

- Undefined
- No constraints
- 1 - 20: Very few constraints
- 20 - 40: Few constraints
- 40 - 60: Partly with constraints
- 60 - 80: Frequent severe constraints
- 80 - 99: Very frequent severe constraints
- 100: Unsuitable for agriculture
- Severe climate constraints
- Water

## Soil, Terrain and Climate Constraints to Agriculture

Source: IIASA and FAO (2002). *Global Agro-ecological Assessment for Agriculture in the 21<sup>st</sup> Century*.

Soil Constraints derived from the FAO Soil Map of the World

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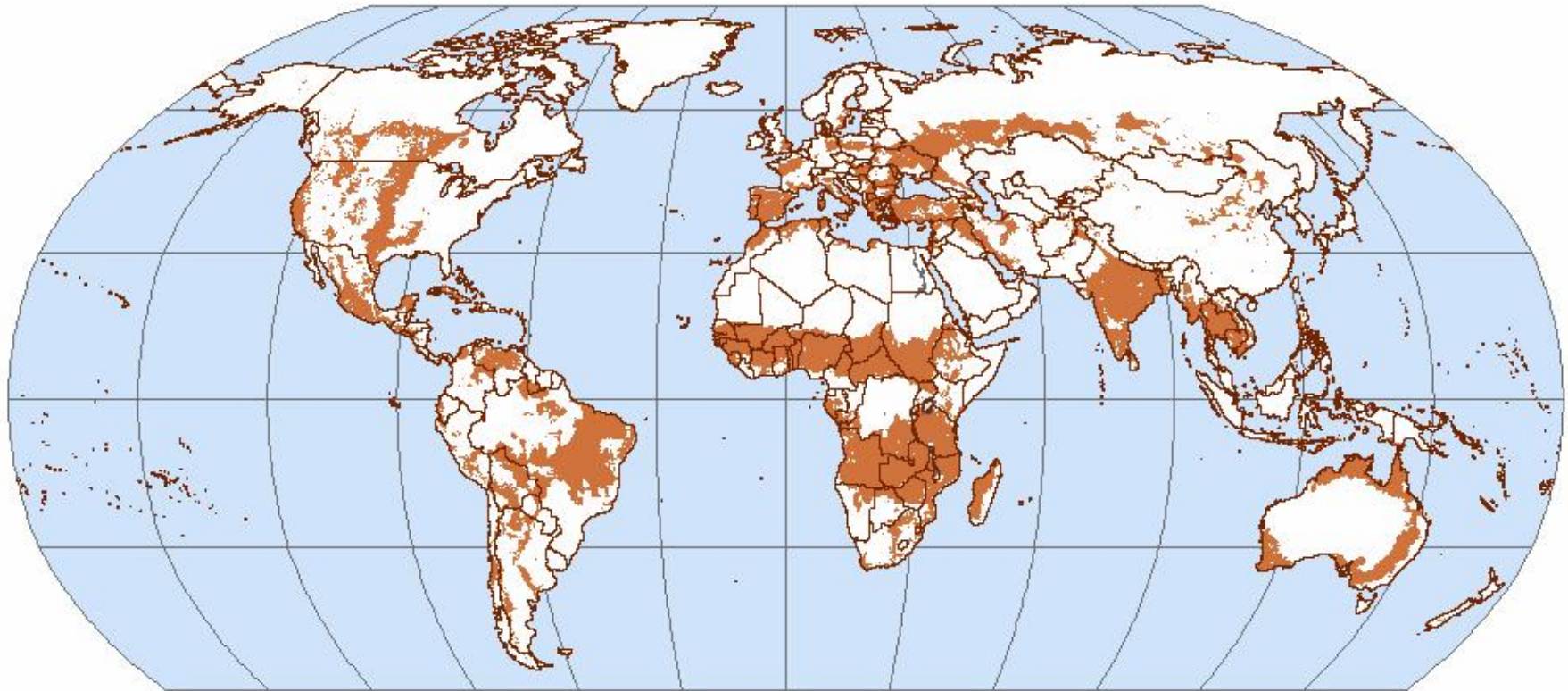
Slope Constraints derived from USGS's GTOPO30

+

Climate Constraints derived from CRU's World Climate Data Set

# Soil Functional Capacity Classification System Map of the World

- Maps the global extent of 17 of the soil fertility constraints and 8 soil texture types defined in the Soil Fertility Capability Classification System, version 4 (Sanchez et al 2003)
- Inputs:
  - FAO Soil Map of the World, re-released in 1995 in digital form at a scale of 1:5M (based on data collected from 1960 onwards)
  - USDA Soil Moisture and Temperature Regimes
  - IRSIC/IFPRI WISE 2 dataset



*Robinson Projection*

## Functional Capacity Soil Classification System, Version 4: Seasonal Moisture Stress

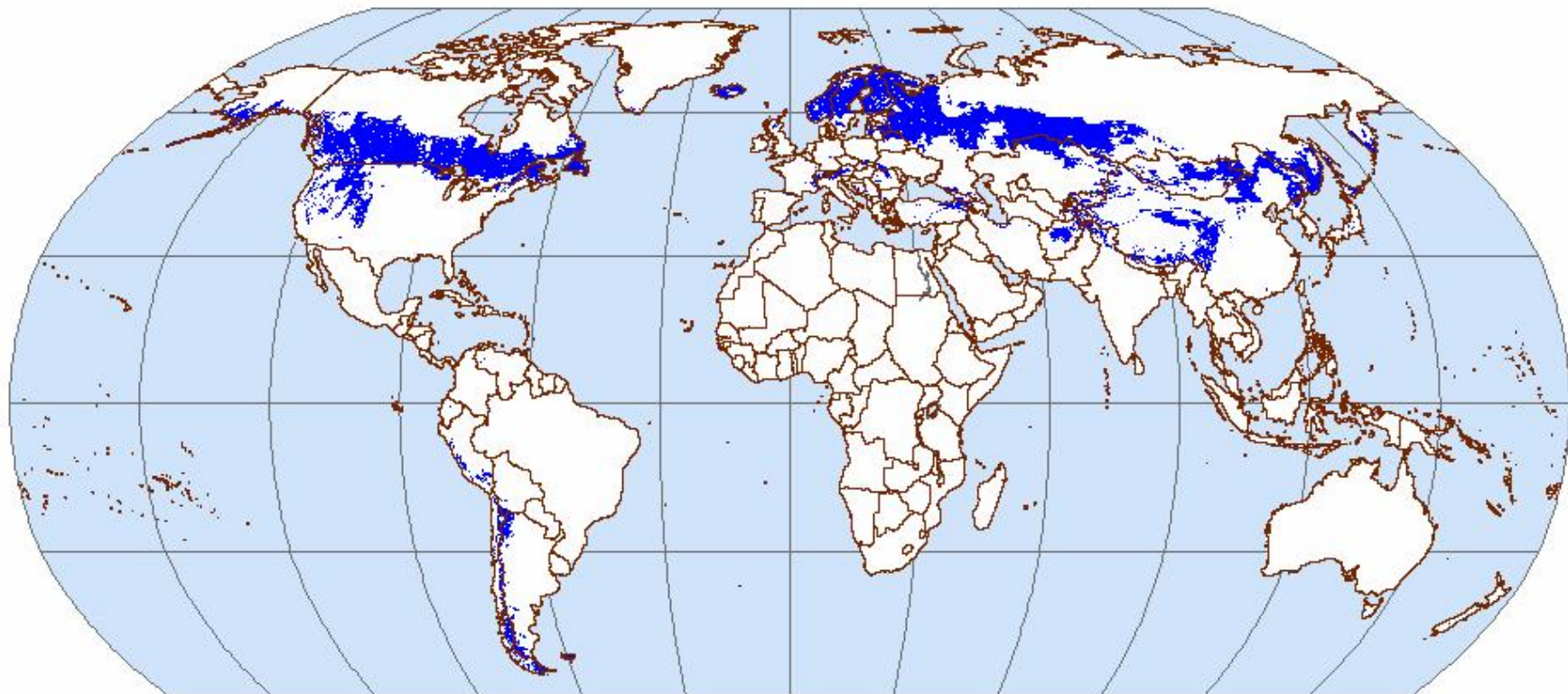
Soils with a strong dry season are defined as having ustic or xeric soil moisture regimes: dry greater than 60 consecutive days/year but moist greater than 180 cumulative days/year within 20-60 cm depth. The brown-colored regions shown in this map are classified as xeric or ustic in the USDA's Soil Moisture Regime (SMR) dataset. In these regions there is at least enough water to grow one single rainfed annual crop.

**Percent Area**

**'d' modifier**



Scale: 1:5 000 000



*Robinson Projection*

## Functional Capacity Soil Classification System, Version 4: Low Soil Temperature

Low temperature soils are defined as cryic, having a mean annual soil temperature lower than 8°C and an organic layer, but no permafrost or waterlogging. Management practices can help warm topsoils for short term cereal production. The blue-colored regions in this map depict soils which have been assigned the 't' modifier to indicate low soil temperature, and are classified as cryic in the USDA's Soil Temperature Regime (STR) dataset.

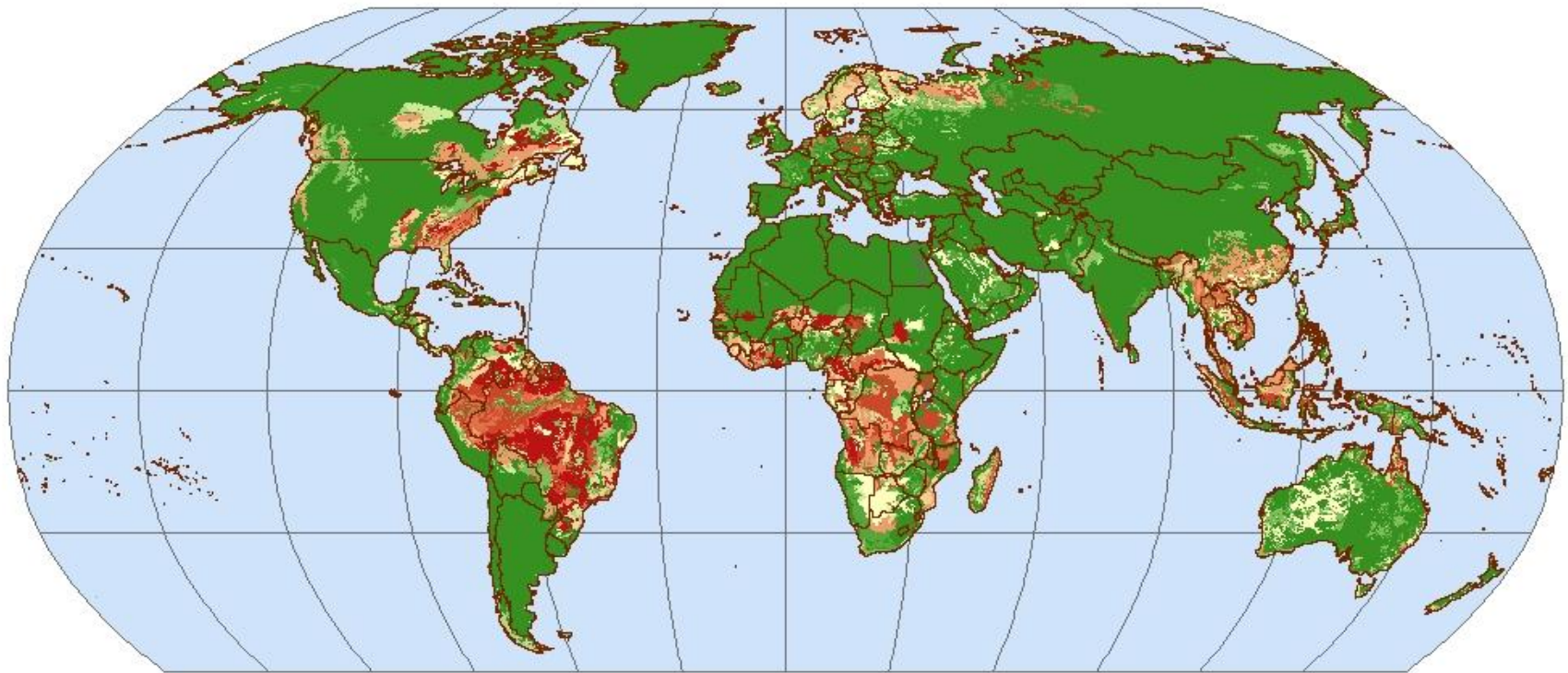
**Percent Area**

**'t' modifier**

0

100

Scale: 1:5 000 000



Robinson Projection

## Soil Functional Capacity Classification System, Version 4: 'K' Modifier

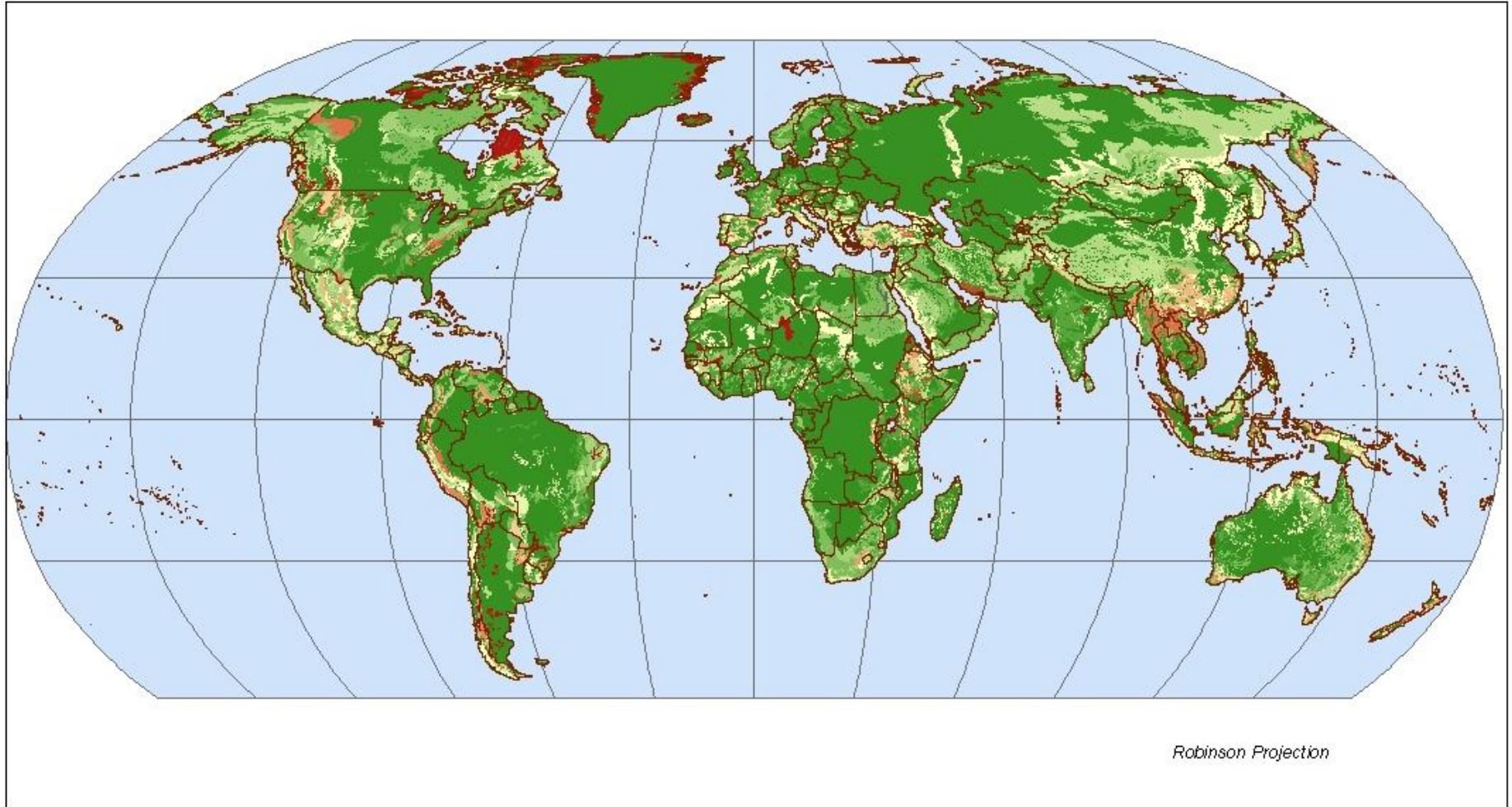
Soils with low nutrient capital reserves (K deficiencies) are defined as having <10% weatherable minerals in their fine silt and sand fractions. This map shows the percentage of FAO map units containing the following soil units, which have been assigned the 'k' modifier to indicate low nutrient capital reserves: A, Ao, Af, Ah, Ap, Ag, F, Fo, Fx, Fr, Fh, Fa, Fp, Q, Qa, Qc, Qf, Ql, P, Po, Pl, Pf, Ph, Pp, Pg.

**Percent Area**

**'k' modifier**



Scale: 1:5 000 000



## Soil Functional Capacity Classification System, Version 4: High Erosion Risk

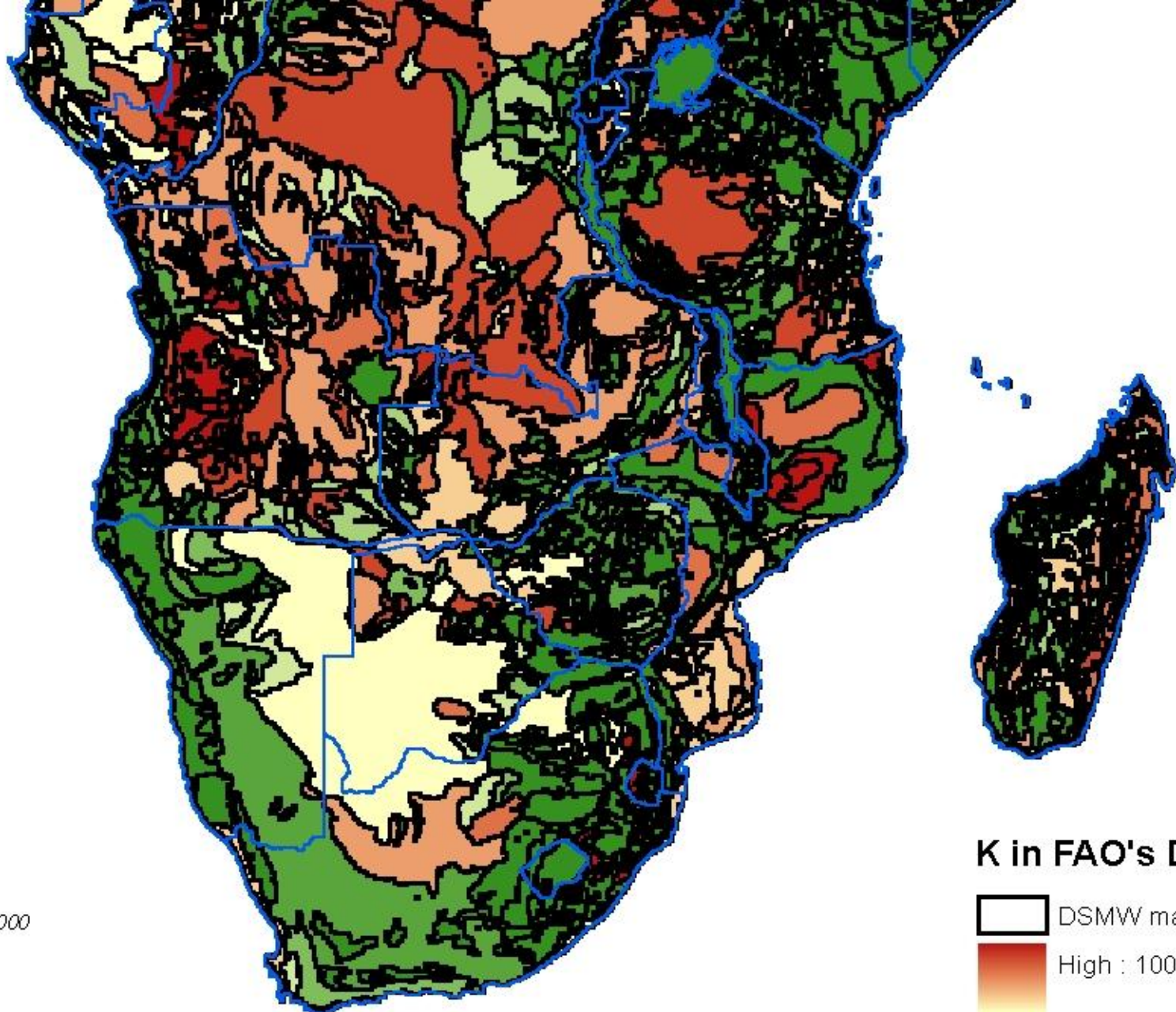
Highly erodible soils are defined as having sharp textural contrasts, shallow depth or steep slope which can negatively affect plant production and watershed stability, as well as cause sedimentation and subsequent eutrophication of rivers and lakes. The key to soil erosion control is to keep land covered with a plant canopy throughout the year. This map shows the percentage of FAO mapping units containing soils classified as Planosols, Lithosols or Rendzinas or which have slope >30%.

### Percent Area

y: w,e,i, sl>30%

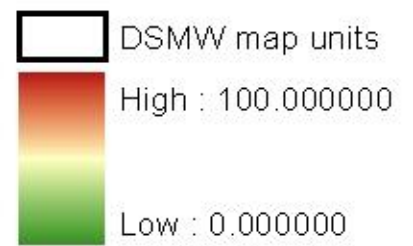


Scale: 1:5 000 000

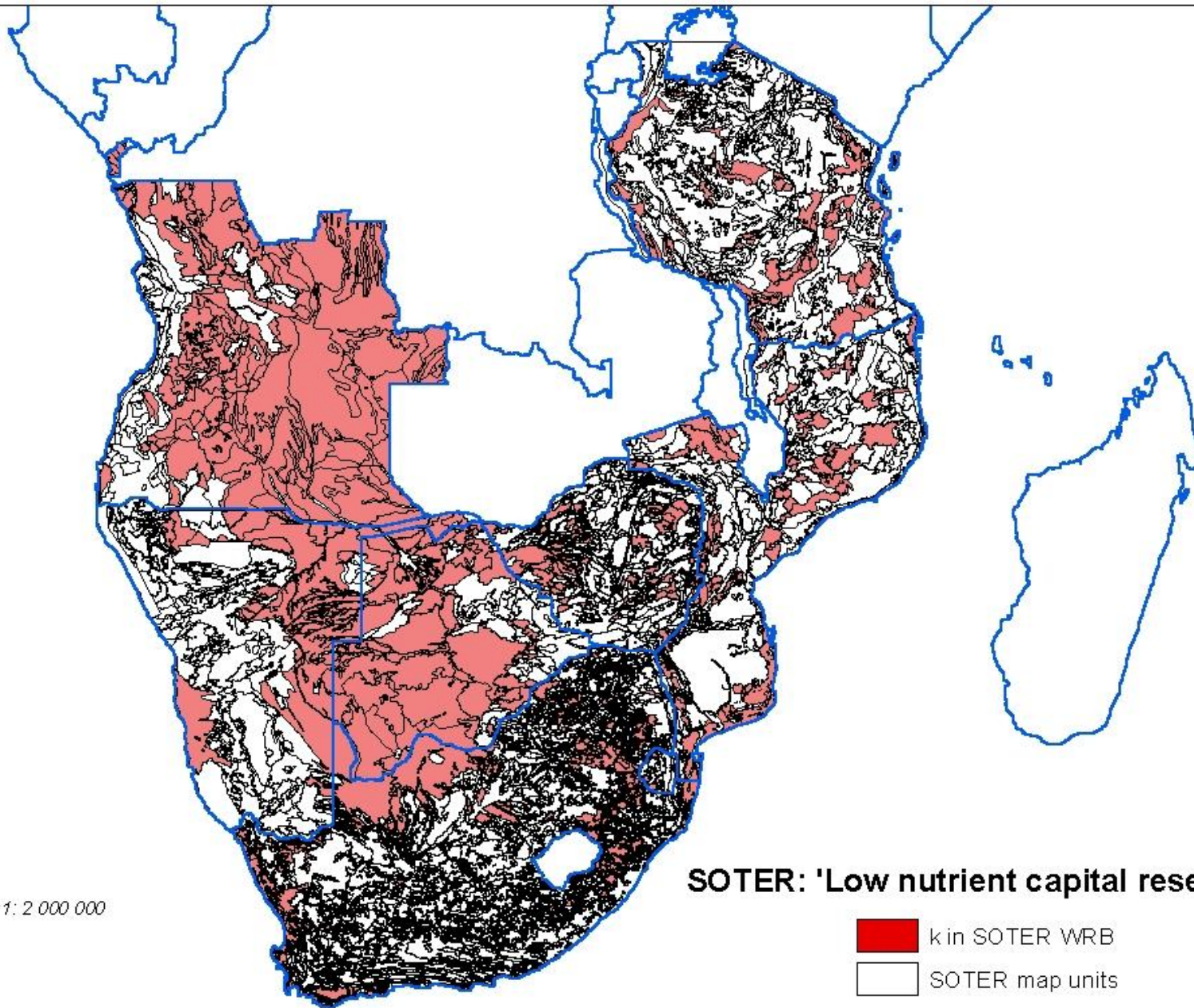


Scale: 1: 5 000 000

**K in FAO's DSMW**



This map shows soils in southern Africa which have low nutrient capital reserves, one key constraint to soil fertility, mapped here using the Digital Soil Map of the World (FAO, 1995). The DSMW is being slowly replaced as a global dataset by the Soil and Terrain Digital Database (SOTER) at a scale of 1:1 M, but to date large sections have yet to be completed.



Scale: 1: 2 000 000

### SOTER: 'Low nutrient capital reserves'

- k in SOTER WRB
- SOTER map units

This map shows soils in southern Africa which have low nutrient capital reserves (the 'k' modifier in the Soil Fertility Capability Classification System), mapped here using the Soil and Terrain Digital Database (SOTER) released by FAO and ISRIC in 2003.



# Ongoing Issues

- Data quality: Digital Soil Map being phased out by SOTER (Soil and Terrain Digital database, 1:1 million; interim versions complete for Latin America, Southern Africa, Eastern Europe)
- Improved resolution: ‘the ideal constraint maps should be at scales of 1:100,000, and eventually 1:25,000’ (resolution of US county soil survey maps; current maps are at 1:5 million)
- Static vs. dynamic constraints
  - FCC identifies inherent soil properties
  - ‘FCC is static and we need a dynamic system’
  - Many human-induced changes are ‘as yet unmappable’

# Mapping Human-Induced Soil Degradation

ISRIC/UNEP datasets

- Global Assessment of Human-induced Soil Degradation (GLASSOD, 1987-1990) 1:10M
  - broad categories: “no, light, medium, severe” soil degradation
    - does not indicate what interventions are appropriate
- Follow-up assessments:
  - Regional- more detailed, includes wind, water erosion; chemical and physical deterioration
    - South and Southeast Asia (ASSOD) 1:5 M(1995-1997)
    - Central and Eastern Europe (SOVEUR) 1:2.5 M (1997-2000)
  - Land Degradation Assessment in Drylands (LADA)
    - Ongoing global project, under UNEP/FAO

