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Supplementary material

Incorporating fine-scale drought information into an eastern US wildfire hazard model

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Section S1. Model training data

A maximum entropy model was parameterised with four environmental data layers consisting of a cumulative drought severity index (CDSI), an integrated moisture index (IMI), percentage forest cover and wildland–urban interface classes (WUI). Three additional models for December, January and February included average mean winter temperature of the 10-year period and CDSI values calculated without a snowmelt function. Each variable was included in the model as a 30-m Ascii grid files.

Wildfires – during the period January 2000 to December 2009, 4847 records reporting area burned >0.1 ha from the following ignition sources: campfire (5.5%), children (10.2%), debris burning (29.9%), equipment (9.4%), incendiary (36.8%), lightning (1.3%), railroad (2.8%) or smoking (4.1%).

CDSI – the cumulative value of monthly Palmer drought severity, derived from 4 × 4-km gridded data, and weighted by 1, 2 and 3 for moderate (–2.0 to –2.99), severe (–3.0 to –3.99) and extreme (≤–4.0) conditions respectively. Because wildfire hazard is modeled monthly with 10 years of reported fires, CDSI is based on 10 observations for each month over the period 2000–2009 (e.g. January 2000 to 2009). CDSI thus represents the 10-year deficit in soil moisture for each month.

IMI – the long-term potential soil moisture based on topographic hillshading, flow accumulation of water downslope, curvature, and soil water-holding capacity (Iverson *et al.* 1997). Curvature, flow accumulation and hillshade were derived from a 10-m digital elevation model. Flow accumulation was processed using an infinite directional algorithm developed by Tarboton (1997). Available water-holding capacity to a depth of 150 cm was derived from soil data within the Natural Resources Conservation Service Soil Survey Geographic (SSURGO) database. Each component was standardised on a 0–100 scale, then cumulated to the same scale according to:

$$\text{IMI} = (\text{curvature} \times 0.1 + \text{flow accumulation} \times 0.3 + \text{hillshade} \times 0.4 + \text{AWC} \times 0.2)$$

Percentage forest – the amount of forest in 10% intervals, within a 30-m grid derived from LANDFIRE data.

WUI – developed from 2000 Census data and 1992 National Land Cover Dataset values, the ratio of housing density (1 structure per 16 ha) to the proportion of wildland vegetation (>50% for intermix and <50%, but within 2.4 km of a 500 ha area with >75% vegetation for interface) per area was classified into five categories and rasterised to 30-m grids.

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Table S1. Generalised WUI class values used in Maxent model

WUI	Non-WUI Vegetated	Non-Vegetated or Agriculture	Uninhabited/ No Vegetation	Water
Low density Interface	Very low density vegetated	Very low density no vegetation	Uninhabited/No Vegetation	Water
Medium density Interface	Uninhabited vegetated	Low density no vegetation		
High density Interface		Medium density no vegetation		
Low density Intermix		High density no vegetation		
Medium density Intermix				
High density Intermix				

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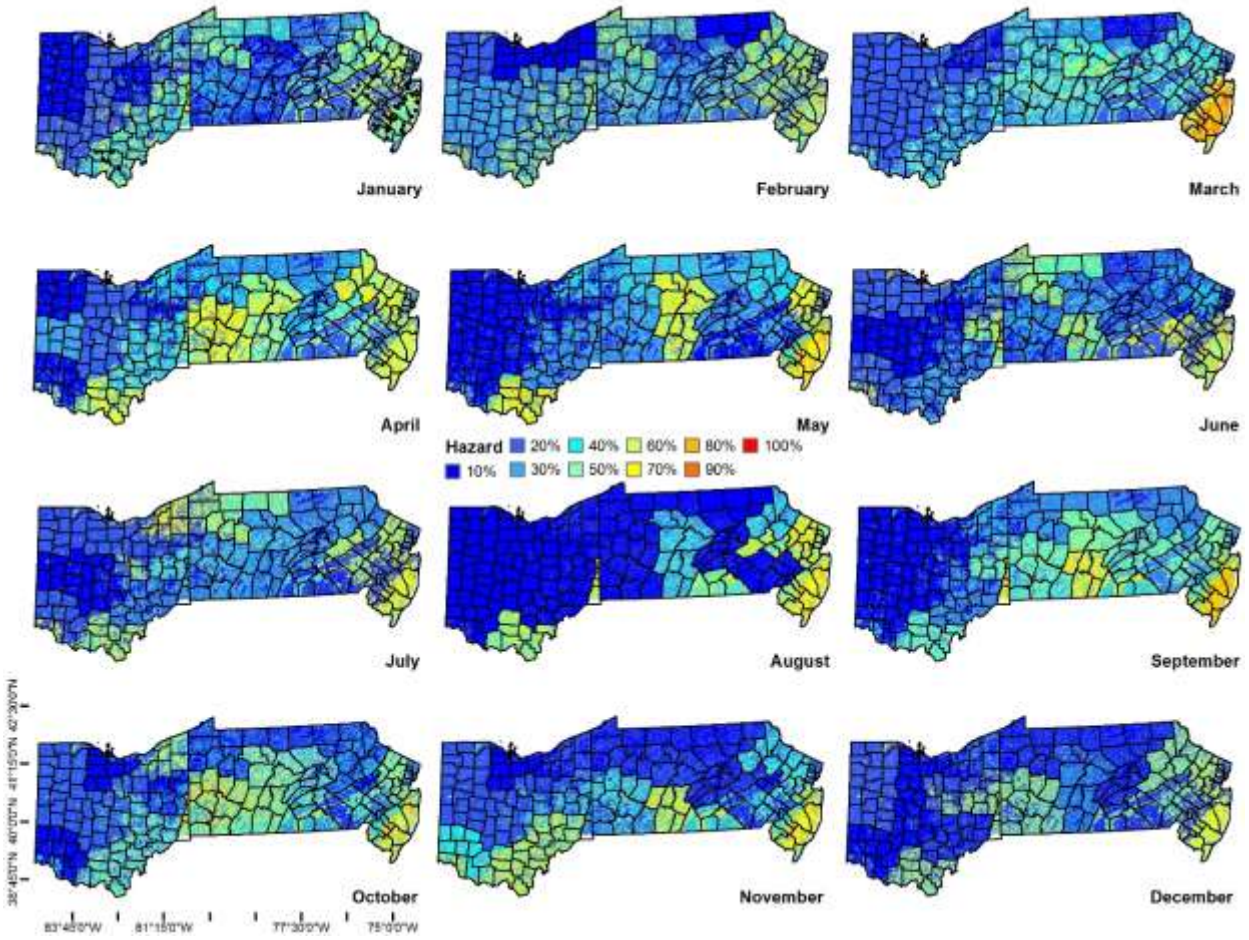

Fig. S1. Mean probability of wildfire hazard models (10 iterations) parameterised with climate division data (Peters *et al.* 2013*a*), for comparison with Fig. 1. Monthly Maxent models were trained with reported wildfires during the period 2000–2009.

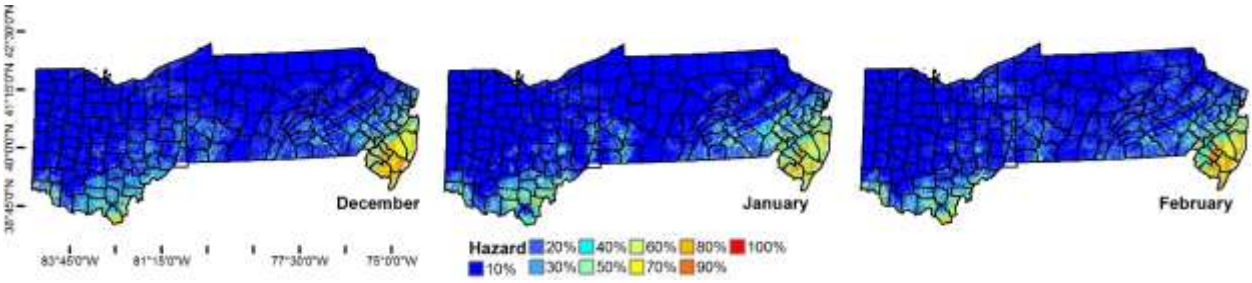

Fig. S2. Mean probability of wildfire hazard models (10 iterations) parameterised with a cumulative drought severity index derived from gridded self-calibrated PDSI and mean winter temperature for December, January and February. Monthly Maxent models were trained with reported wildfires during the period 2000–2009.

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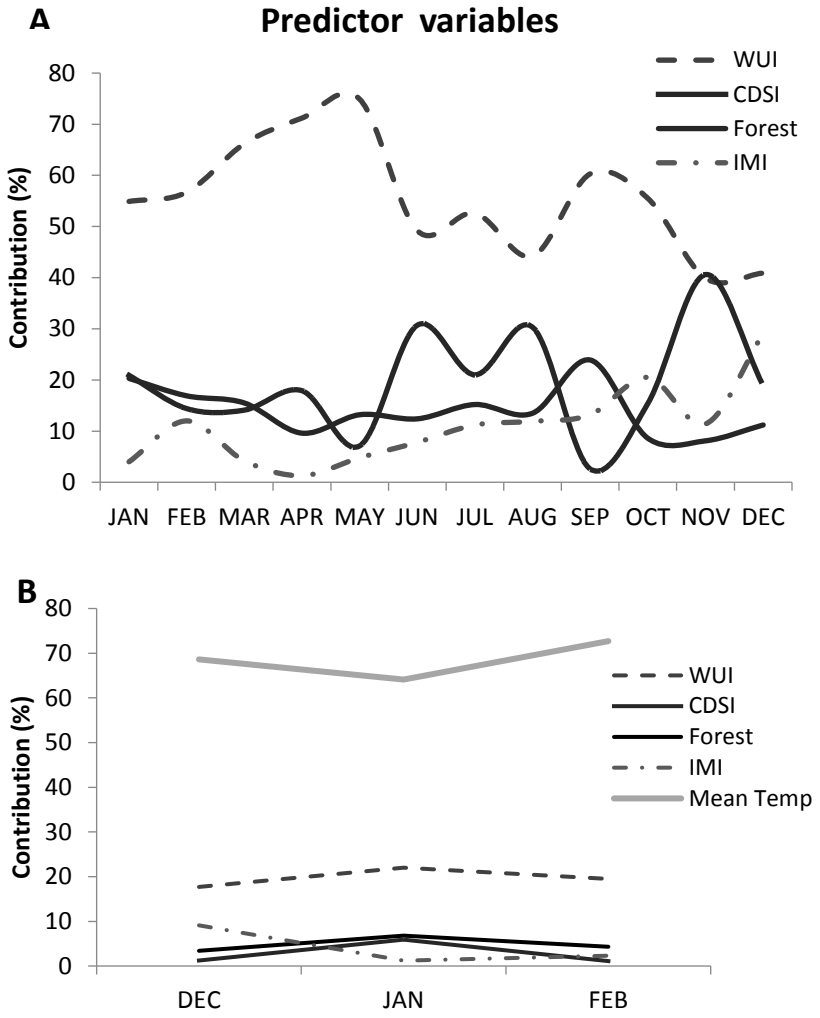

Fig. S3. Mean percentage contribution of environmental variables used to parameterise 10 iterations of Maxent. The cumulative drought severity index (CDSI) was derived from PDSI calculated with a snowmelt function (A) and without a snowmelt function additionally including mean winter temperature (B).

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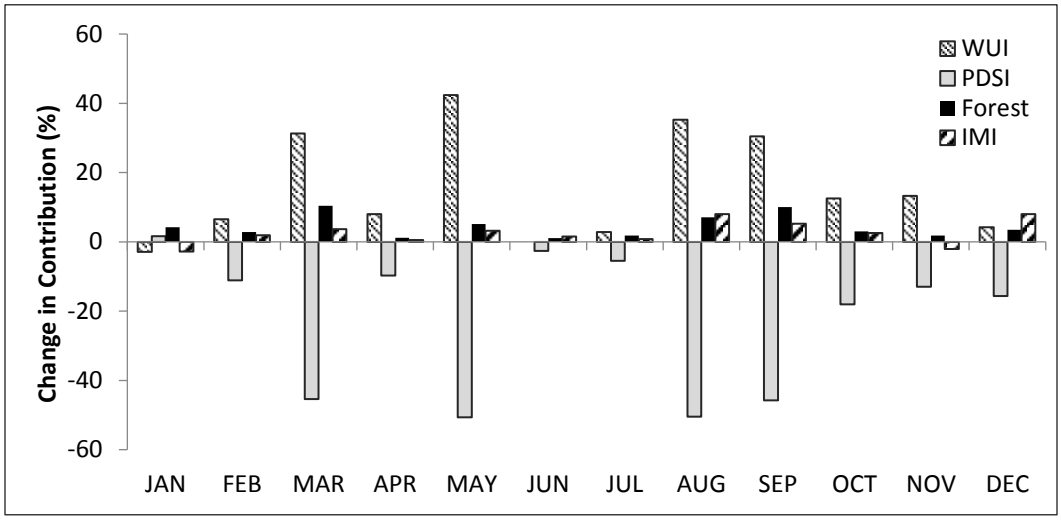

Fig. S4. Change in predictor variable contribution from original climate division wildfire hazard models (Peters *et al*. 2013*a*) and updated models including a cumulative drought severity index (CDSI) derived from 4×4 km gridded self-calibrated PDSI data instead of climate division data. CDSI incorporates drought intensity with frequency, by month over 10 years of data.

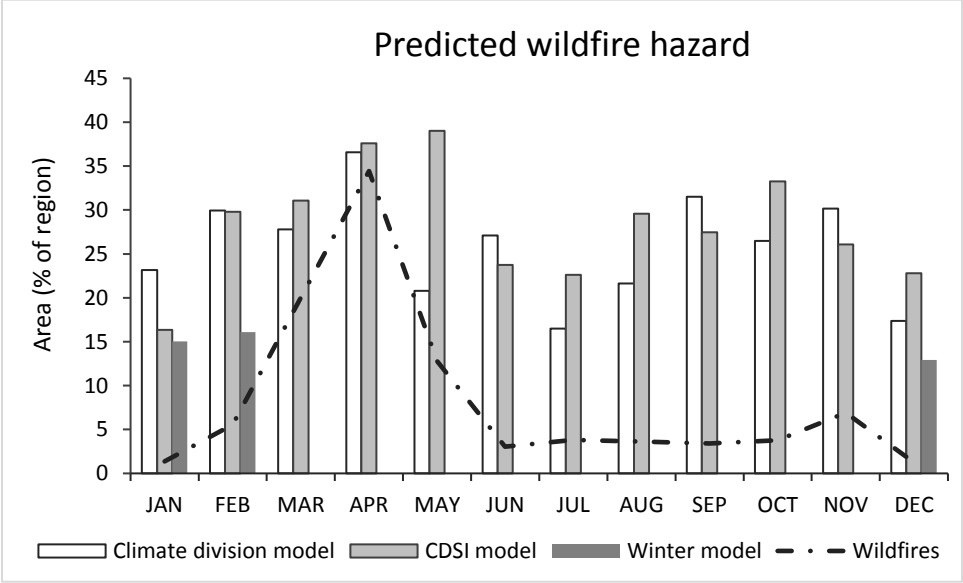

Fig. S5. Percentage of region with predicted wildfire hazard probabilities ≥ the maximum training sensitivity plus specificity logistic threshold among the three models for each month. Cumulative drought severity index (CDSI) values, a summation of weighted drought conditions for the period 2000 to 2009 for each month were included in each model. The climate division model used drought conditions aggregated among 10 or fewer counties; while the CDSI and winter models used 4-km^2 gridded drought conditions. Except for the winter model, which included mean winter temperature as a predictor variable, a snowmelt function was used to calculate Palmer drought severity. Percentage of monthly wildfires (dashed line) during the 2000–2009 period included to show the bimodal pattern of spring and fall fires.

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