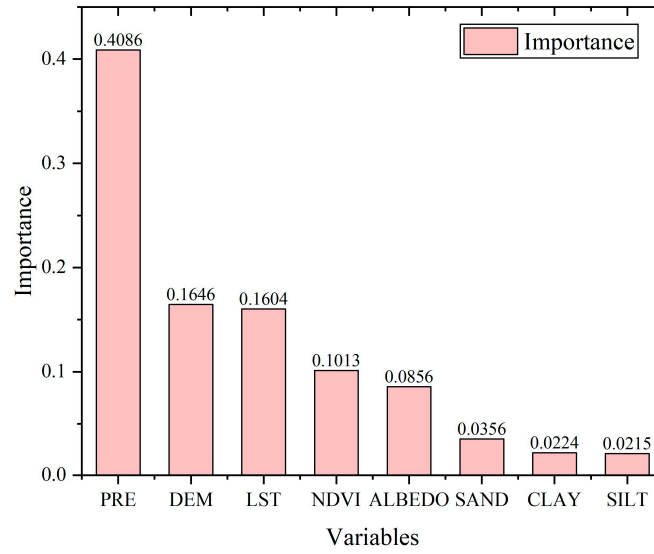
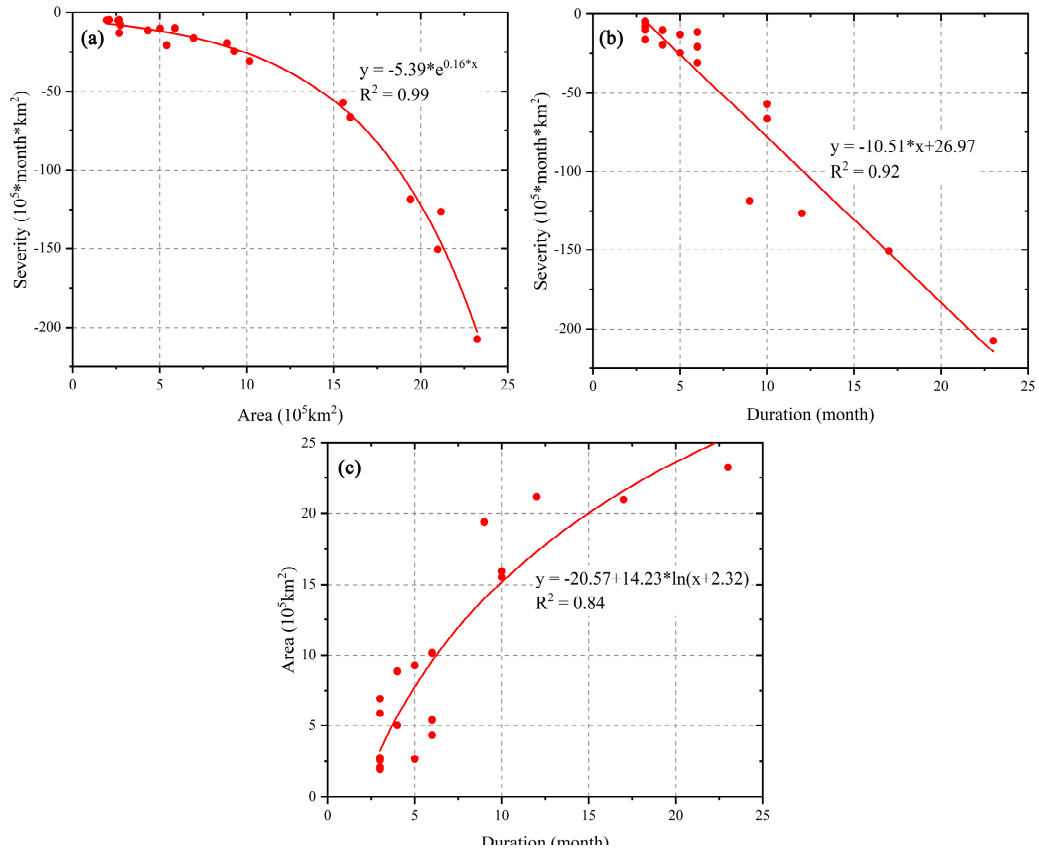


**Table S1.** Parameter settings in RF model.

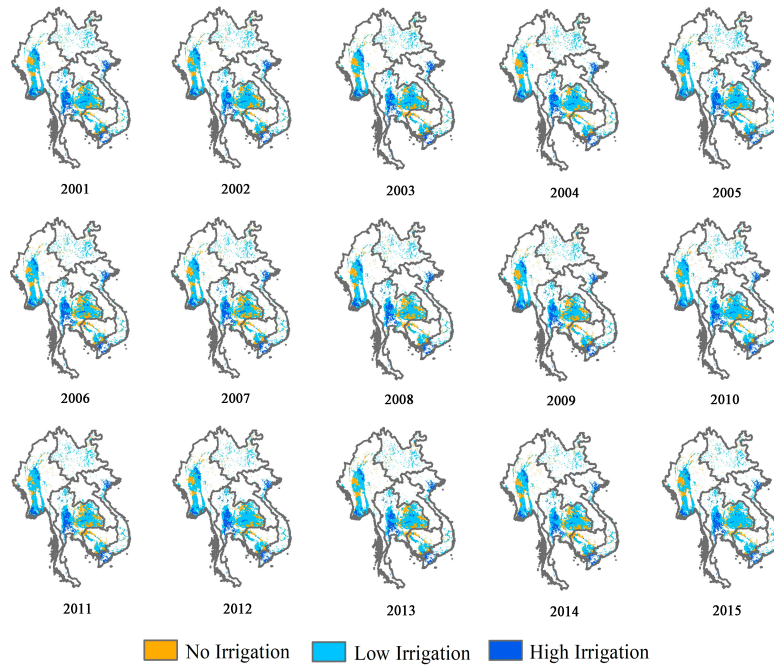
Parameters	Value
Number of trees	500
Minimum samples for a split	2
Minimum sample leaf	1
Maximum features	8
Number of jobs to run in parallel	-1
Quality of a split	Mean squared error



**Figure S1.** The importance scores for environmental variables.



**Figure S2.** Relationships between drought characteristics: (a) severity and area; (b) severity and duration; and (c) area and duration.



**Figure S3.** Irrigation levels over cropland in the GMS from 2001 to 2015.

**Text S1.** The calculation method of SPEI index.

The SPEI index is estimated by precipitation and potential evapotranspiration ( $PET$ ). In this research, the Penman-Monteith formula is used to calculate  $PET$ , which can be expressed as:

$$PET = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T + 273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34u_2)} \quad (1)$$

where  $PET$  represents potential evapotranspiration,  $\Delta$  represents slope of saturation vapor pressure curve,  $\gamma$  represents the humidity constant,  $R_n$  represents surface net radiation,  $G$  represents soil heat flux density,  $T$  represents daily average temperature,  $u_2$  represents the wind speed at a height of 2 meters, and  $e_s$  and  $e_a$  represent saturated vapor pressure and actual vapor pressure, respectively.

The difference ( $D$ ) is computed by the equation (2) [1]:

$$D_i = P_i - PET_i \quad (2)$$

where  $P_i$  and  $PET_i$  represent local precipitation and potential evapotranspiration in  $i$ th month, respectively.

The water balance is normalized based on a log-logistic probability distribution to obtain the SPEI time series. The probability density function of a variable with a log-logistic distribution is expressed as:

$$f(x) = \frac{\beta}{\alpha} \left( \frac{x-\gamma}{\alpha} \right)^{\beta-1} \left[ 1 + \left( \frac{x-\gamma}{\alpha} \right)^{\beta} \right]^{-2} \quad (3)$$

where  $\alpha$ ,  $\beta$ , and  $\gamma$  are the scale, shape, and origin parameters, respectively, for  $D$  values in the range ( $\gamma < D < \infty$ ).

Thus, the probability distribution function of series  $D$  is given by the following equation.

$$F(x) = \left[ 1 + \left( \frac{\alpha}{x-\gamma} \right)^{\beta} \right]^{-1} \quad (4)$$

The SPEI can be obtained as the standardized values of  $F(x)$  with the following approximation:

$$SPEI = W - \frac{C_0 + C_1 W + C_2 W^2}{1 - d_1 W + d_2 W^2 + d_3 W^3} \quad (5)$$

where  $W = \sqrt{-2 \ln p}$  when  $p \leq 0.5$  and  $W = \sqrt{-2 \ln(1 - p)}$  when  $p > 0.5$ . The constants are  $C_0 = 2.515517$ ,  $C_1 = 0.802853$ ,  $C_2 = 0.010328$ ,  $d_1 = 1.432788$ ,  $d_2 = 0.189269$ , and  $d_3 = 0.001308$ .

When the SPEI is greater than -0.5, it is defined as normal condition, and when the SPEI is greater than -1.0 and less than or equal to -0.5, it is defined as general drought. When the SPEI is less than -1.5, it is defined as moderate drought, and when SPEI is greater than -2.0, it is defined as extremely drought [1].

## References

1. Vicente-Serrano, S.M.; Begueria, S.; Lopez-Moreno, J.I. A Multiscalar Drought Index Sensitive to Global Warming: The Standardized Precipitation Evapotranspiration Index. *J. Clim.* **2010**, *23*, 1696-1718, doi:10.1175/2009jcli2909.1.