

# ORCHIDEE soil maps

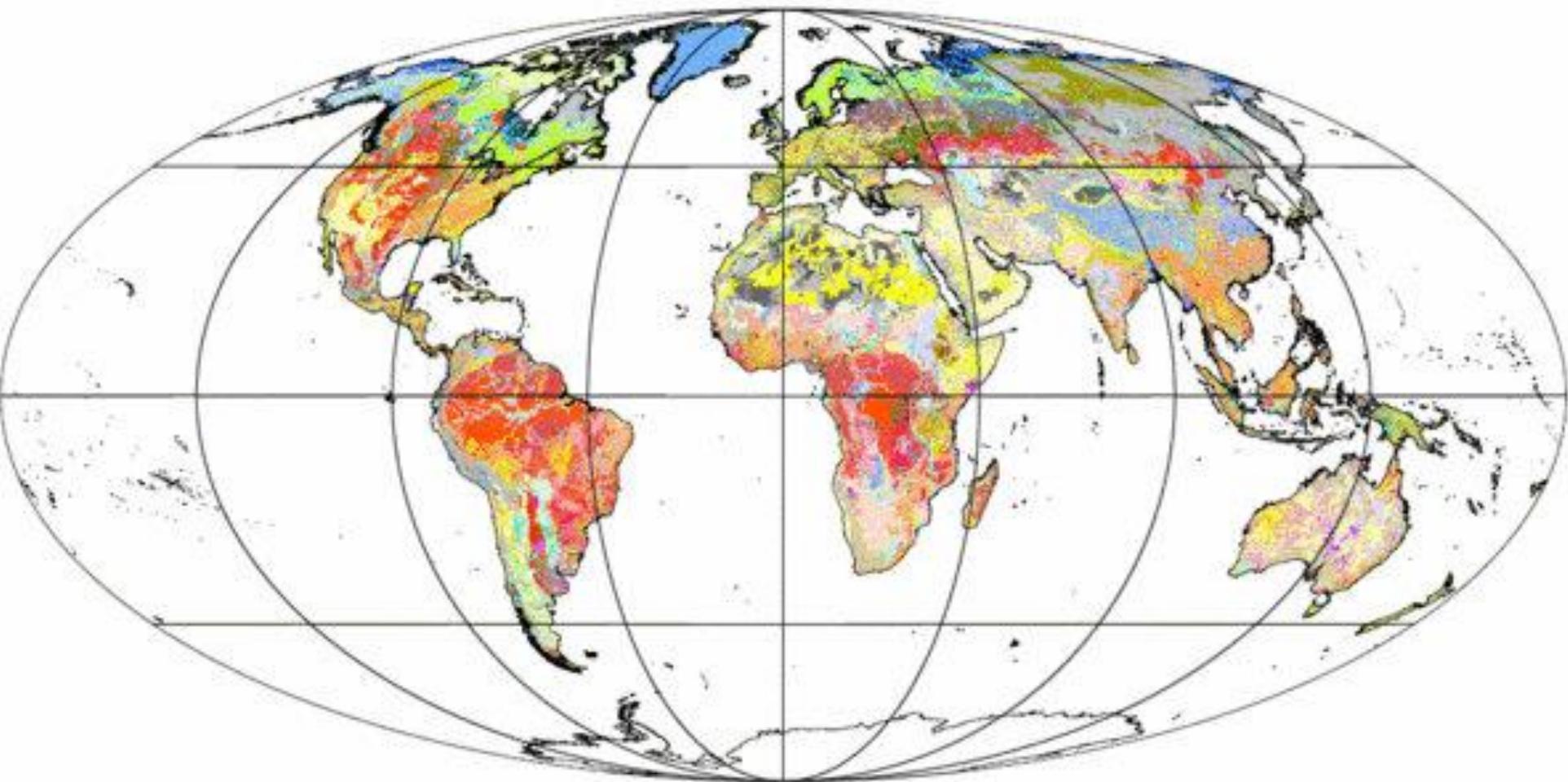
C. Otlé

# Outline

1. Status on the existing global soil maps
2. Their interpretation in terms of soil texture
3. Exemple of Zobler 's work
4. ORCHIDEE soil texture maps
5. Comparison of ORCHIDEE-Zobler's and ORCHIDEE-USDA's soil texture maps
6. Zooms in Sahara and South-America regions

# FAO/UNESCO soil map of the world (1961....1971-1981)

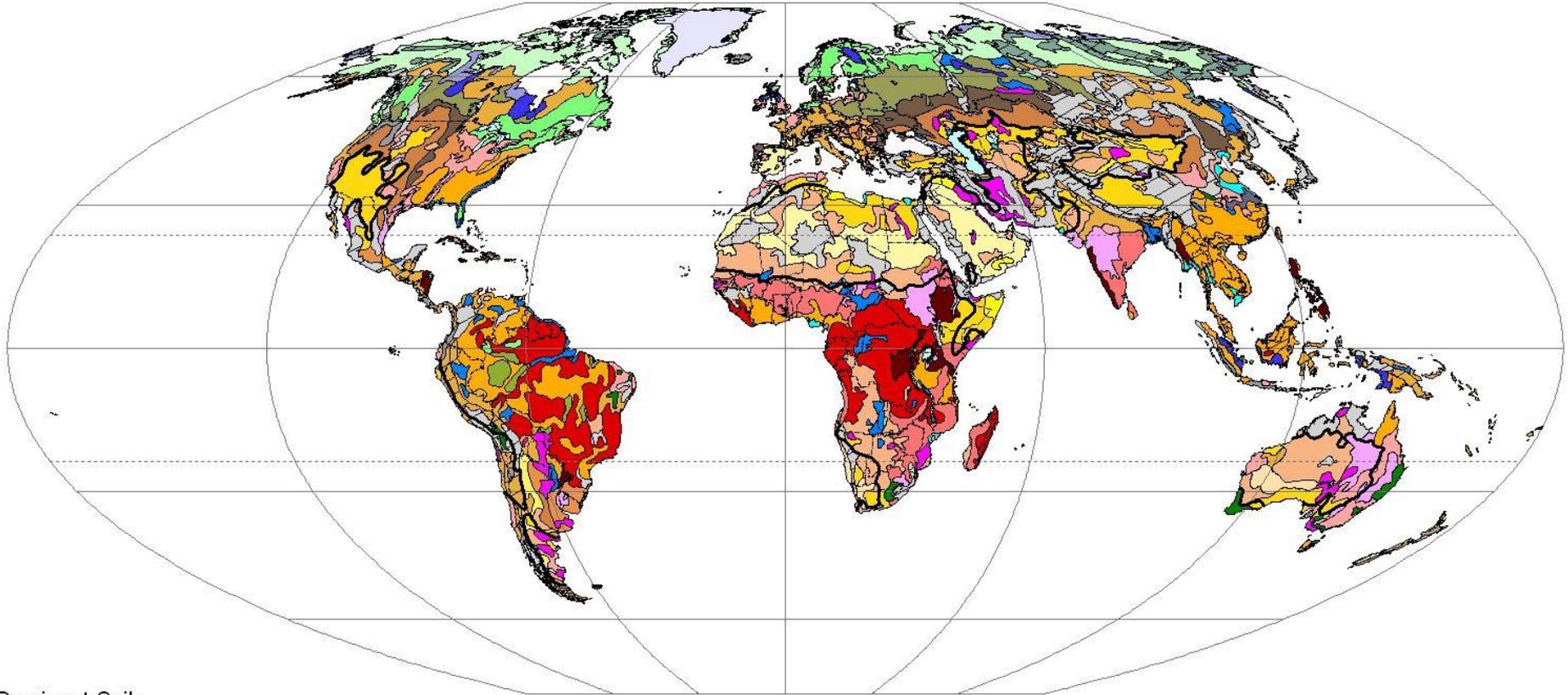
Digital Soil Map of the World



1:5 000 000 scale

# The World Resource Base Map of World Soil Resources available at 1:25 000 000 scale (most recent, FAO revised, 1km?)

## WORLD SOIL RESOURCES



### Dominant Soils

- Acrisols, Alisols, Plinthosols (AC)
- Albeluvisols, Luvisols (AB)
- Andosols (AN)
- Anthrosols (AT)
- Arenosols (AR)
- Calcisols, Cambisols, Luvisols (CL)
- Calcisols, Regosols, Arenosols (CA)
- Cambisols (CM)

- Chernozems, Phaeozems (CH)
- Cryosols (CR)
- Durisols (DU)
- Ferralsols, Acrisols, Nitisols (FR)
- Fluvisols, Gleysols, Cambisols (FL)
- Gleysols, Histosols, Fluvisols (GL)
- Gypsisols, Calcisols (GY)
- Histosols, Cryosols (HR)

- Histosols, Gleysols (HS)
- Kastanozems, Solonetz (KS)
- Leptosols, Regosols (LP)
- Leptosols, Cryosols (LR)
- Lixisols (LX)
- Luvisols, Cambisols (LV)
- Nitisols (NT)
- Phaeozems (PH)

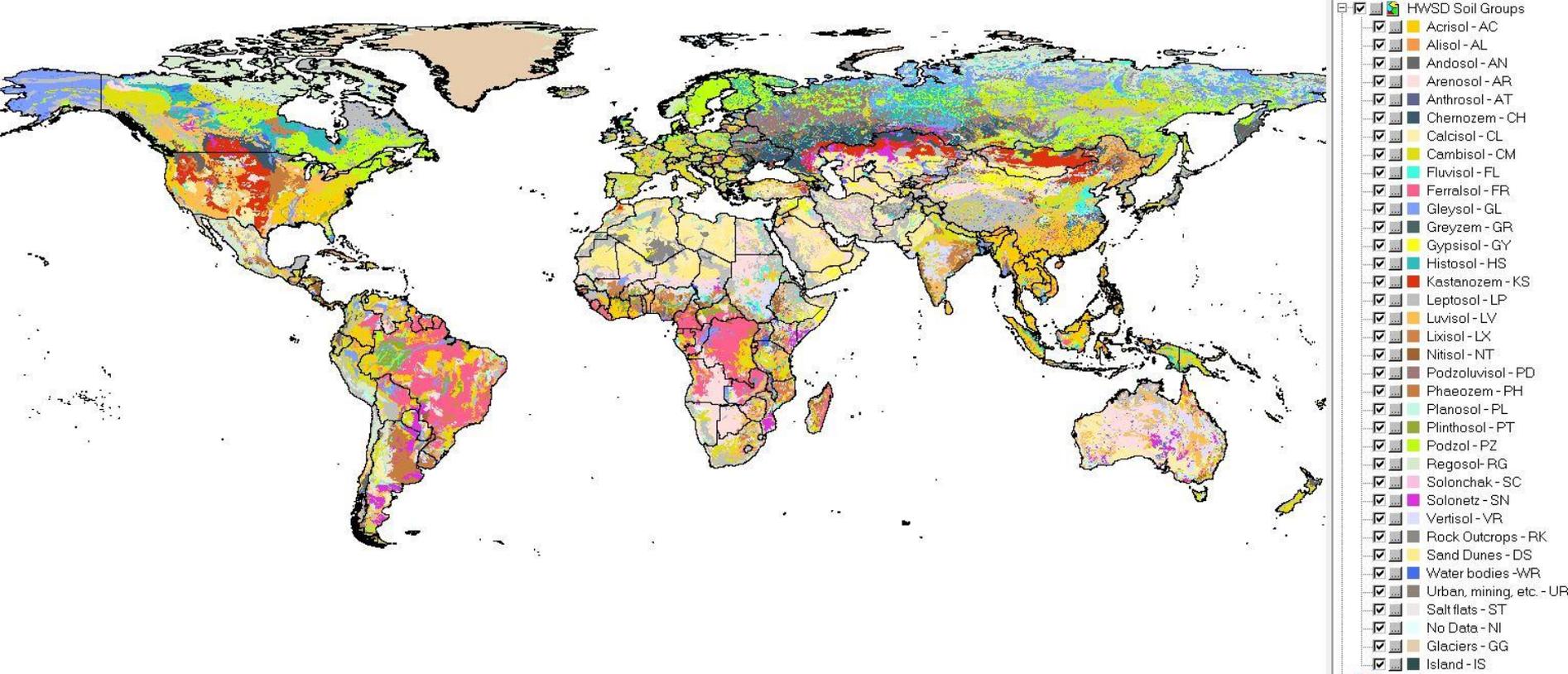
- Planosols (PL)
- Plinthosols (PT)
- Podzols, Histosols (PZ)
- Regosols (RG)
- Solonchaks, Solonetz (SC)
- Umbrisols (UM)
- Vertisols (VR)
- Glaciers (gl)

- Waterbodies
- Steep lands
- Limit of aridity
- Country boundaries

Harmonized World Soil Database v 1.2, collaboration between the FAO with IIASA, ISRIC-World Soil Information, Institute of Soil Science, Chinese Academy of Sciences (ISSCAS), and the Joint Research Centre of the European Commission (JRC), 2008

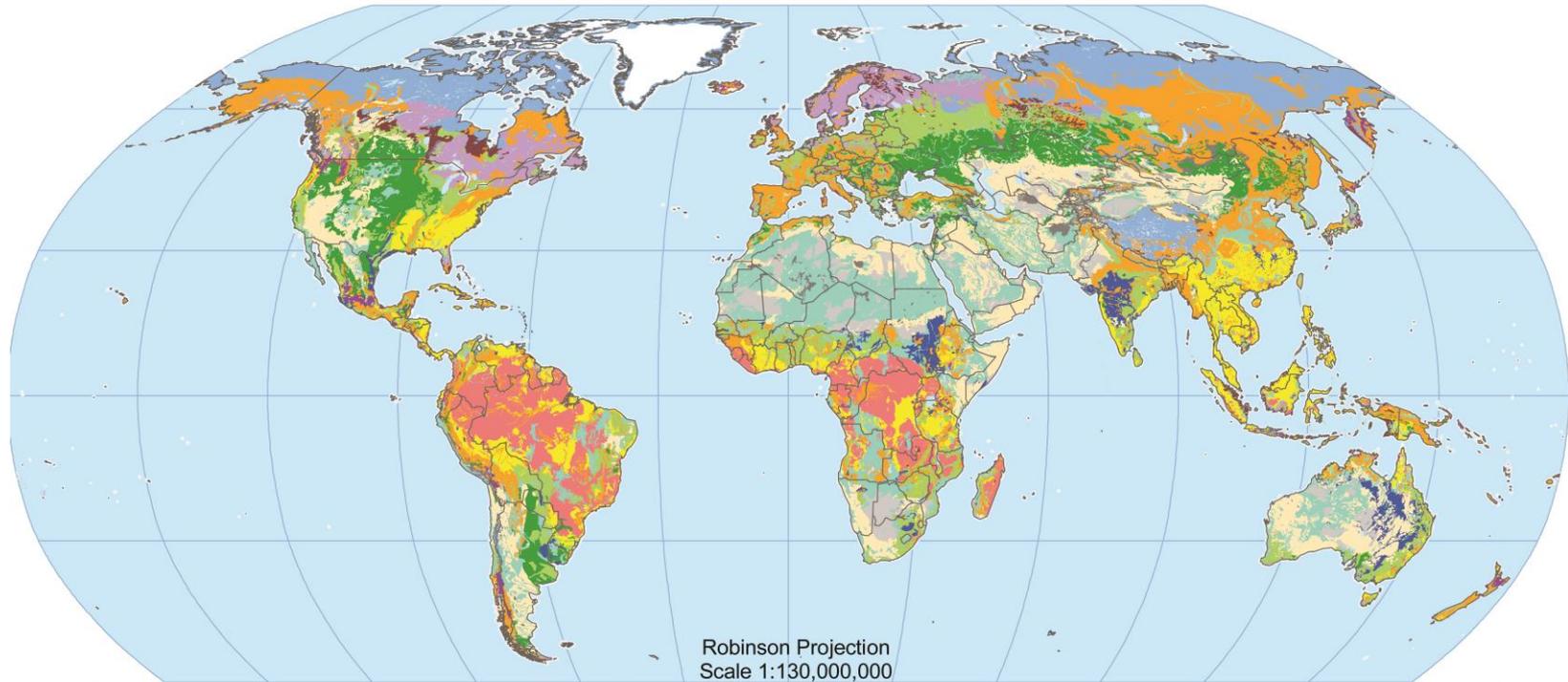
*Fischer, G., F. Nachtergaele, S. Prieler, H.T. van Velthuisen, L. Verelst, D. Wiberg, 2008. Global Agro-ecological Zones Assessment for Agriculture (GAEZ 2008). IIASA, Laxenburg, Austria and FAO, Rome, Italy.*

**30 arc-second raster database, grid cell = 5', 8km**



USDA soil map based on the [FAO-UNESCO Soil Map of the World](#) but uses the [USDA Soil Taxonomy](#).

## Global Soil Regions

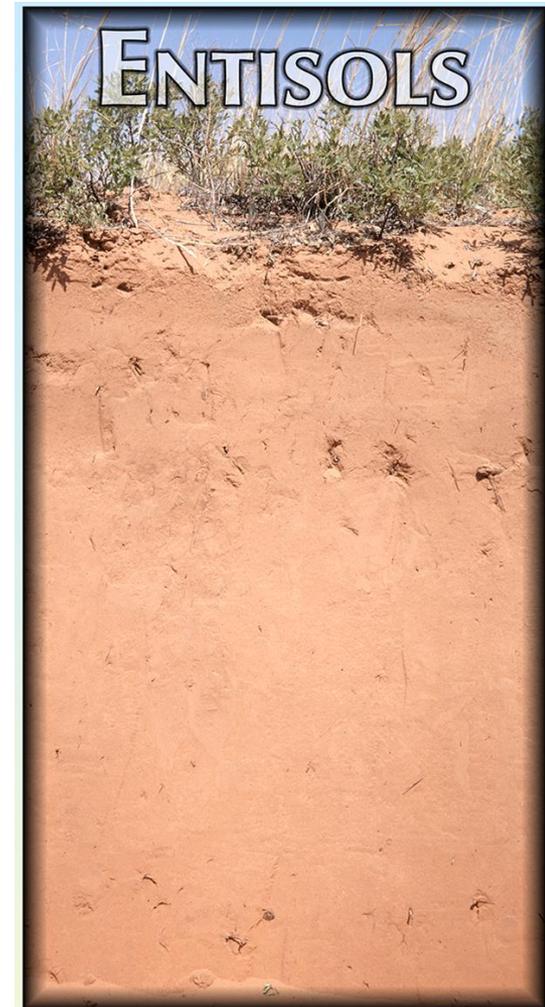


Soil Orders				
 Alfisols	 Entisols	 Inceptisols	 Spodosols	 Rocky Land
 Andisols	 Gelisols	 Mollisols	 Ultisols	 Shifting Sand
 Aridisols	 Histosols	 Oxisols	 Vertisols	 Ice/Glacier

THE 12 ORDERS OF SOIL TAXONOMY

 <p><b>ALFISOLS</b></p> <p>These soils are characterized by a...          Alfisols are soils that have...          Alfisols are found in...          Alfisols are...          Alfisols are...          Alfisols are...</p>	 <p><b>ANDISOLS</b></p> <p>These soils are characterized by...          Andisols are soils that...          Andisols are...          Andisols are...          Andisols are...</p>	 <p><b>ARIDISOLS</b></p> <p>These soils are characterized by...          Aridisols are soils that...          Aridisols are...          Aridisols are...          Aridisols are...</p>	 <p><b>ENTISOLS</b></p> <p>These soils are characterized by...          Entisols are soils that...          Entisols are...          Entisols are...          Entisols are...</p>
 <p><b>GELISOLS</b></p> <p>These soils are characterized by...          Gelisols are soils that...          Gelisols are...          Gelisols are...          Gelisols are...</p>	 <p><b>HISTOSOLS</b></p> <p>These soils are characterized by...          Histosols are soils that...          Histosols are...          Histosols are...          Histosols are...</p>	 <p><b>INCEPTISOLS</b></p> <p>These soils are characterized by...          Inceptisols are soils that...          Inceptisols are...          Inceptisols are...          Inceptisols are...</p>	 <p><b>MOLLISOLS</b></p> <p>These soils are characterized by...          Mollisols are soils that...          Mollisols are...          Mollisols are...          Mollisols are...</p>
 <p><b>OXISOLS</b></p> <p>These soils are characterized by...          Oxisols are soils that...          Oxisols are...          Oxisols are...          Oxisols are...</p>	 <p><b>SPODOSOLS</b></p> <p>These soils are characterized by...          Spodosols are soils that...          Spodosols are...          Spodosols are...          Spodosols are...</p>	 <p><b>ULTISOLS</b></p> <p>These soils are characterized by...          Ultisols are soils that...          Ultisols are...          Ultisols are...          Ultisols are...</p>	 <p><b>VERTISOLS</b></p> <p>These soils are characterized by...          Vertisols are soils that...          Vertisols are...          Vertisols are...          Vertisols are...</p>

USDA taxonomy : 12 soil type classes



**ENTISOLS**

Entisols are soils that show little or no evidence of pedogenic horizon development.

Entisols occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development; such as dunes, steep slopes, and flood plains. They occur in many environments.

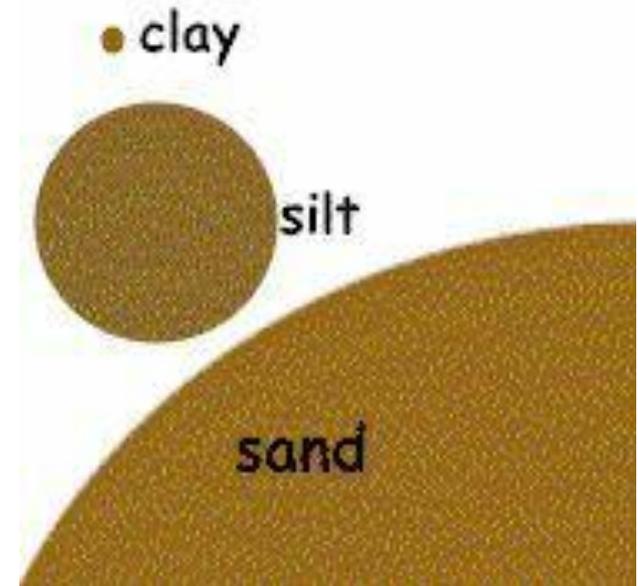
**ENTISOLS MAKE UP ABOUT 16% OF THE WORLD'S ICE-FREE LAND SURFACE.**

These soil type maps are further interpreted in terms of soil texture and pedotransfer variables... etc..

What is soil texture ?

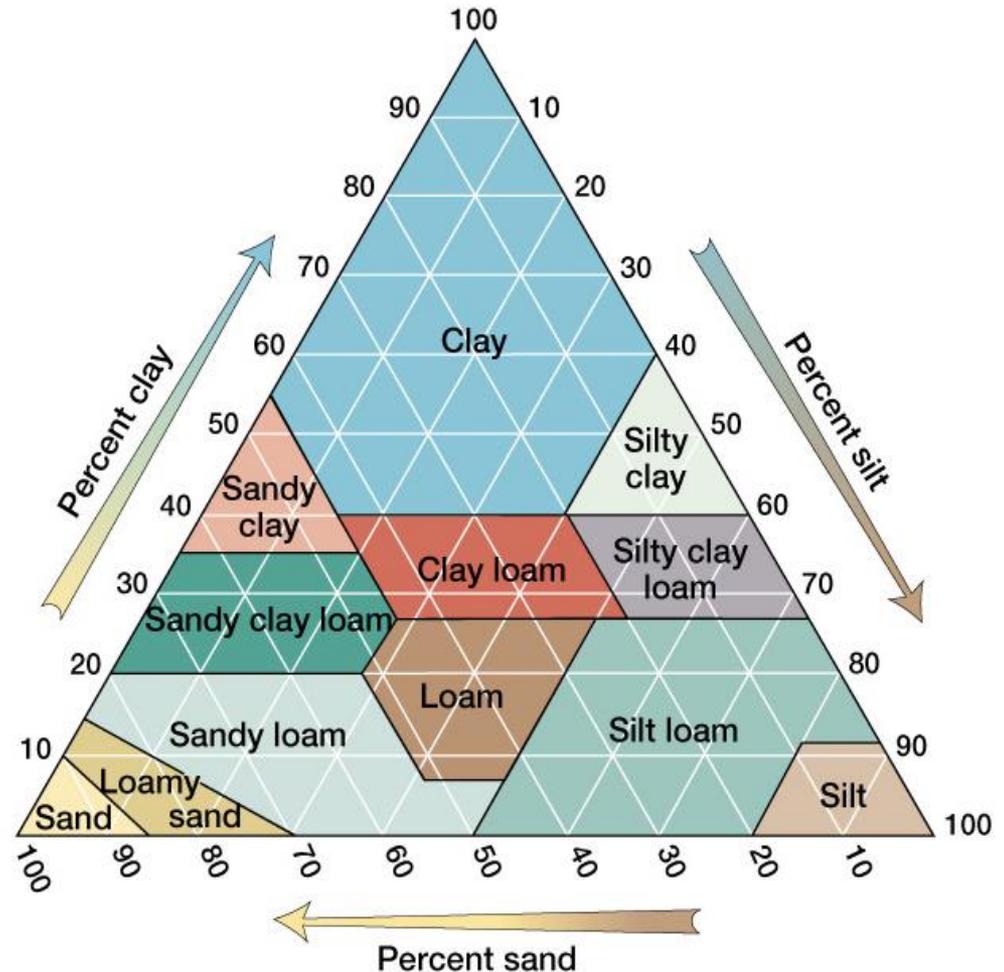
Concerns only mineral soil (not organic matter)

- *Soil texture* is defined as the relative proportion of its mineral components: sand, silt and clay.
- The ranges of diameters of the three separates are: sand (2.0- 0.05 mm), silt (0.05- .002 mm), and clay (<0.002 mm).



# Texture Triangle

- The percentage units (0-100%) of sand, silt, and clay are listed along the sides of the triangle.
- Also notice that the relative proportion of sand, silt, and clay always adds up to 100%.



The [Zobler "World Soil File for Global Climate Modelling"](#) shows the **global distribution of soil types, including data for dominant soil units (classification of soil types), slope classes, soil texture classes and soil phases.** These have been generalized from the [FAO Soil Map of the World \(FAO, 1974\)](#) and the Matthews Vegetation data (1984) into one-degree square latitude/longitude grid cells, using a dot grid overlay technique to determine the largest map unit of each one-degree cell. The data are only suitable for **very large-area studies such as climate research with GCM.**

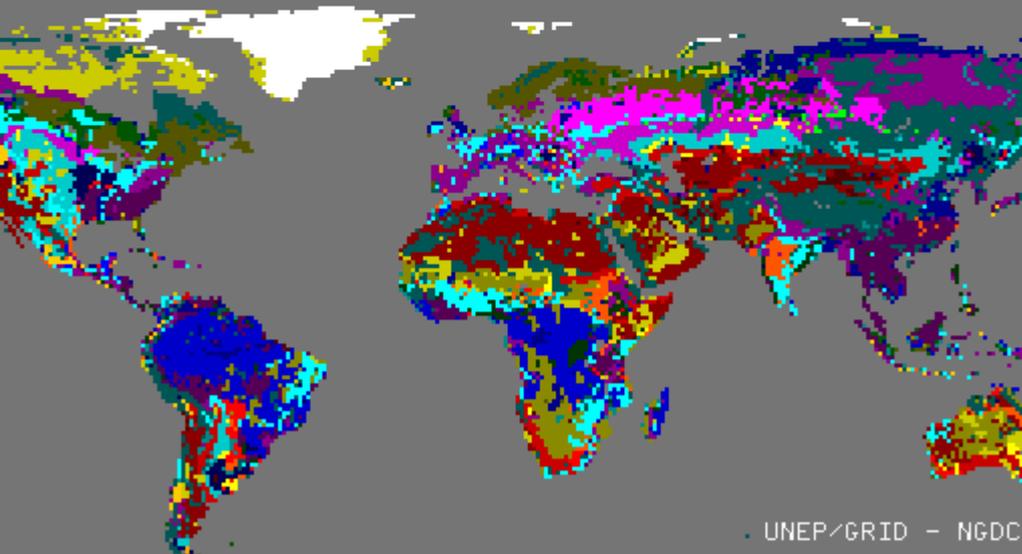
### ZOBLER WORLD SOIL UNITS (DOMINANT SOIL TYPES)

	ACRISOLS		NITOSOLS
	CAMBISOLS		HISTOSOLS
	CHERNOZEMS		PODZOLS
	PODZOLUVISOLS		ARENOSOLS
	RENDZINAS		REGOSOLS
	FERRALSOLS		SOLONETZ
	GLEYSOLS		ANDOSOLS
	PHAEZEMS		RANKERS
	LITHOSOLS		VERTISOLS
	FLUVISOLS		PLANOSOLS
	KASTENOZEMS		XEROSOLS
	LUVISOLS		YERMOSOLS
	GREYZEMS		SOLOCHAKS

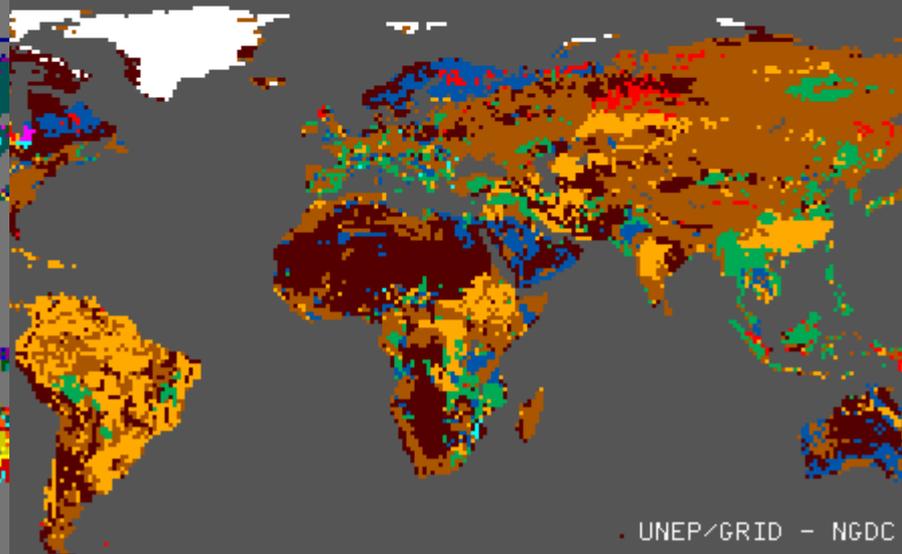
### ZOBLER WORLD SOILS - TEXTURE CLASSIFICATION

AIR-SURFACE (30 CM.) TEXTURE OF DOMINANT SOIL UNITS

(1)		COARSE
(2)		MEDIUM
(3)		FINE
(4)		(1) AND (2)
(5)		(1) AND (3)
(6)		(2) AND (3)
(7)		(1) (2) (3)
(8)		ORGANIC
		LAND - ICE



UNEP/GRID - NGDC



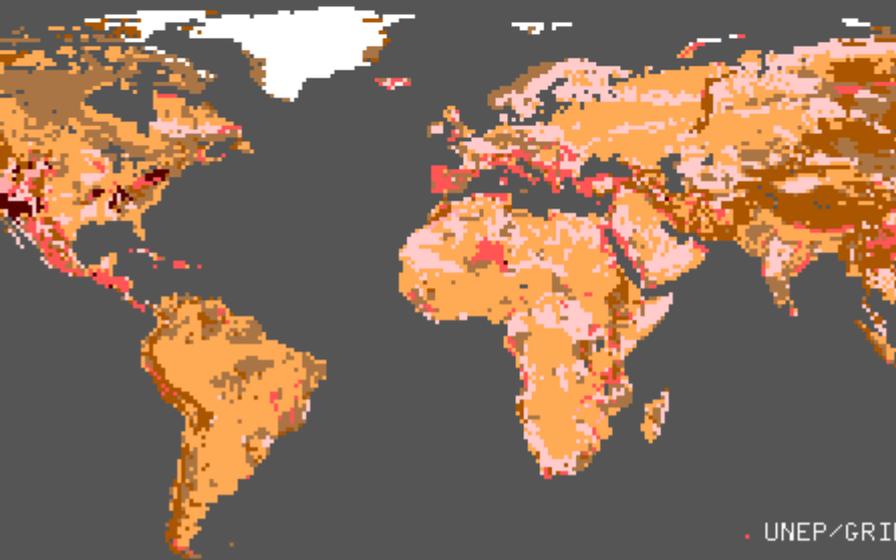
UNEP/GRID - NGDC

# Slope and phase classifications

## ZOBLER WORLD SOILS - SLOPE CLASSIFICATION

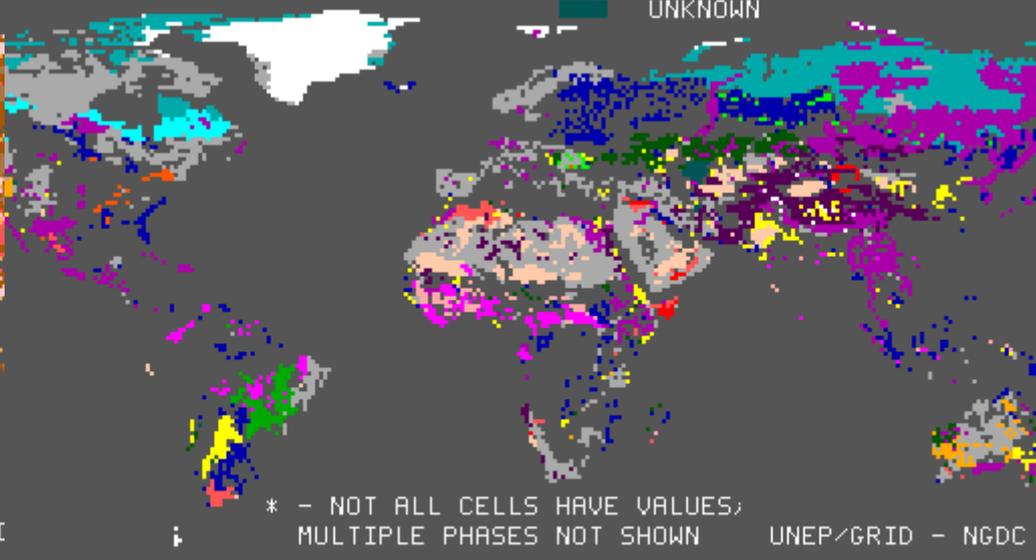
SURFACE SLOPES OF DOMINANT SOIL UNITS (ONE-DEGREE CE

- (1) 0% TO 8%
- (2) 8% TO 30%
- (3) > 30% SLOPE
- (4) (1) AND (2)
- (5) (1) AND (3)
- (6) (2) AND (3)
- (7) (1) (2) (3)
- (8) LAND - ICE



## ZOBLER WORLD SOILS - PHASE CLASSIFICATION \*

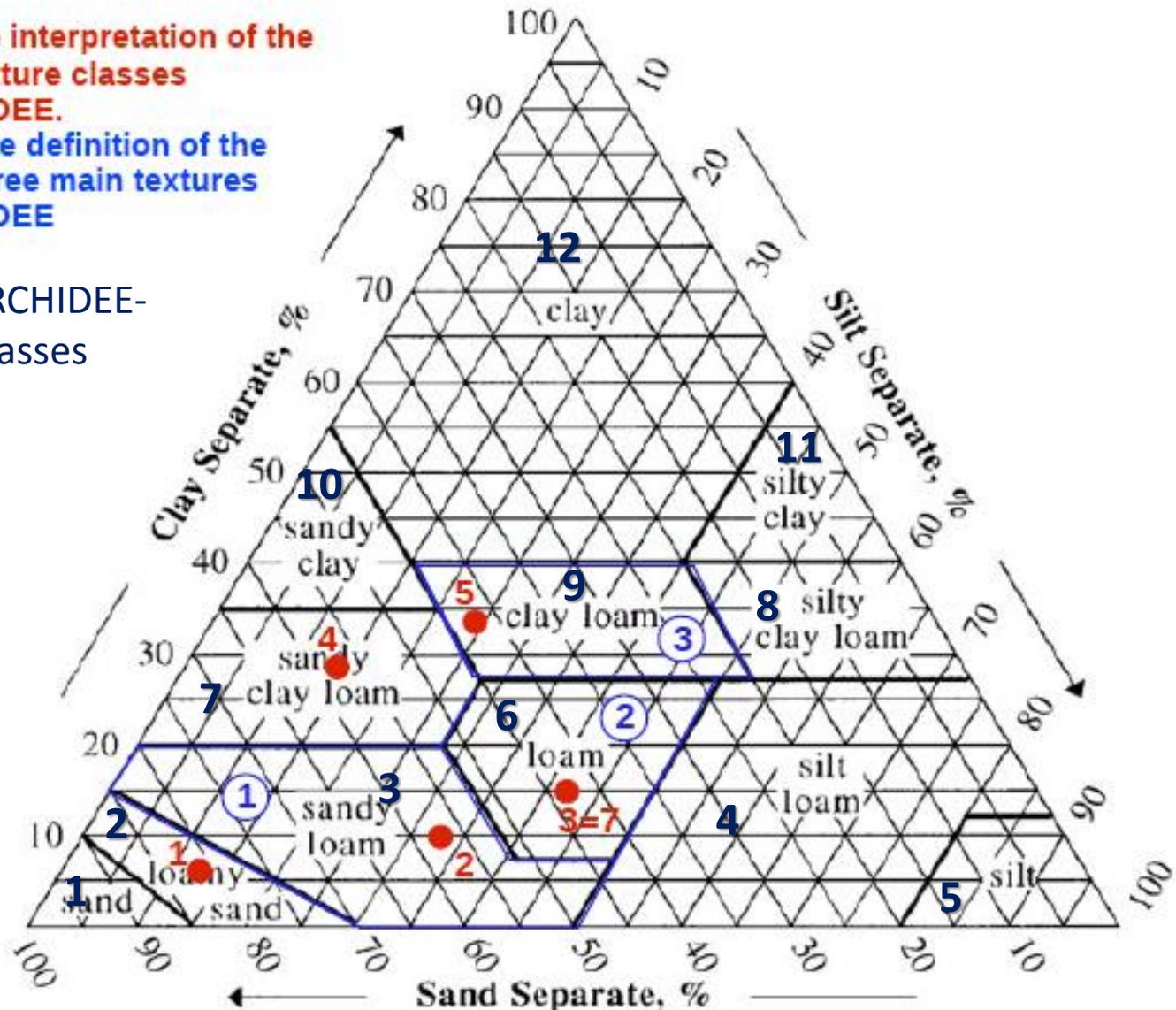
- STONY
- LITHIC
- PETRIC
- PETROFERRIC
- PETROCALCIC
- PETROGYPSIC
- FRAGIPAN
- DURIPAN
- SALINE
- PHREATIC
- CERRADO
- SODIC
- PONDED
- ROCK DEBRIS
- DUNES, SANDS
- PERMAFROST
- INTERMITTENT P-F.
- GLACIER (LAND-ICE)
- UNKNOWN



- In ORCHIDEE : 2 soil texture maps available , **both based on FAO soil regions map**
- Zobler interpreted in 7 classes and reduced to the 3 main texture classes
  - USDA interpreted in 12 classes

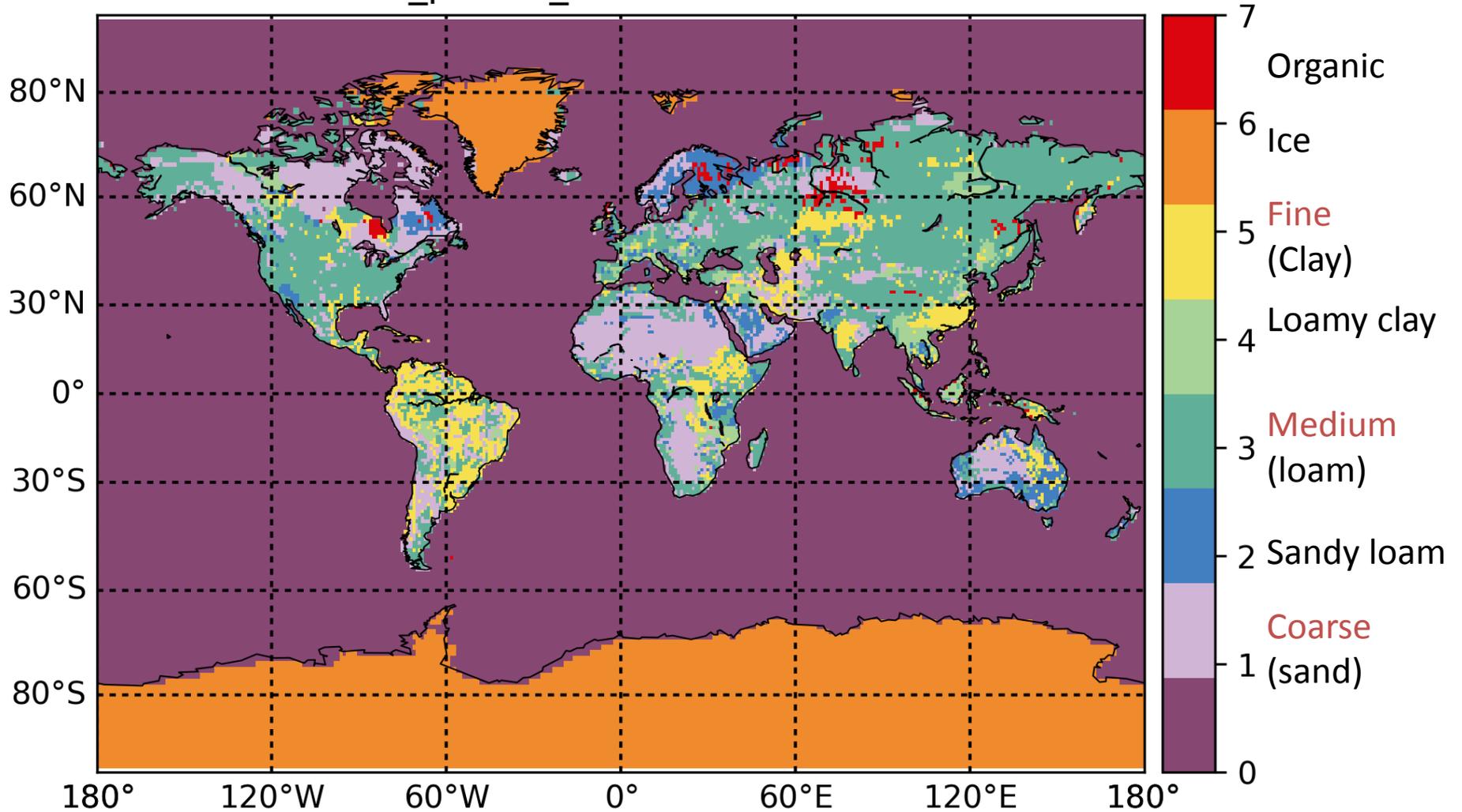
In red, the interpretation of the Zobler texture classes in ORCHIDEE.  
 In blue, the definition of the default three main textures in ORCHIDEE

In black, the « ORCHIDEE-USDA » soil classes



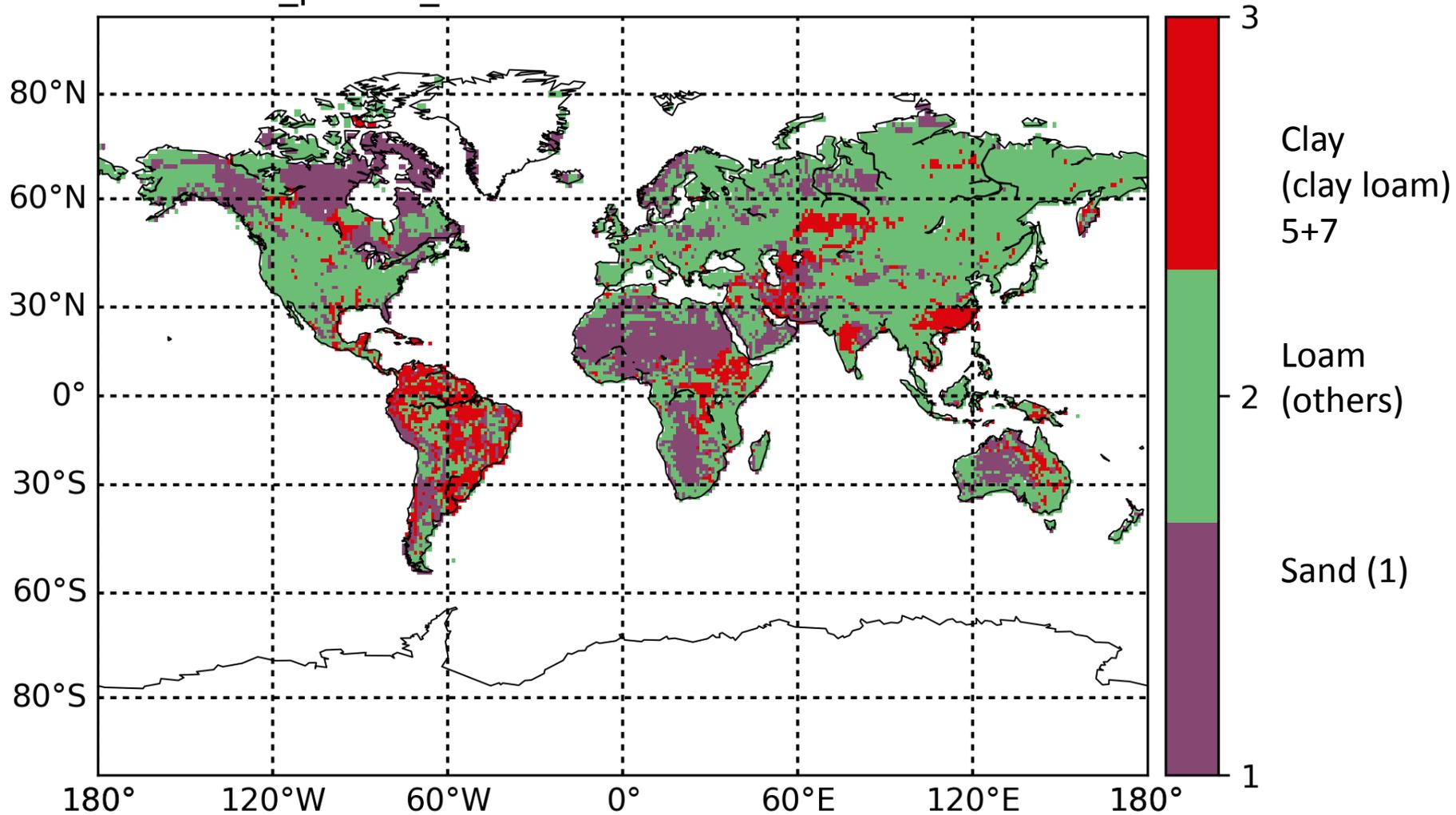
# Zobler soil textural map

soils\_param\_zobler.nc : soiltext



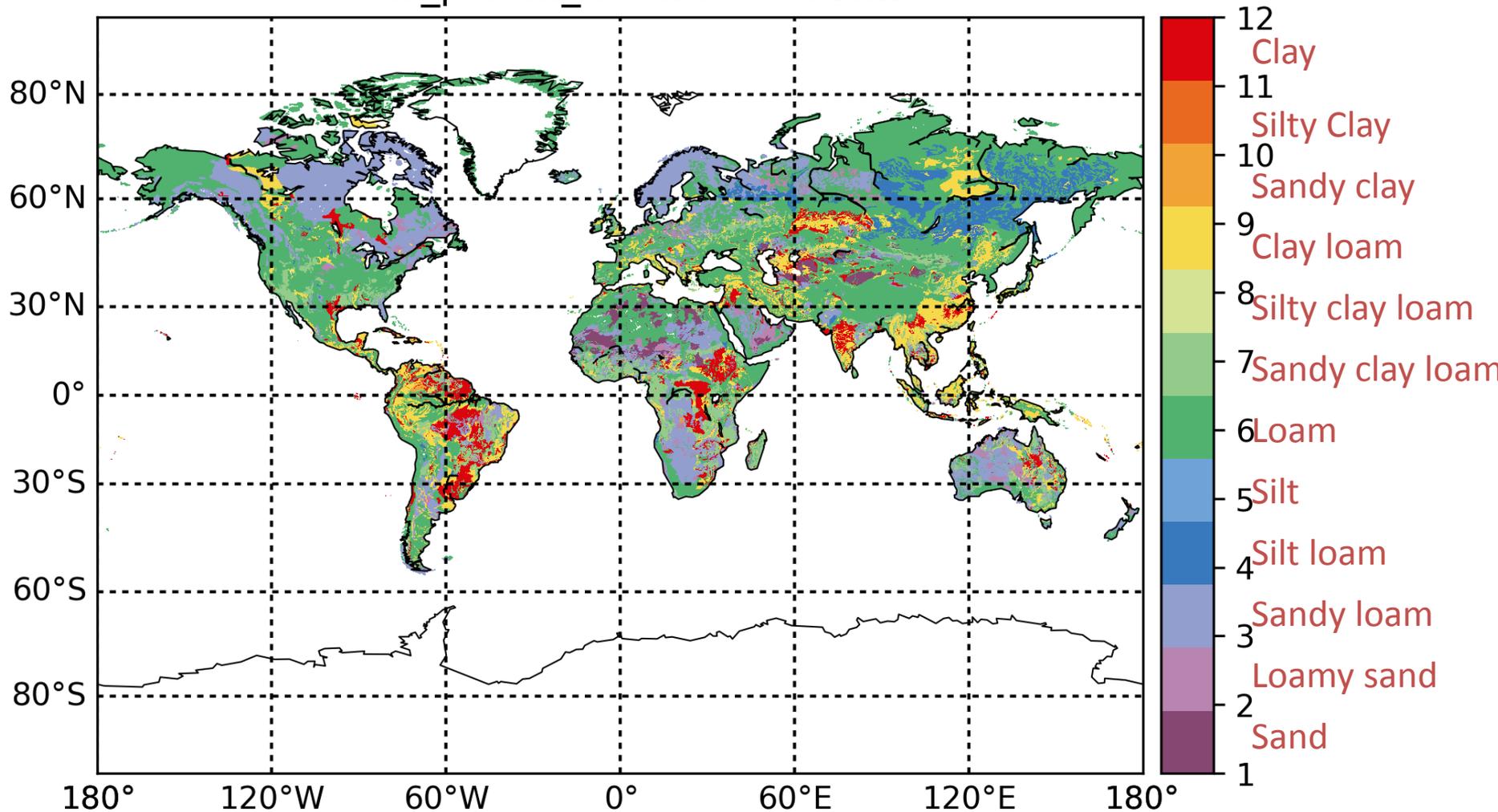
# Final Zobler map used in ORCHIDEE

soils\_param\_zobler.nc : soiltext -> 3 textures



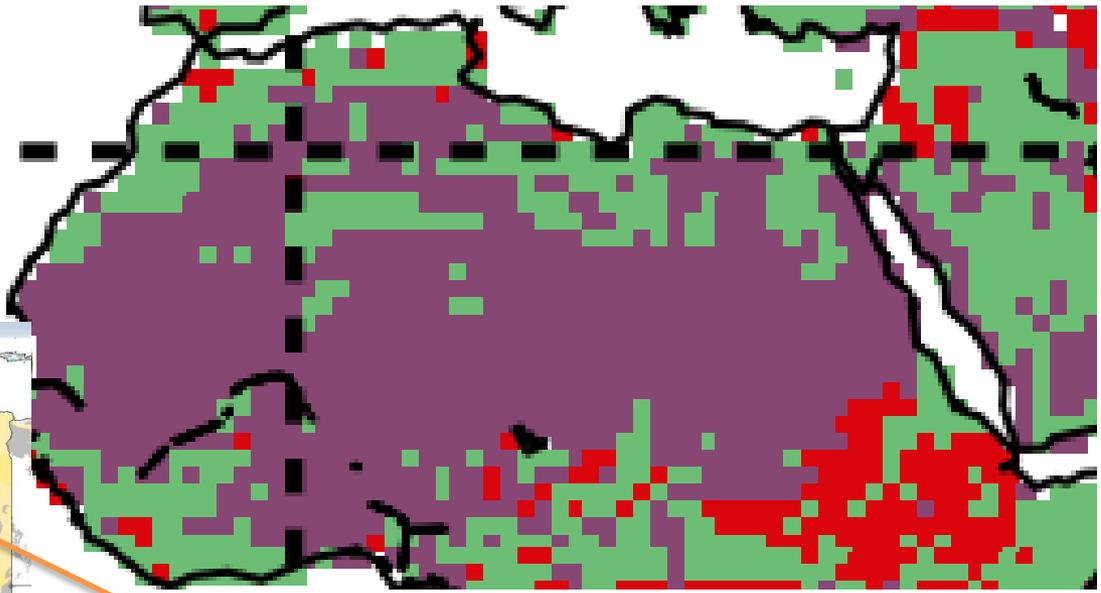
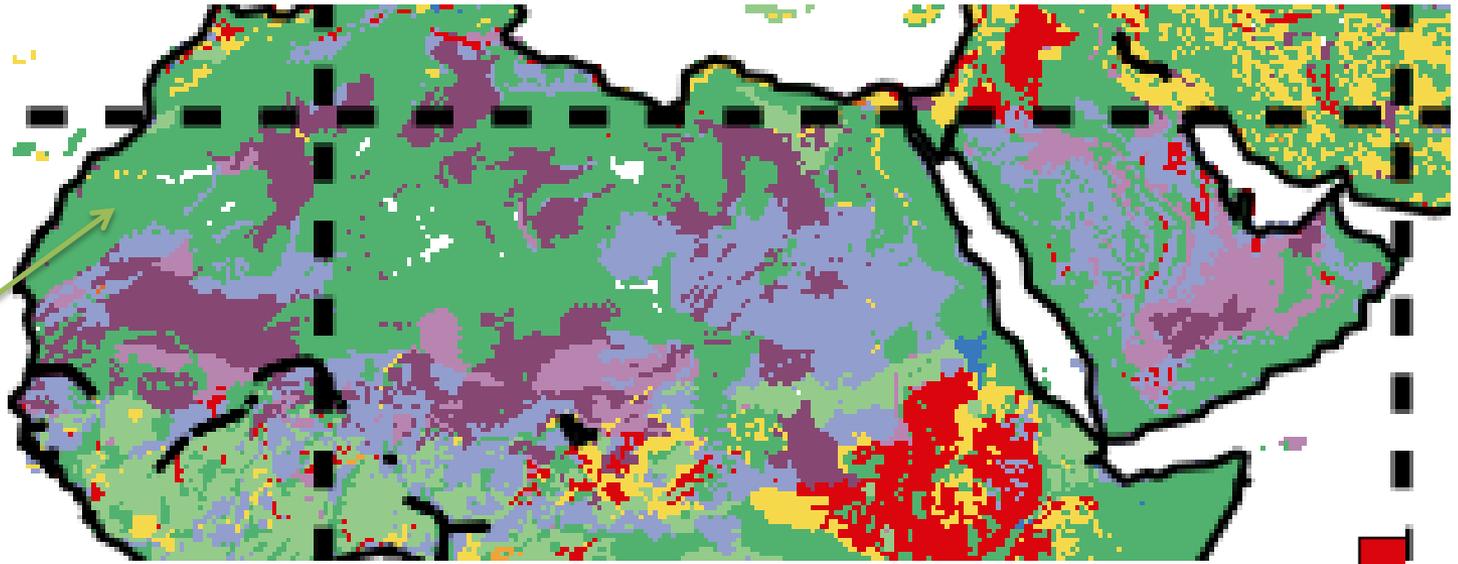
# « USDA » textural map used in ORCHIDEE

soils\_param\_usda.nc : soiltext

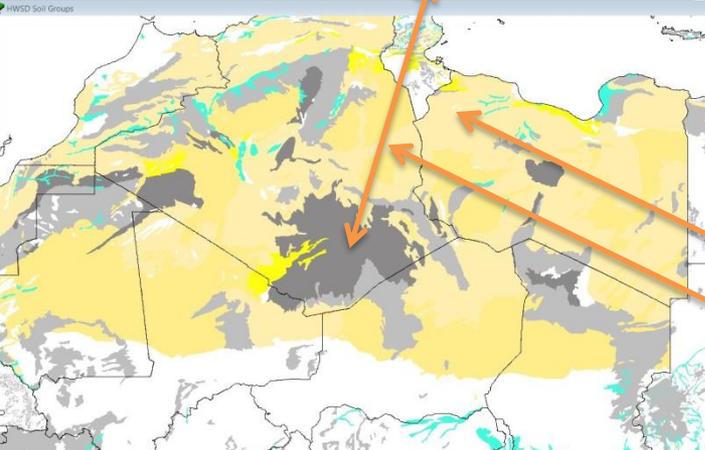


# Zoom in Sahara : comparison USDA / Zobler

- Clay
- Silty Clay
- Sandy clay
- Clay loam
- Silty clay loam
- Sandy clay loam
- Loam**
- Silt
- Silt loam
- Sandy loam
- Loamy sand
- Sand



- Clay
- Loam
- Sand

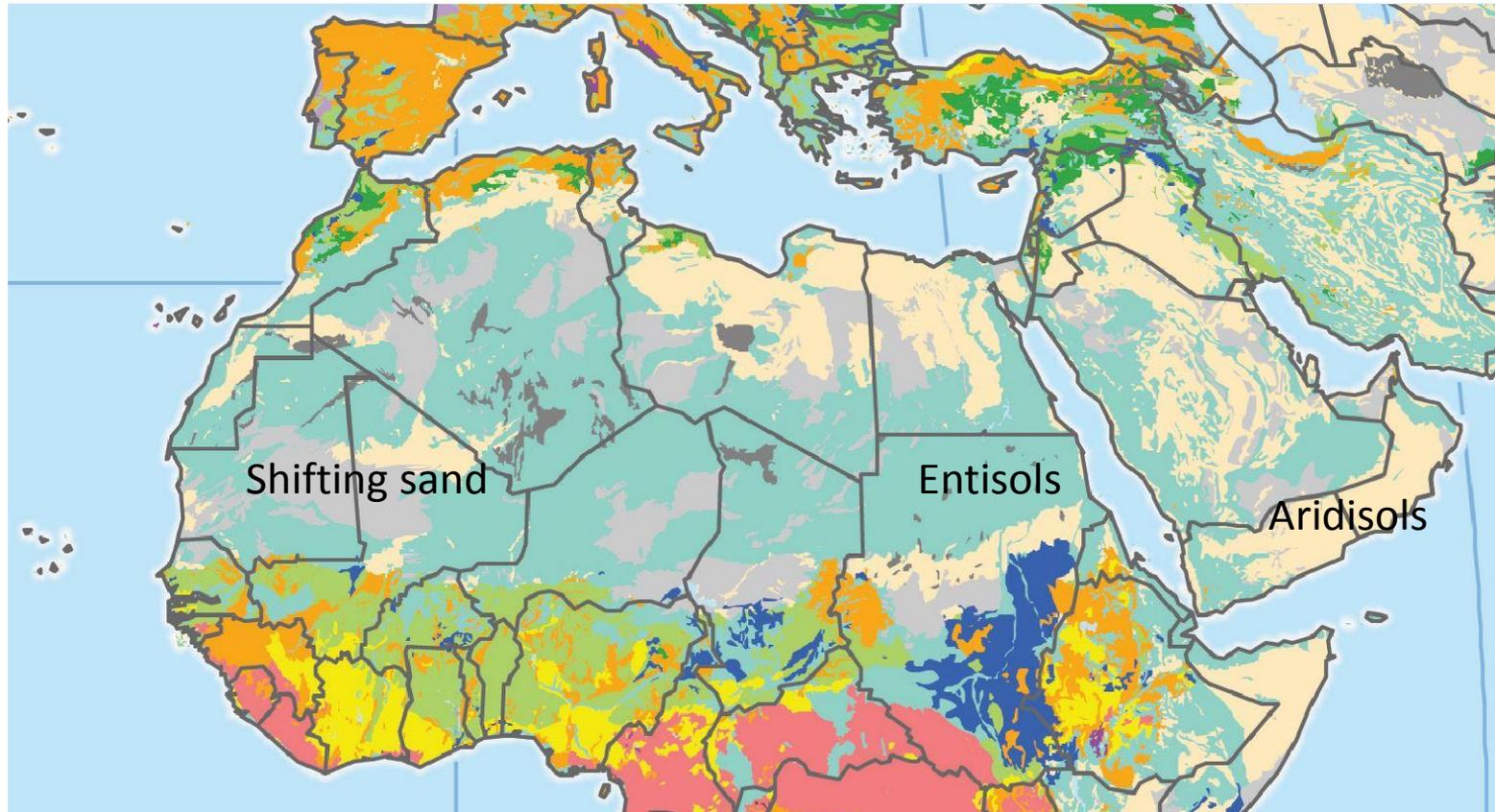


Rocks

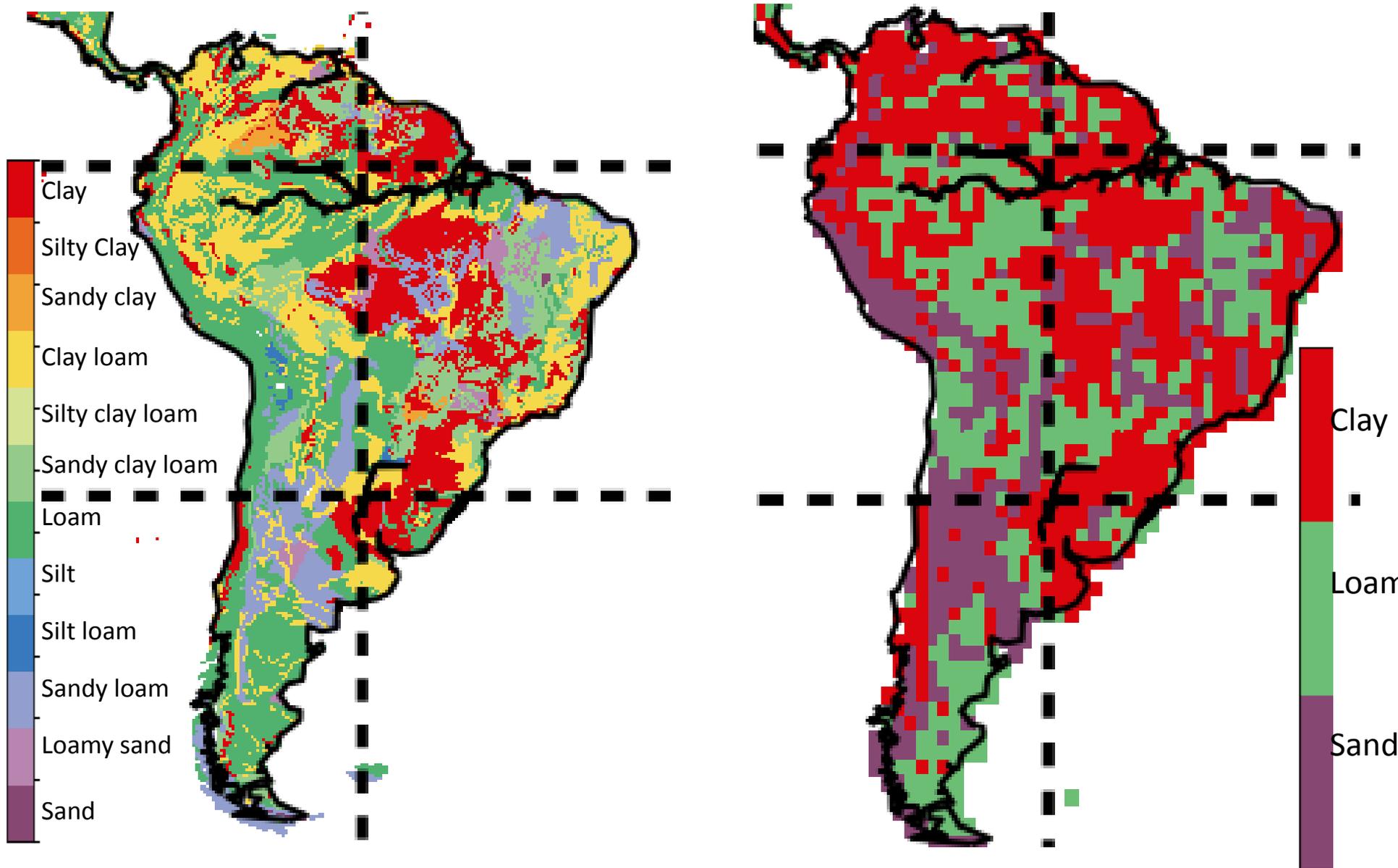
Calcisols (stony and calcareous soils)

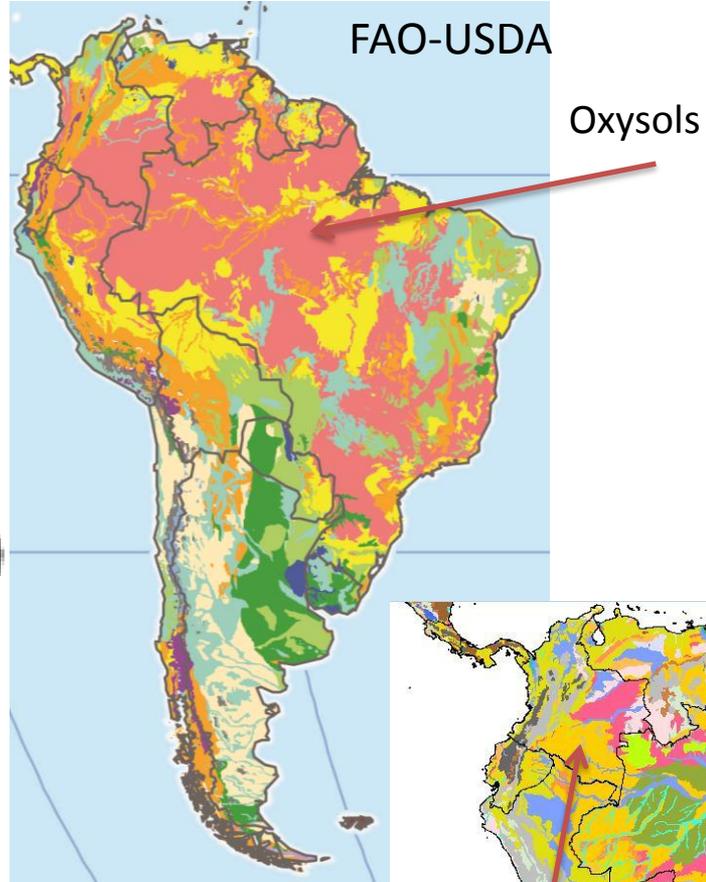
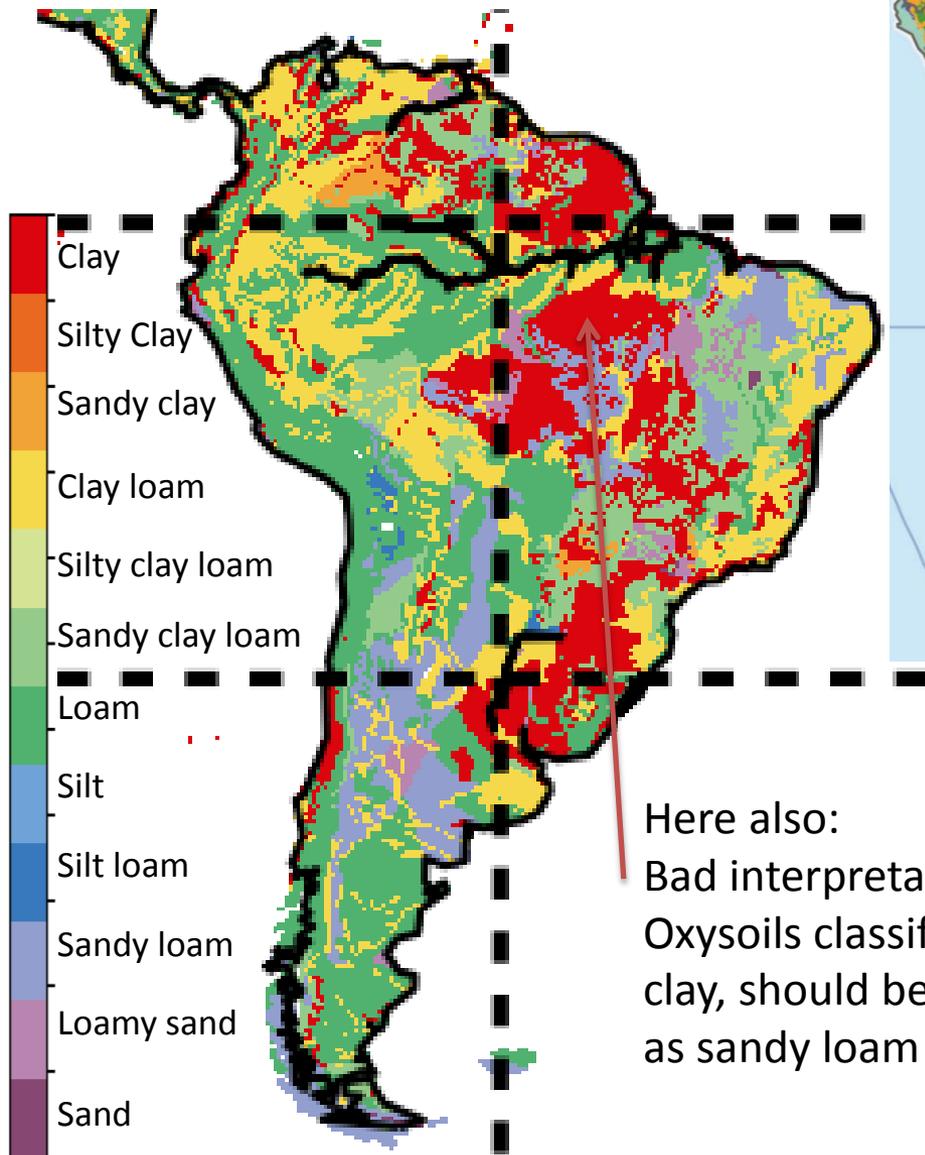
Sand dunes

There seems to be an error in the interpretation of the USDA-Entisols and « Aridisols » classes in terms of soil texture : classified as Loam and should be classed as Sand



# Zoom in South America : comparison USDA / Zobler





Here also:  
Bad interpretation of the  
Oxysoils classified as  
clay, should be classified  
as sandy loam (3) ?

