

## Supplementary Information

### Iran's Land Suitability for Agriculture

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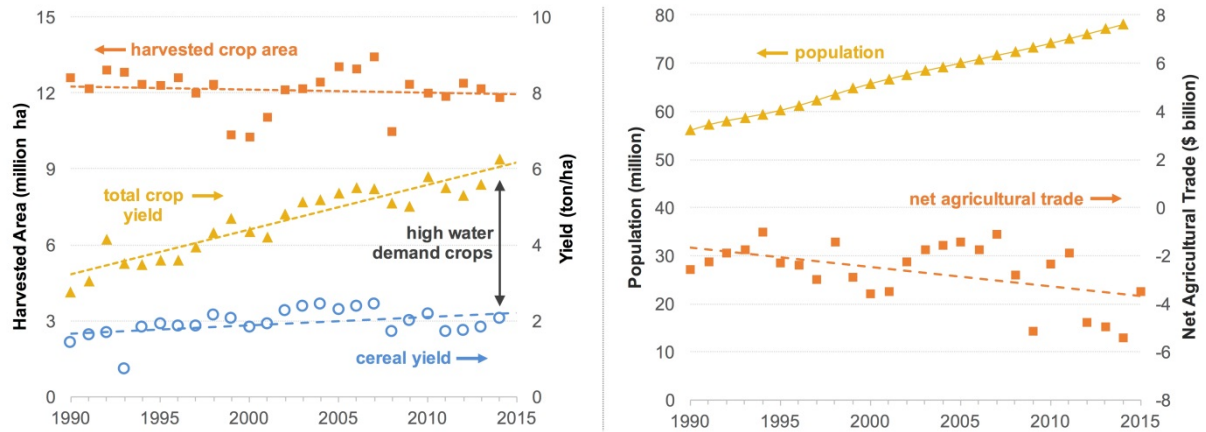
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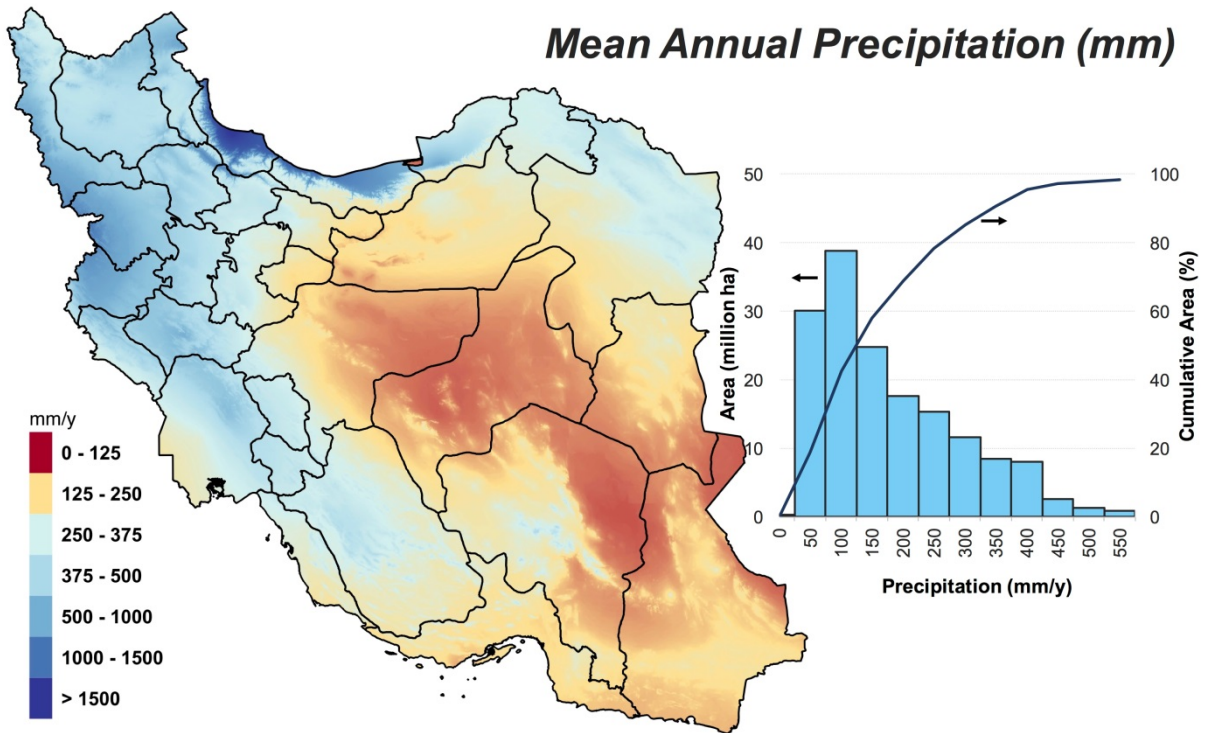
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## Supplementary Information

### Introduction

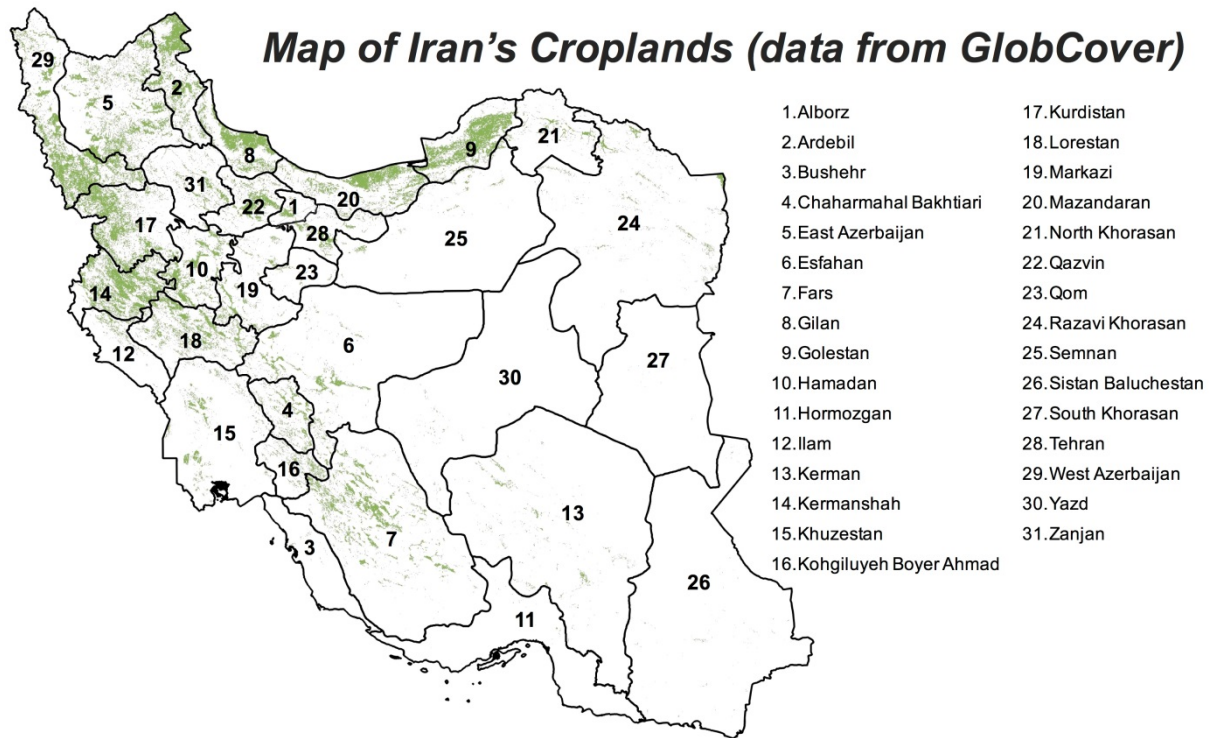


**Supplementary Figure S1.** Time variation of Iran's harvested area and yield for field crops (left, data from ref.1-3), and the population and net value of international trade of the agricultural products (right, data from ref. 4).



**Supplementary Figure S2.** Distribution of mean annual precipitation in Iran (long-term average of 1960-1990). Geospatial data obtained from ref. 5. Map was generated using QGIS 2.18.

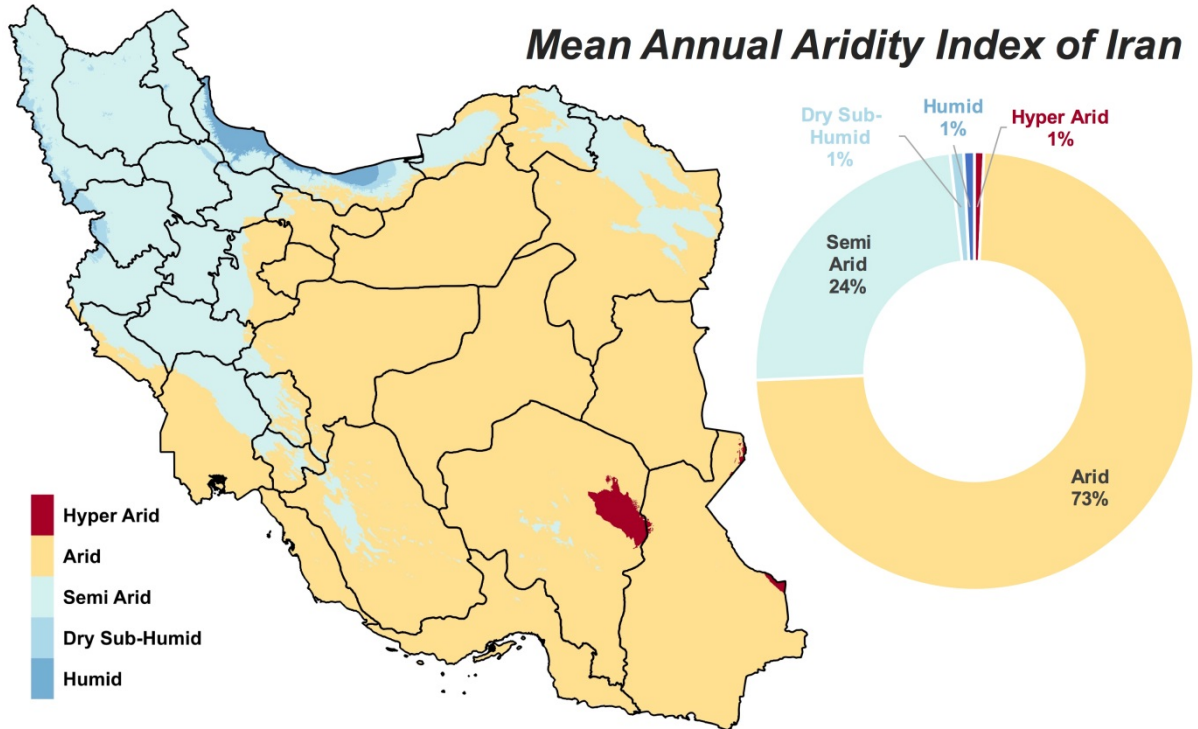
## Supplementary Information



**Supplementary Figure S3.** Map of Iran's croplands based on data from GlobCover 2009<sup>6</sup>. Also shown is the name of provinces. Map was generated using QGIS 2.18.

## Supplementary Information

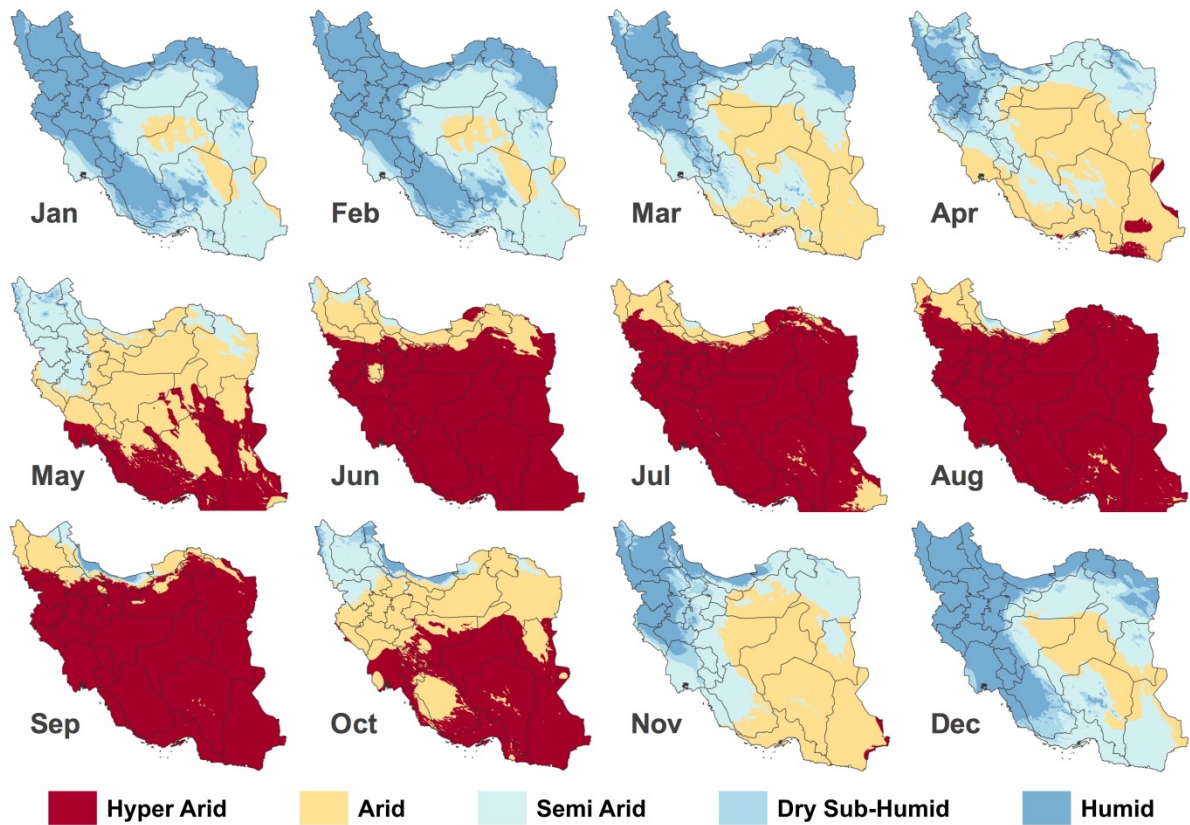
### Results



**Supplementary Figure S4.** The long-term (1960-1990) mean annual aridity index of Iran based on data from ref. 7 and classified according to ref. 8. Map was generated using QGIS 2.18.

## Supplementary Information

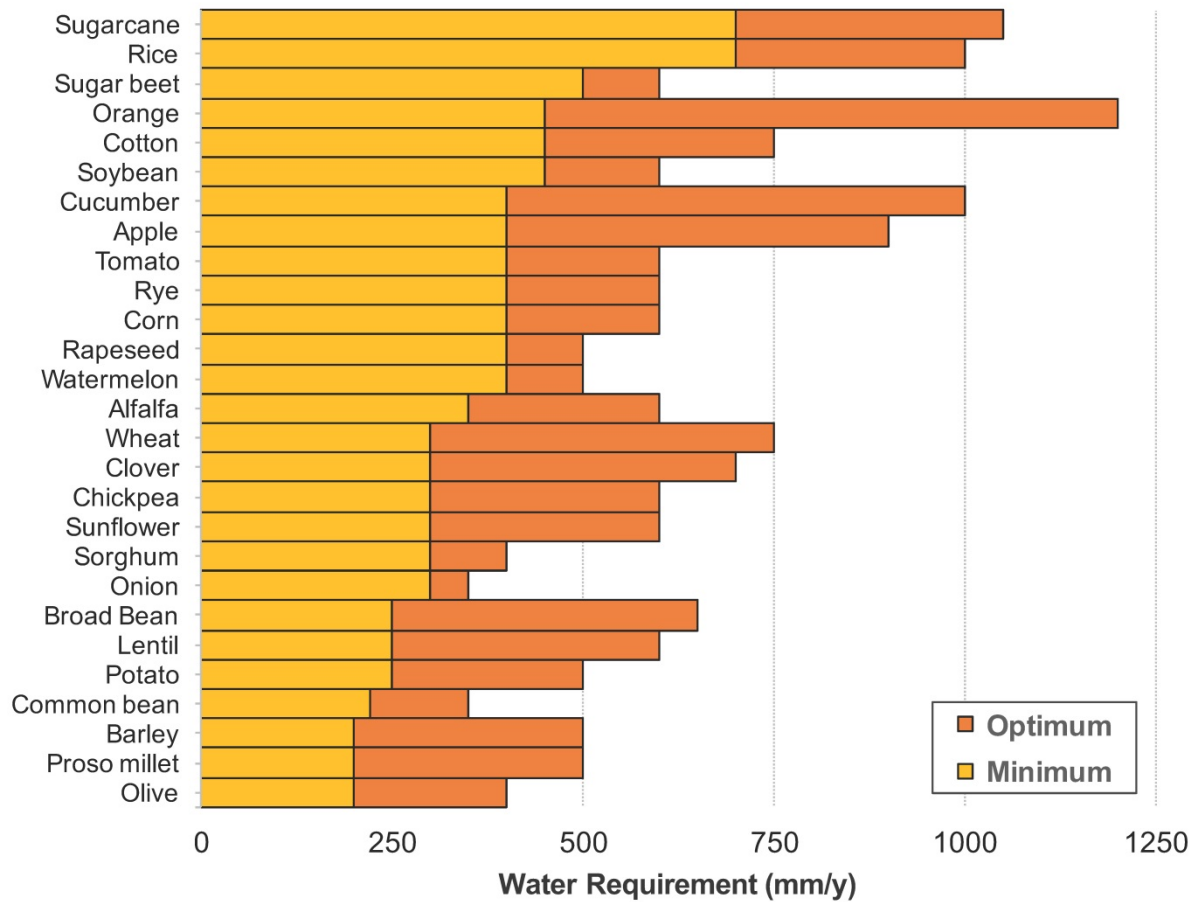
### Maps of Monthly Aridity in Iran



**Supplementary Figure S5.** Temporal and geographical distributions of aridity classes in Iran. Aridity index was calculated based on long-term (1960-1990) monthly precipitation and PET data (see Table 4 for source of data). Maps were generated using QGIS 2.18.

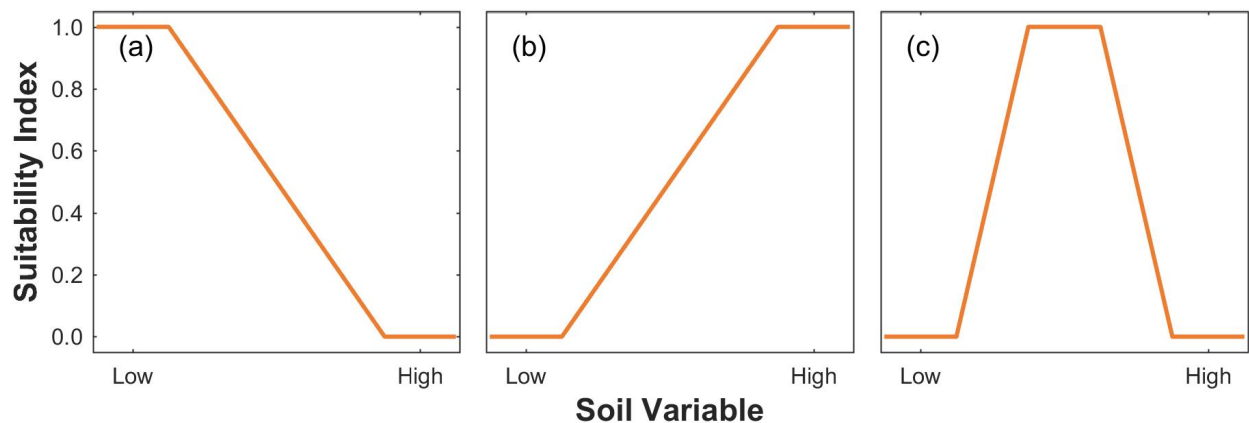
## Supplementary Information

### Crop Minimum and Optimum Water Requirement



**Supplementary Figure S6.** Minimum and optimum water requirements of selected crops and orchards based on data from refs. 9 and 10.

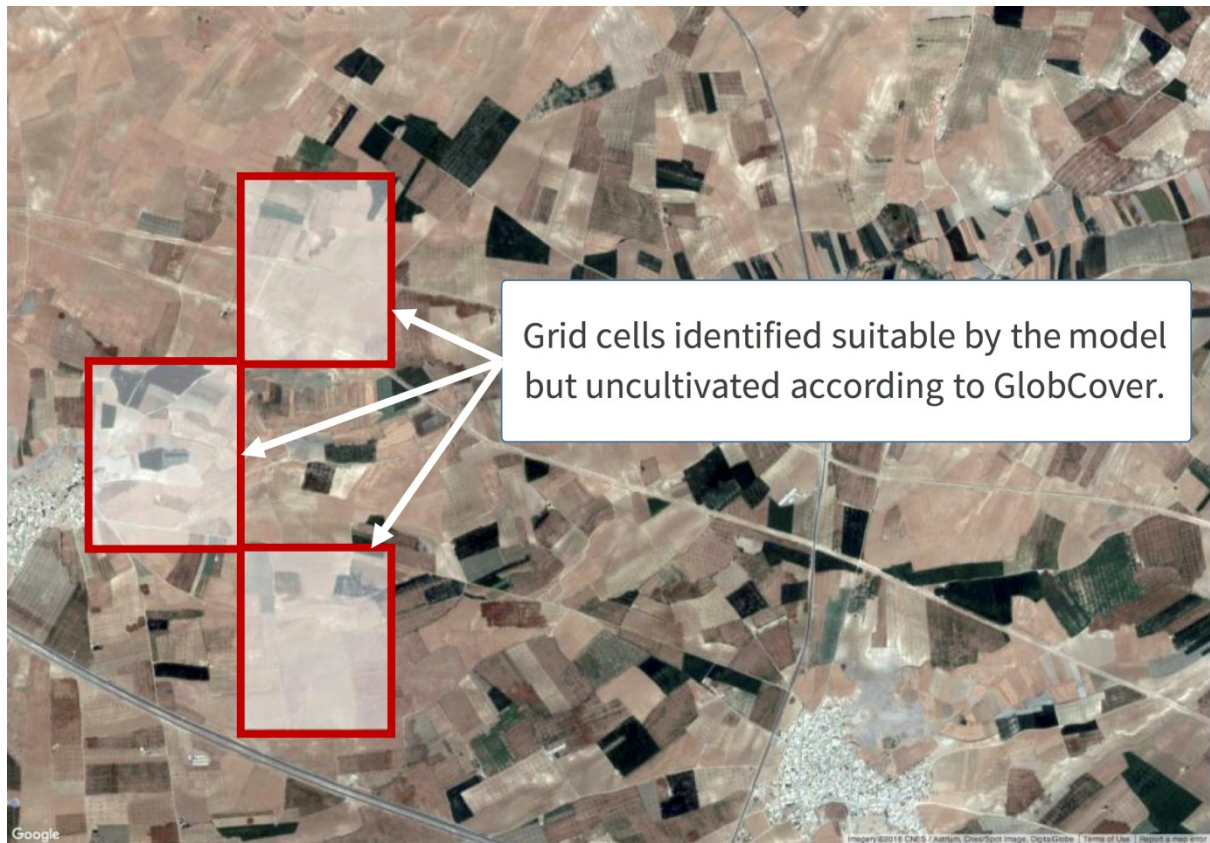
### Methods



**Supplementary Figure S7.** Three response shapes used for relating soil and topographic properties to suitability index: (a) Z shape (equation. 1 in Methods), (b) mirrored-Z shape (equation. 2 in Methods) and (c) dent shape (equation. 3 in Methods).



## Supplementary Information



**Supplementary Figure S8.** Example of missing agricultural areas in GlobCover land-use databases<sup>6</sup>. Our suitability analysis characterized the selected grid cells as highly suitable for cropping and Google Earth images shows that these areas are under cultivation. However, in the GloBCover<sup>6</sup> land-use data these grid cells were identified as non-cropping areas. We identified many more cases of such mismatches between the GlobCover<sup>6</sup> and satellite images.

## Supplementary Information

**Supplementary Table S1.** Excluded lands from the suitability analysis.

Land cover	Area (million ha)	% of country area
Inland water	1.1	0.7
Protected areas	11.4	7.1
Urbanized areas	0.5	0.3
Natural Forest and Rangelands	7.6	4.7
<b>Total</b>	<b>19.3*</b>	<b>11.9</b>

\* Note that because of the geographical overlap between some land cover types, the total excluded area is slightly smaller than the mathematical summation of the individual excluded areas.

**Supplementary Table S2.** Shape of response functions and threshold values used for transforming variables to suitability index (*SI*).

Variable	Response shape	$V_{min}$	$V_{oL}$	$V_{oU}$	$V_{max}$
pH (H <sub>2</sub> O)	Dent shape (equation. 3)	4.5	6.5	7.1	8.5
Cation Exchange Capacity, CEC (cmol <sub>c</sub> /kg)	Mirrored-Z shape (equation. 2)	4	16	-	-
Organic carbon, OC (%)	Mirrored-Z shape (equation. 2)	0.2	1.8	-	-
Coarse fragments (%)	Z shape (equation. 1)	-	-	10	55
Calcium carbonate, CaCO <sub>3</sub> (%)	Z shape (equation. 1)	-	-	5	50
Gypsum (%)	Z shape (equation. 1)	-	-	2	25
Base saturation, BS (%)	Mirrored-Z shape (equation. 2)	20	50	-	-
Electrical conductivity, EC (dS/m)	Z shape (equation. 1)	-	-	2	20
Exchangeable Sodium Percentage, ESP (%)	Z shape (equation. 1)	-	-	4	45
Available Water Content, AWC (mm/m)	Mirrored-Z shape (equation. 2)	35	100	-	-
Slope (%)	Z shape (equation. 1)	-	-	5	30
Precipitation (mm)	Mirrored-Z shape (equation. 2)	100	500	-	-

The threshold parameters were derived from ref. 9-13.



## Supplementary Information

**Supplementary Table S3.** Suitability index of soil textures for cropping as related to nutrient availability, rooting conditions, and workability according to FAO's recommendation<sup>13</sup>.

Texture	Nutrient availability	Rooting conditions	Workability
Clay (heavy)	1.00	0.91	0.82
Silty clay	1.00	1.00	1.00
Silty clay loam	1.00	1.00	1.00
Clay loam	1.00	1.00	1.00
Silt	1.00	1.00	1.00
Silt loam	1.00	1.00	1.00
Sandy clay	1.00	1.00	1.00
Loam	1.00	1.00	1.00
Sandy clay loam	1.00	0.99	1.00
Sandy loam	0.90	0.99	1.00
Loamy sand	0.69	0.99	1.00
Sand	0.35	0.98	1.00

### References

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## Supplementary Information

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