Supplementary Information

Supplementary Table S1: Vector habitat suitability conditions

Variable	*H. marginatum*	*H. lusitanicum*	Dataset
Forest/woodland > 40%	No	Yes	Corine/ESA CCI
Woodland or Forest 15 - 40%	Yes	Yes	Corine/ESA CCI
Shrubland/Grassland	Yes	Yes	Corine/ESA CCI
Cropland	Yes	Yes	Corine/ESA CCI
Sparse Vegetation	Yes	No	Corine/ESA CCI
Minimum Elevation	< 2000m	< 2000m	GMTED (see URL below)
Max temp	< 35 ^{o}C	< 40 ^{o}C	Worldclim (see URL below)
Summer minimum Relative Humidity		>10%, < 65%	Derived from MODIS LST (see URL below)
Cumulative temperature above 15^{o}C, April to August	>800, plus 50km buffer		Worldclim (see URL below)
Cumulative minimum temperature above 0 ^{o}C, October and November		>400	Worldclim (see URL below)
Mean Annual Vapour Pressure Deficit	< 15%		ECWMF (see URL below)
Corine Land Cover 2018 https://land.copernicus.eu/pan-european/corine-land-cover, ESA CCI land Cover http://maps.elie.ucl.ac.be/CCI/viewer/download.php GMTED https://topotools.cr.usgs.gov/gmted_viewer/gmted2010_global_grids.php Modis Land Surface Temperature https://modis.gsfc.nasa.gov/data/dataprod/mod11.php Worldclim: https://www.worldclim.org/data/index.html ECMWF: https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5			

Supplementary Table S2: Covariates offered to modelling procedures

1 VCC1103A0: Middle infra-red mean	43 VCC1115A2: EVI amplitude 2
2 VCC1103A1: Middle infra-red amplitude 1	44 VCC1115A3: EVI amplitude 3
3 VCC1103A2: Middle infra-red amplitude 2	45 VCC1115MN: EVI minimum
4 VCC1103A3: Middle infra-red amplitude 3	46 VCC1115MX: EVI maximum
5 VCC1103MN: Middle infra-red minimum	47 VCC1115P1: EVI phase 1
6 VCC1103MX: Middle infra-red maximum	48 VCC1115P2: EVI phase 2
7 VCC1103P1: Middle infra-red phase 1	49 VCC1115P3: EVI phase 3
8 VCC1103P2: Middle infra-red phase 2	50 VCC1115VR: EVI variance
9 VCC1103P3: Middle infra-red phase 3	51 VCMI30GRDP1K DEM (Elevation) +1000
10 VCC1103VR: Middle infra-red variance	52 VC1920A0: ERA5 Precipitation mean
11 VCC1107A0: Daytime LST mean	53 VC1920A1: ERA5 Precipitation amplitude 1
12 VCC1107A1: Daytime LST amplitude 1	54 VC1920A2: ERA5 Precipitation amplitude 2
13 VCC1107A2: Daytime LST amplitude 2	55 VC1920A3: ERA5 Precipitation amplitude 3
14 VCC1107A3: Daytime LST amplitude 3	56 VC1920MN: ERA5 Precipitation minimum
15 VCC1107MN: Daytime LST minimum	57 VC1920MX: ERA5 Precipitation maximum
16 VCC1107MX: Daytime LST maximum	58 VC1920P1: ERA5 Precipitation phase 1
17 VCC1107P1: Daytime LST phase 1	59 VC1920P2: ERA5 Precipitation phase 2
18 VCC1107P2: Daytime LST phase 2	60 VC1920P3: ERA5 Precipitation phase 3
19 VCC1107P3: Daytime LST phase 3	61 VC1920VR: ERA5 Precipitation variance
20 VCC1107VR: Daytime LST variance	62 VCWPOPPPP: Worldpop Human Population density 2020
21 VCC1108A0: Nighttime LST mean	63 VCV59EL500: GNTED Elevation + 500
22 VCC1108A1: Nighttime LST amplitude 1	64 VCEELCBARE: consensus % bare ground
23 VCC1108A2: Nighttime LST amplitude 2	65 VCEELCDCBD3: consensus % deciduous broadleaved forest
24 VCC1108A3: Nighttime LST amplitude 3	66 VCEELCEVGBD2: consensus % evergreen broadleaved forest
25 VCC1108MN: Nighttime LST minimum	67 VCEELCEVGND1: consensus % evergreen needleleaved forest
26 VCC1108MX: Nighttime LST maximum	68 VCEELCFLOOD8: consensus % flooded
27 VCC1108P1: Nighttime LST phase 1	69 VCEELCHVCB: consensus % herbaceous cover
28 VCC1108P2: Nighttime LST phase 2	70 VCEELCMANAG7: consensus % managed land
29 VCC1108P3: Nighttime LST phase 3	71 VCEELCOTHTR4: consensus % other land cover
30 VCC1108VR: Nighttime LST variance	72 VCEELCSHRUB5: consensus % shrub cover
31 VCC1114A0: NDVI mean	73 VCEELCURB9: consensus % urban
32 VCC1114A1: NDVI amplitude 1	74 VCEELCWATER12: consensus % water
33 VCC1114A2: NDVI amplitude 2	75 VC82094A0: Relative Humidity mean
34 VCC1114A3: NDVI amplitude 3	76 VC82094A1: Relative Humidity amplitude 1
35 VCC1114MN: NDVI minimum	77 VC82094A2: Relative Humidity amplitude 2
36 VCC1114MX: NDVI maximum	78 VC82094A3: Relative Humidity amplitude 3
37 VCC1114P1: NDVI phase 1	79 VC82094MN: Relative Humidity minimum
38 VCC1114P2: NDVI phase 2	80 VC82094MX: Relative Humidity maximum
39 VCC1114P3: NDVI phase 3	81 VC82094P1: Relative Humidity phase 1
40 VCC1114VR: NDVI variance	82 VC82094P2: Relative Humidity phase 2
41 VCC1115A0: EVI mean	83 VC82094P3: Relative Humidity phase 3
42 VCC1115A1: EVI amplitude 1	84VC82094VR: Relative Humidity variance

LST = Land Surface Temperature. NDVI Normalised Difference vegetation Index; EVI Enhanced Vegetation Index. DEM Digital Elevation. All files starting with VCC11, VC19 and VC82 are Fourier processed MODIS Satellite Imagery produced by the Environmental Research Group Oxford according to the methods set out in Scharlemann *et. al.* (2008) [24].

The Relative Humidity layers were produced as described in n Kraemer *et. al.* (2019)[38] and then Fourier Processed as described above.

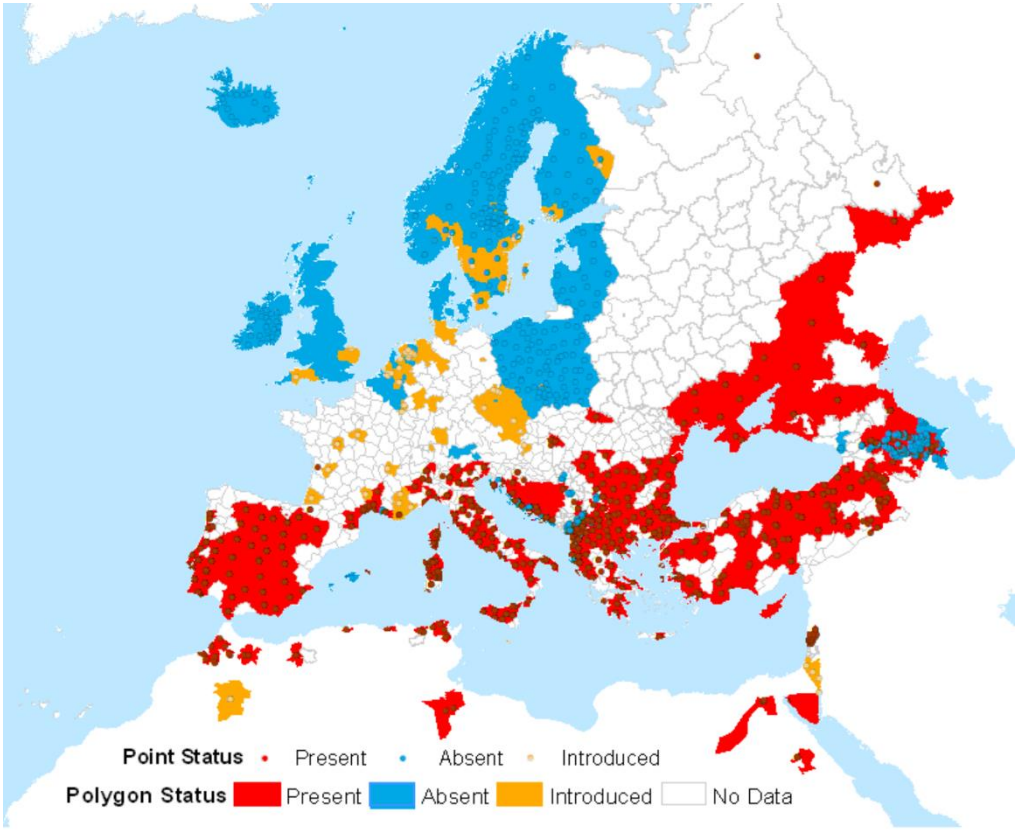
The Elevation layer was extracted from the GMTED datasets (https://topotools.cr.usgs.gov/gmted_viewer/gmted2010_global_grids.php) and the negative values removed by adding 1000.

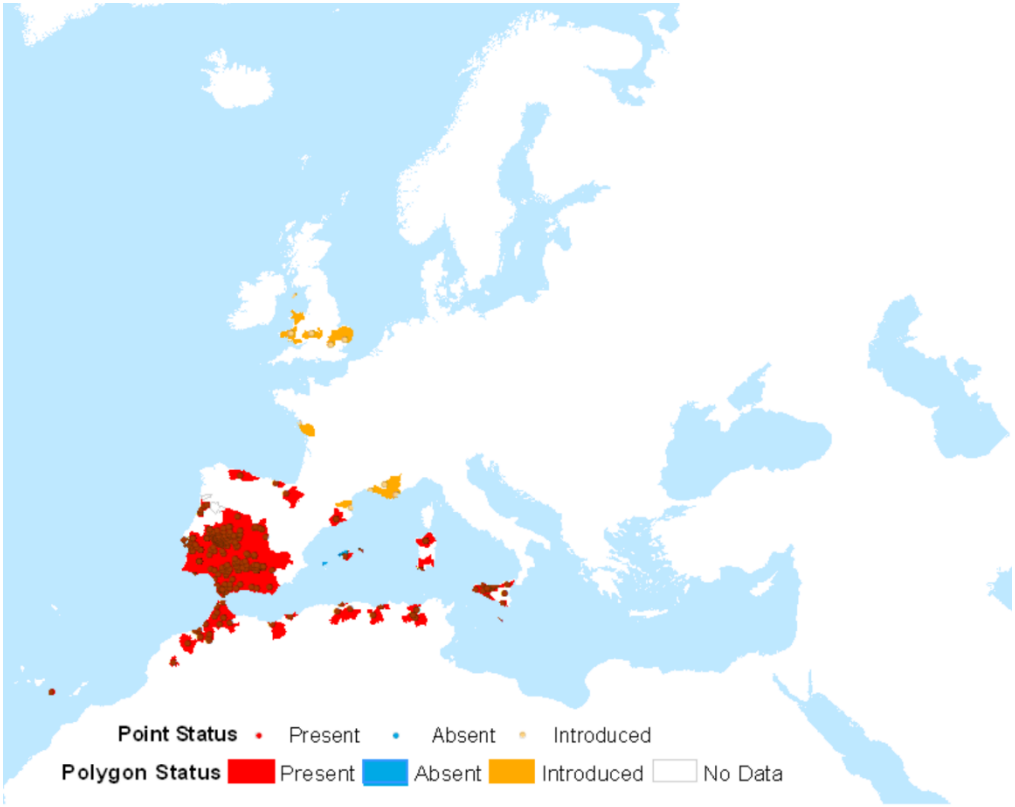
Population layers derived from layers produced by worldpop (https:// www.worldpop.org/datacatalog/)

All Files with VCEELC in file name were derived from the Earthenv consensus land cover data product (https://www.earthenv.org/landcover)

All layers extracted and standardised by ERGO for MOOD Horizon 2020 project N° 874850 (https://mood-h202.eu)

Supplementary Figure S1:VectorNet data locations

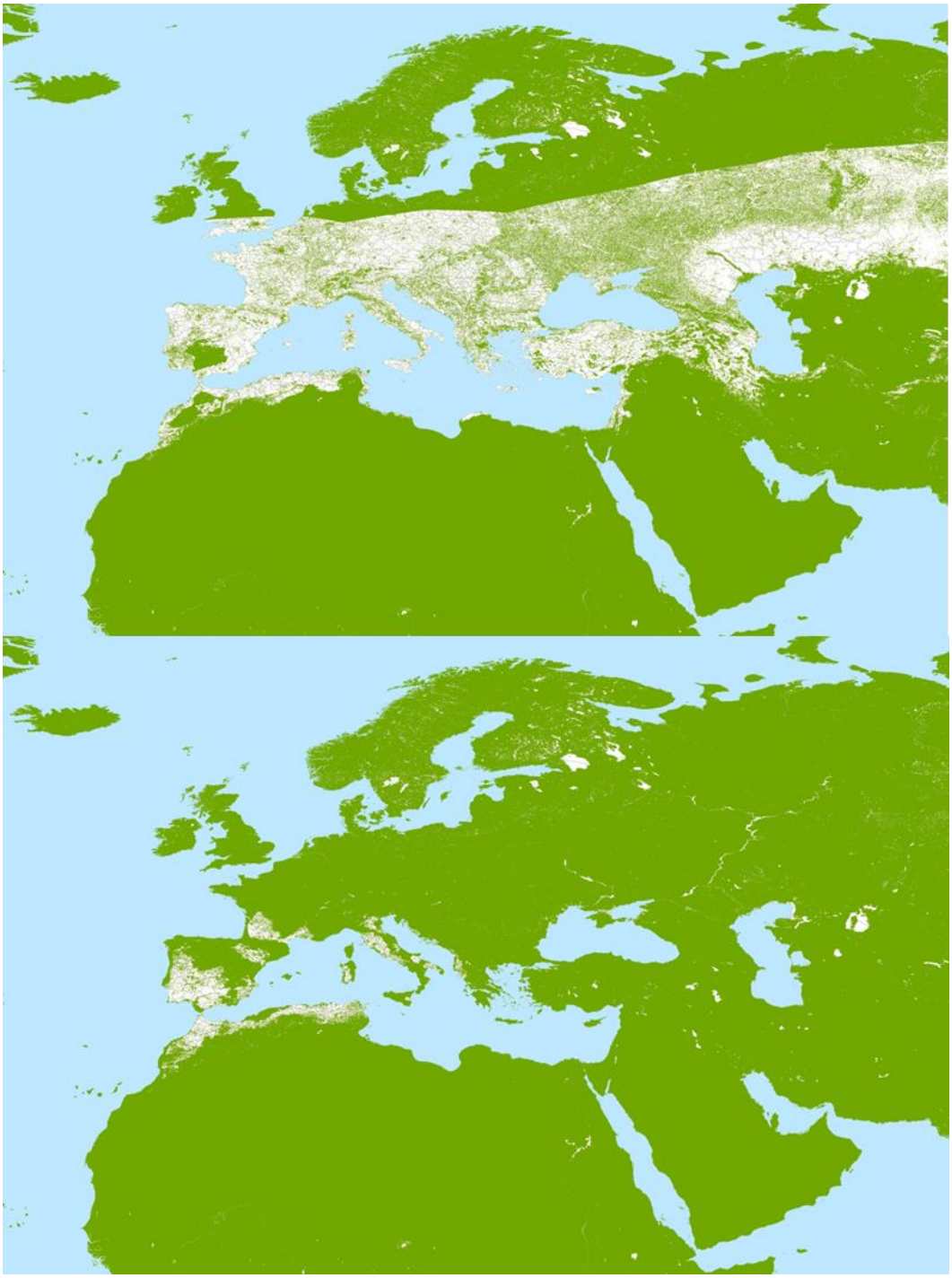




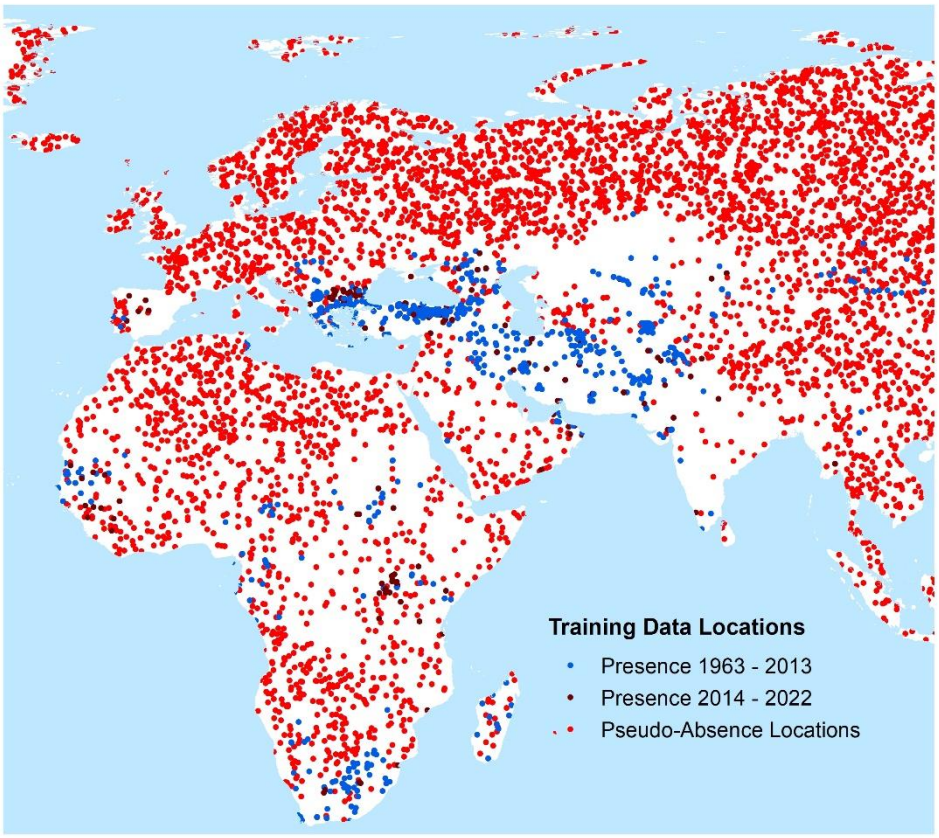
Top *H. marginatum*, Bottom *H. lusitanicum.*

Supplementary Figure S2: Habitat suitability for each vector.

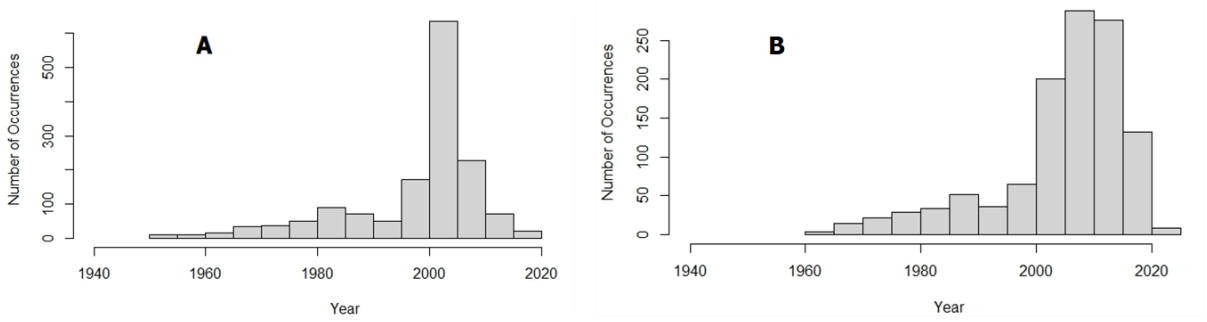
Top *H. marginatum*, Bottom *H. lusitanicum.* Unsuitable = Green, Suitable=white



Supplementary Figure S3: Full extent of CCHF pseudo-absence and occurrence locations



Supplementary Figure S4: Frequency histograms of CCHF human occurrence locations by year of published report. *Histograms by year of (A) point occurrence locations; (B) administrative area (polygon) occurrence locations*

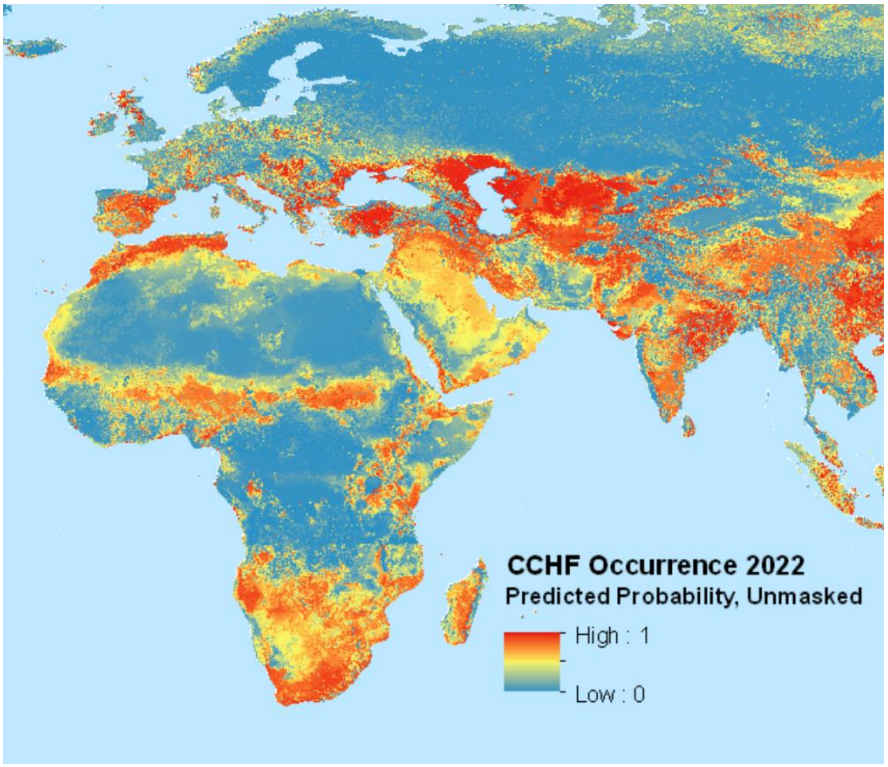


Supplementary Table S3: Top 10 vector model predictors

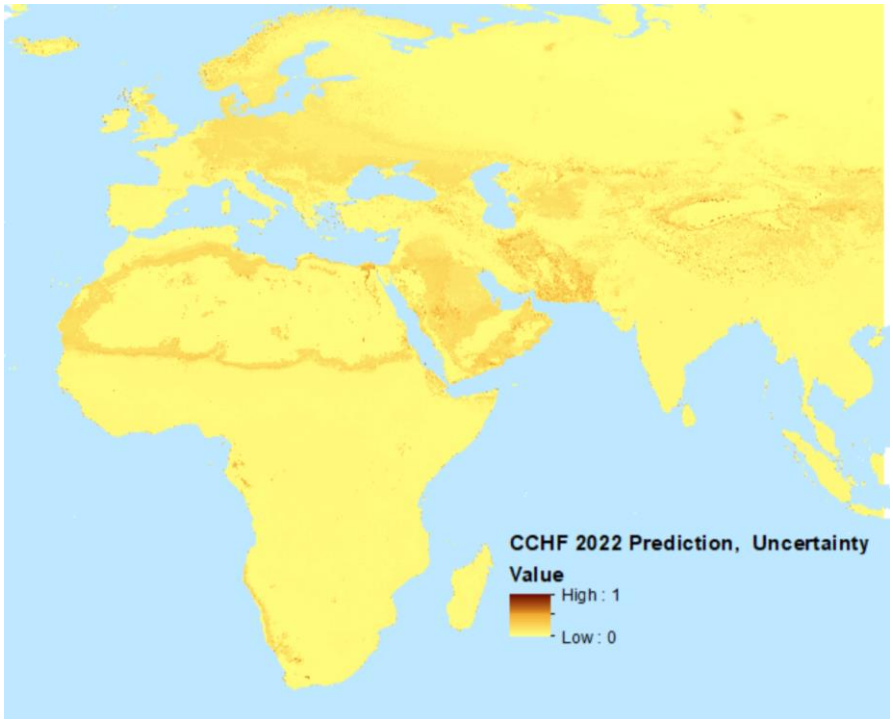
H. lusitanicum				*H. marginatum*			
RF		BRT		RF		BRT	
Predictor	Metric	Predictor	Metric	Predictor	Metric	Predictor	Metric
Rainfall Amplitude Component 1	20.44	Rainfall Amplitude Component 1	2.57	NDVI Minimum	9.84	Day Temperature Mean	1.66
Day Temperature Phase Component 2	17.2	Rainfall Amplitude Component 2	2.45	Rainfall Amplitude Component 2	9.8	NDVI Minimum	1.62
Rainfall Minimum	11.68	Day Temperature Phase Component 2	2.17	Day Temperature Mean	7.3	Rainfall Amplitude Component 2	1.55
Night Temperature Amplitude Component 1	7.1	Infra Red Amplitude Component 1	1.92	Rainfall Phase Component 3	4.36	Rainfall Amplitude Component 1	1.46
Night Temperature Minimum	4.12	EVI Phase Component 1	1.62	Rainfall Phase Component 1	4.34	Night Temperature Phase Component 2	1.41
Rainfall Amplitude Component 2	3.8	Infra Red Phase Component 1	1.52	Bare Ground Proportion	3.48	Night Temperature Maximum	1.35
Rainfall Phase Component 2	2.91	Night Temperature Amplitude Component 1	1.52	Night Temperature Phase Component 2	2.95	Rainfall Maximum	1.29
Infra Red Phase Component 1	2.59	Day Temperature Mean	1.4	Relative Humidity minimum	2.85	Day Temperature Phase Component 1	1.29
Night Temperature Mean	2.12	NDVI Phase Component 1	1.3	Relative Humidity Phase Component 3	2.8	NDVI Amplitude Component 2	1.26
Relative Humidity Amplitude Component 2	1.91	Infra Red Phase Component 2	1.28	Rainfall Phase Component 2	2.77	Day Temperature Maximum	1.25

Note: for both RF and BRT the higher the metric within each method the more important the predictor. The Metrics are different for each method, and should not be compared

Supplementary Figure S5: Full extent of modelled CCHF suitability map

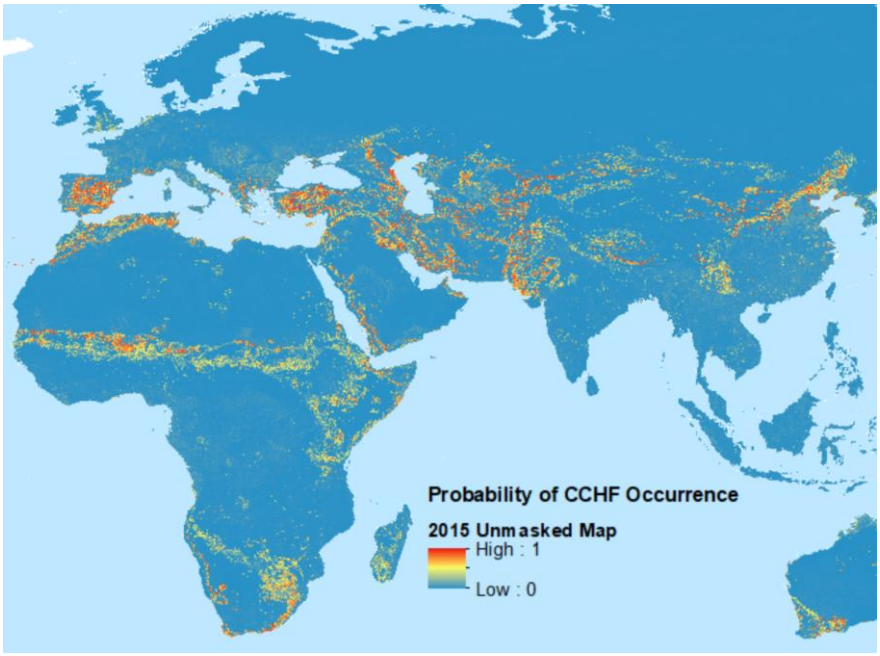


Supplementary Figure S6: Uncertainty estimates for CCHF suitability estimates (probability of occurrence)



Uncertainty ranges from 0 to 1, with higher values indicating greater ranges in the estimated probability of occurrence.

Supplementary Figure S7: Unmasked 2015 CCHF prediction from Messina et al (2015).



Supplementary Figure S8: Areas with > 0.75 probability of vector presence