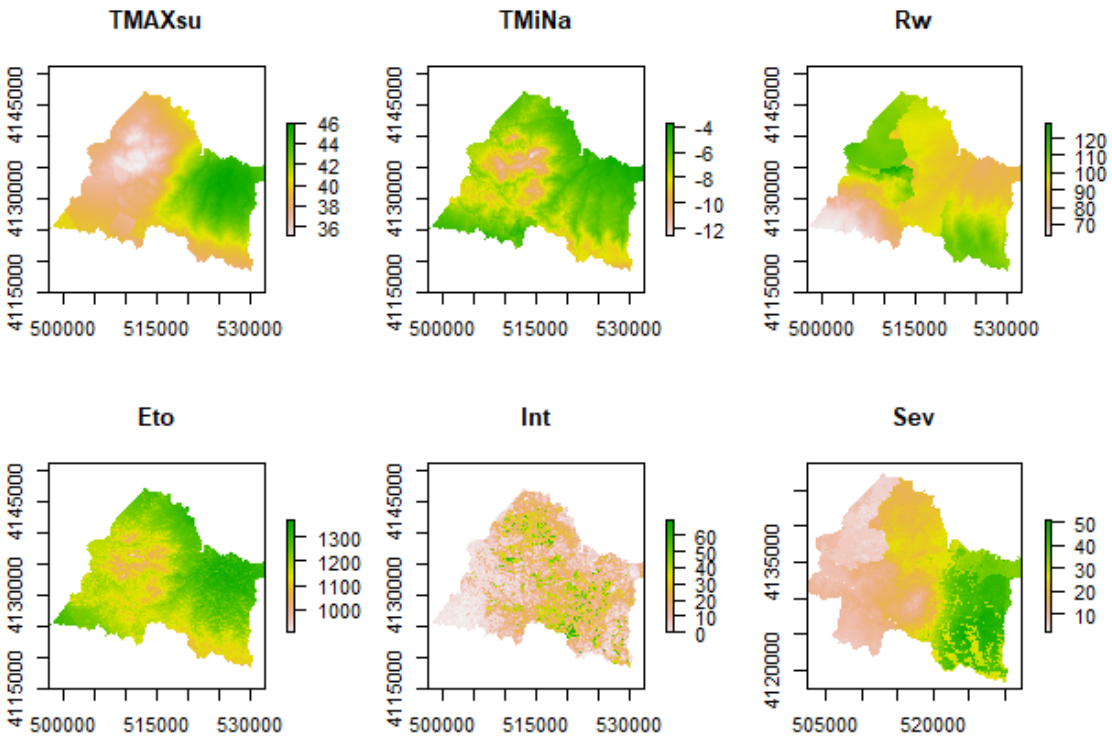

Figure S1. Hydrological variables derived from your WiMMed model. Average summer Maximum temperature (TMAXsu), Potential evapotranspiration (Eto), Average annual Minimum temperature (TMINa), Soil evaporation (Sev), Winter rainfall (Rw), Infiltration (Inf), Snowdays in winter (SDw), Annual Snowfall (Sa), Interception (Int).

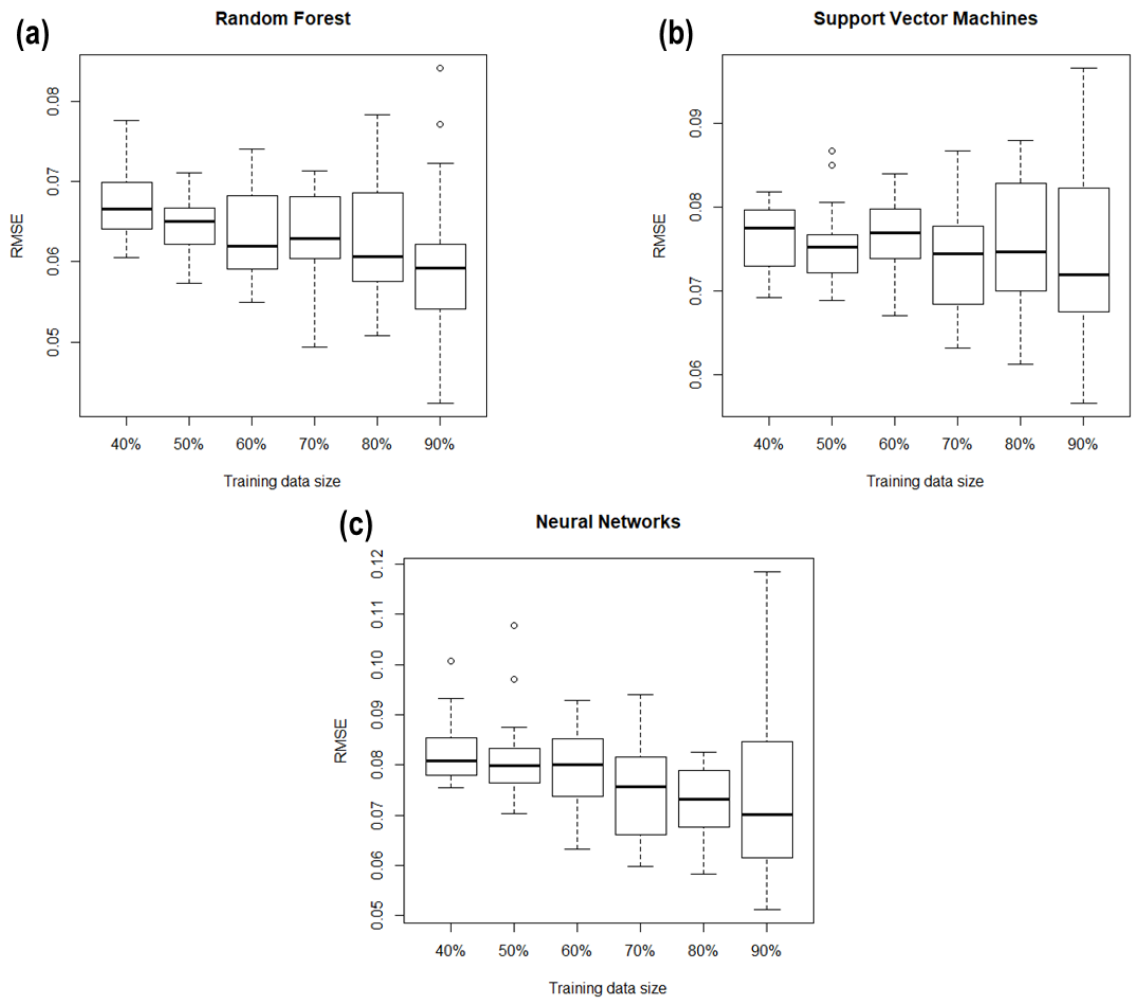

Figure S2. Performance of regression models as a function of training data size used to study defoliation of *Pinus pinaster* forests in Sierra de Baza (Andalusia-Granada). **(a)** Regression model random forest, **(b)** support vector machines, **(c)** neural networks.