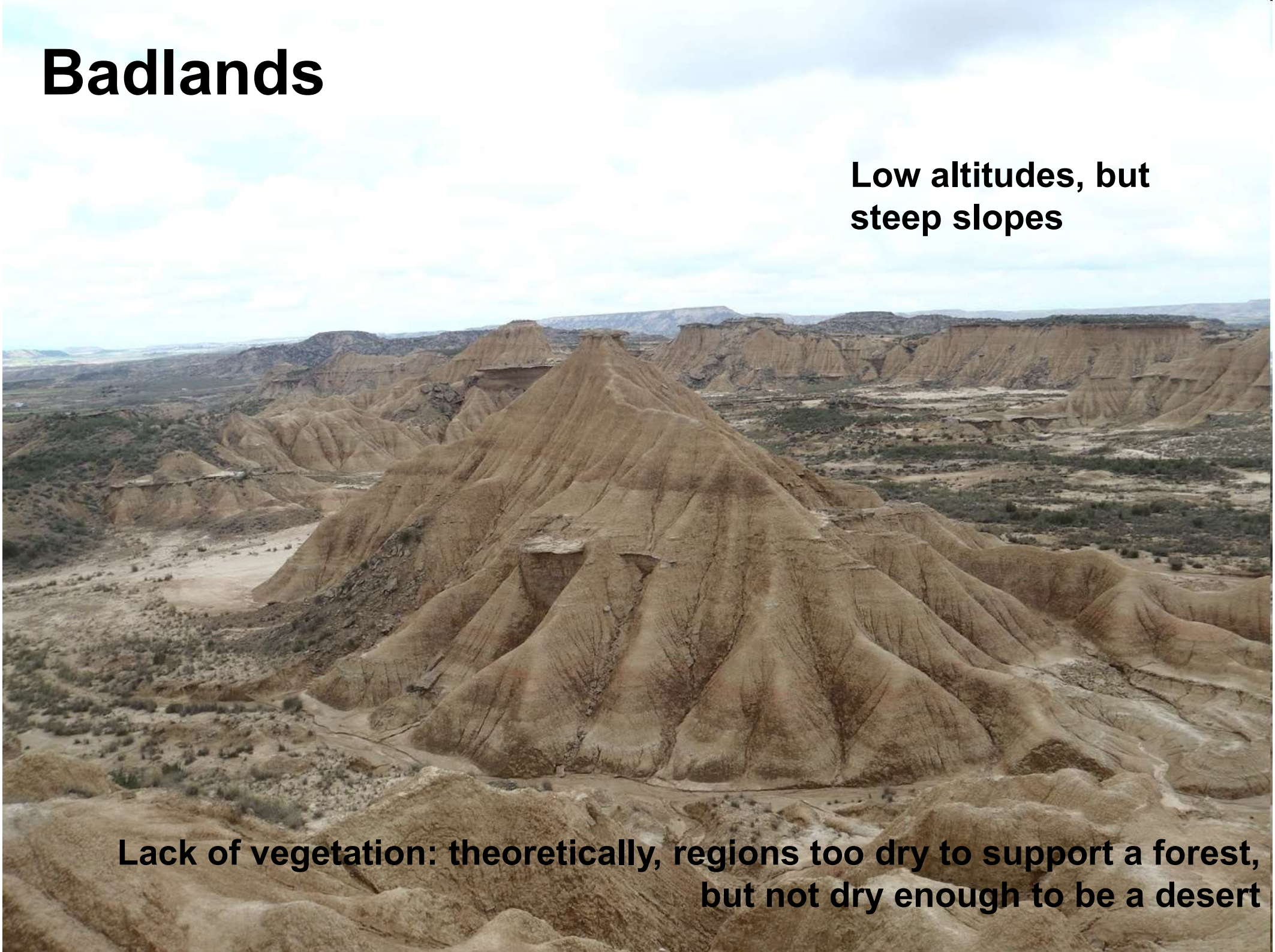
SPANISH

"BAD LANDS"

LANDSCAPES


Toulouse
Gijón
La Coruña
Bilbao
San Sebastián
Santiago de Compostela
Andorra
Vigo
Valladolid
Zaragoza
Barcelona
Oporto
Salamanca
Madrid
Coimbra
Mar Balear
Portugal
España
Palma
Valencia
Lisboa
Alicante (Alacant)
Sevilla
Granada
Gibraltar
Mar de Alborán
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
405 km

Badlands



Low altitudes, but steep slopes

Lack of vegetation: theoretically, regions too dry to support a forest, but not dry enough to be a desert

Badlands


High drainage density
Lack of **regolith**
Layer of non-consolidated material (small brocken rocks, dust, soils, mineral grains…) covering solid rock
Thin soils (bare rocks) extensively eroded.

Badlands

- In Spain, results from a combination of factors:
  - Geologic.
  - Climatic.
  - Human.

Geologic

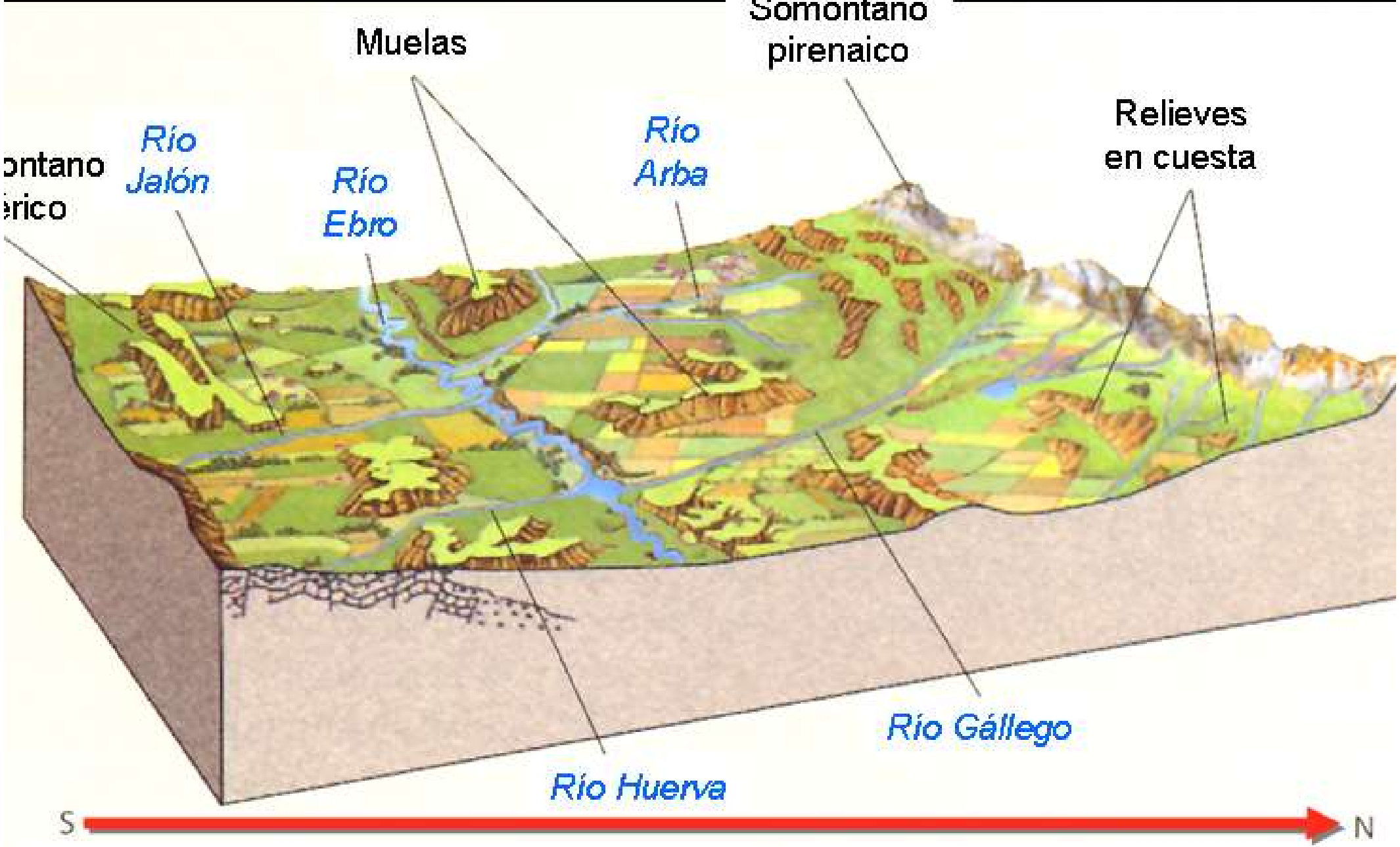
Sedimentary basins: regions of long-term tectonic **subsidence**

Subsidence up-down movement resulting from different processes, usually associated with plate tectonic activity

1. Thinning of underlying crust
2. Sedimentary, volcanic, and tectonic loading
3. Changes in the thickness or density of adjacent lithosphere

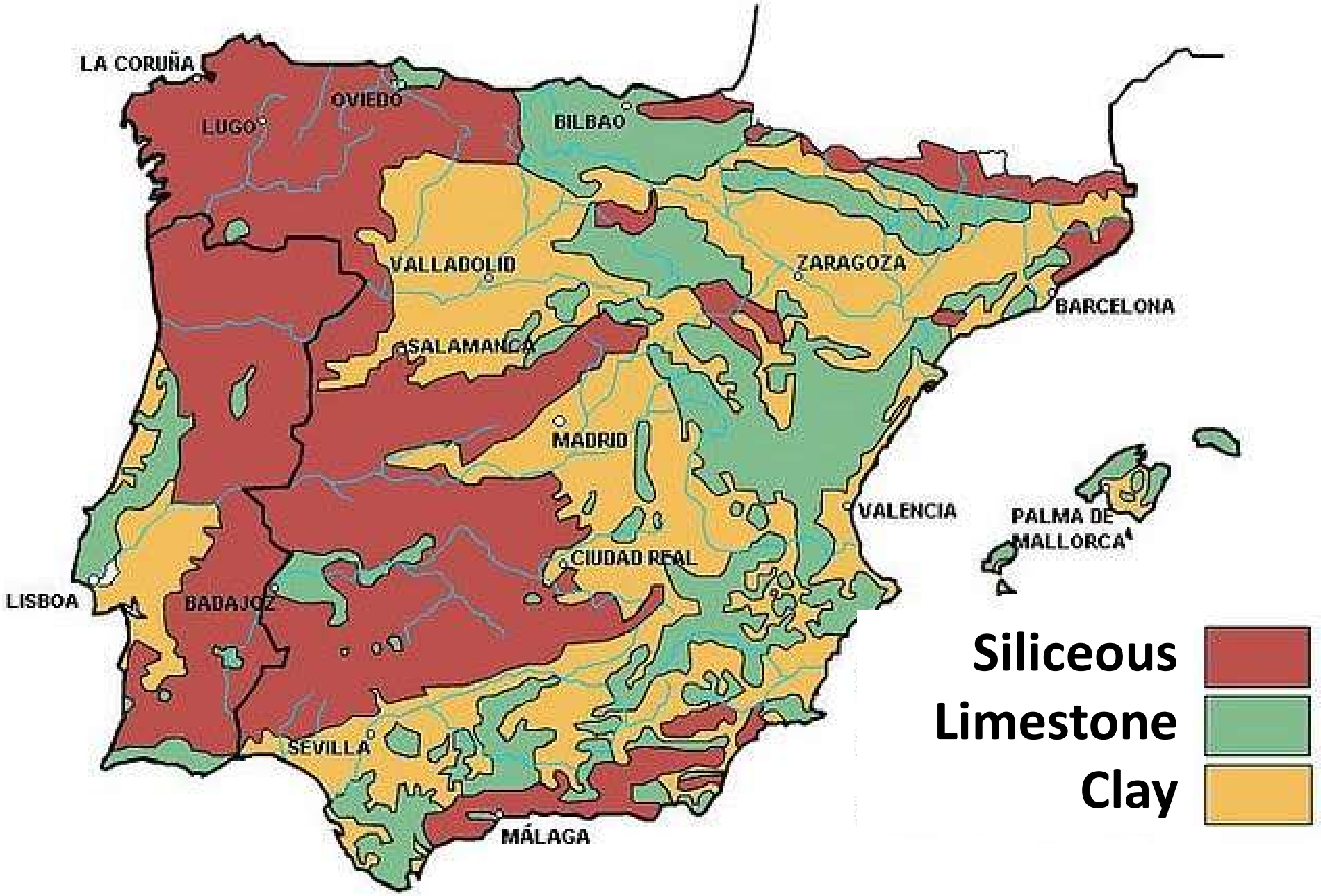
Geologic

- Deposition: accumulation, over time, of layers of mineral material under different environments (sea, river, coast …).
  - Soft rocks: clay, sand, limestone.
- Once the sediments have solidified, the sedimentary material becomes subject to erosion (climate).



Ebro Valley underwent a long period of deposition which spanned three major geologic periods (the Cretaceous Period, the Late Eocene, and the Oligocene Epochs), resulting in clear, distinct layers of sediment which serve as a dramatic display of the law of superposition.

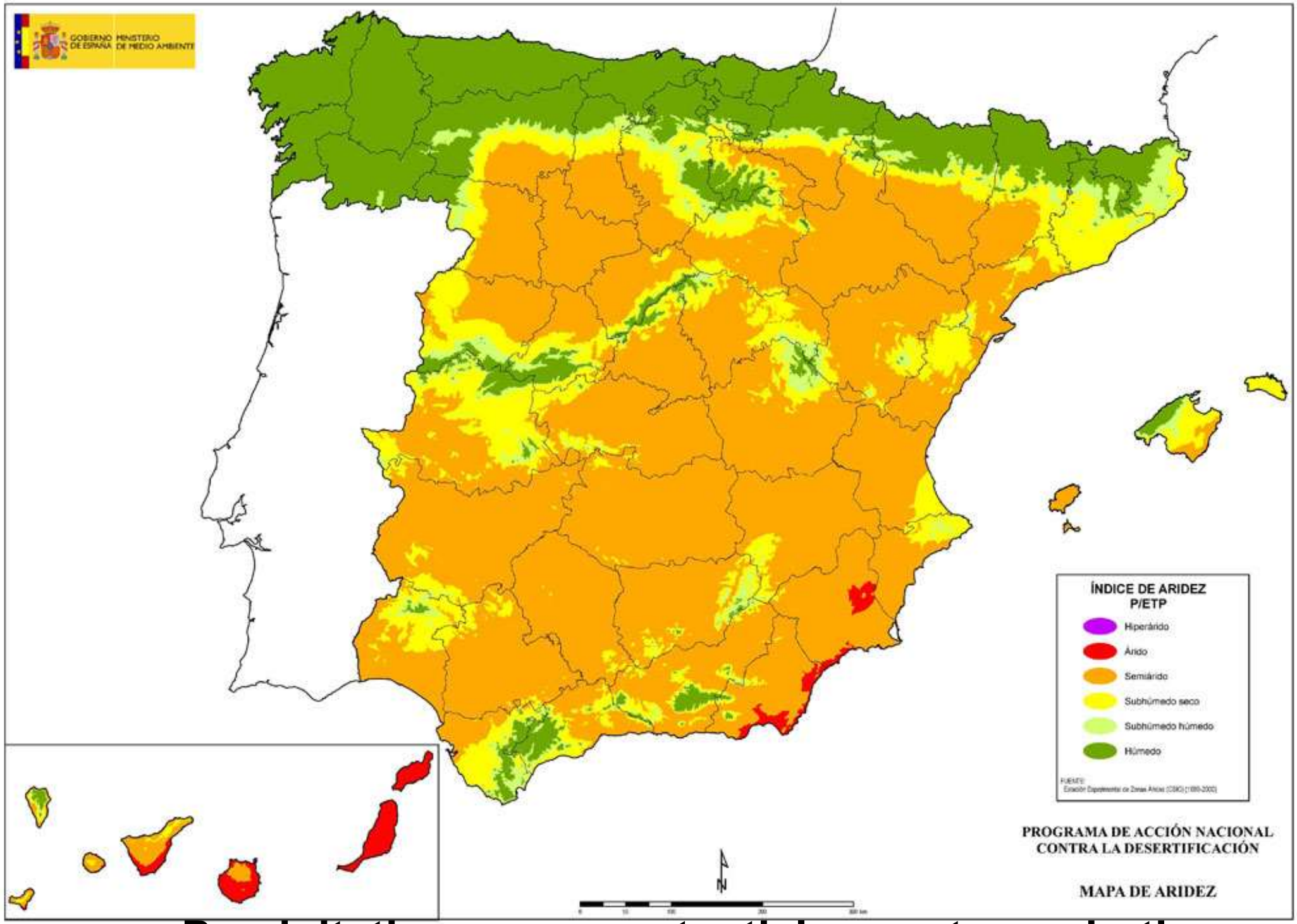
Often have a spectacular color display that alternates bands of different **rocks**.


LA CORUÑA
OVIEDO
LUGO
BILBAO
VALLADOLID
ZARAGOZA
BARCELONA
SALAMANCA
MADRID
VALENCIA
PALMA DE MALLORCA
CIUDAD REAL
LISBOA
BADAJOZ
SEVILLA
MÁLAGA
Siliceous
Limestone
Clay

CLIMATIC FACTORS

1. Lack of vegetation → reduced precipitation and high temperatures -> negative water balance (less precipitation than potential evapotranspiration)→ unprotected soils.

2. Short periods of violent rains (downpurs).



Precipitation versus potential evapotranspiration.

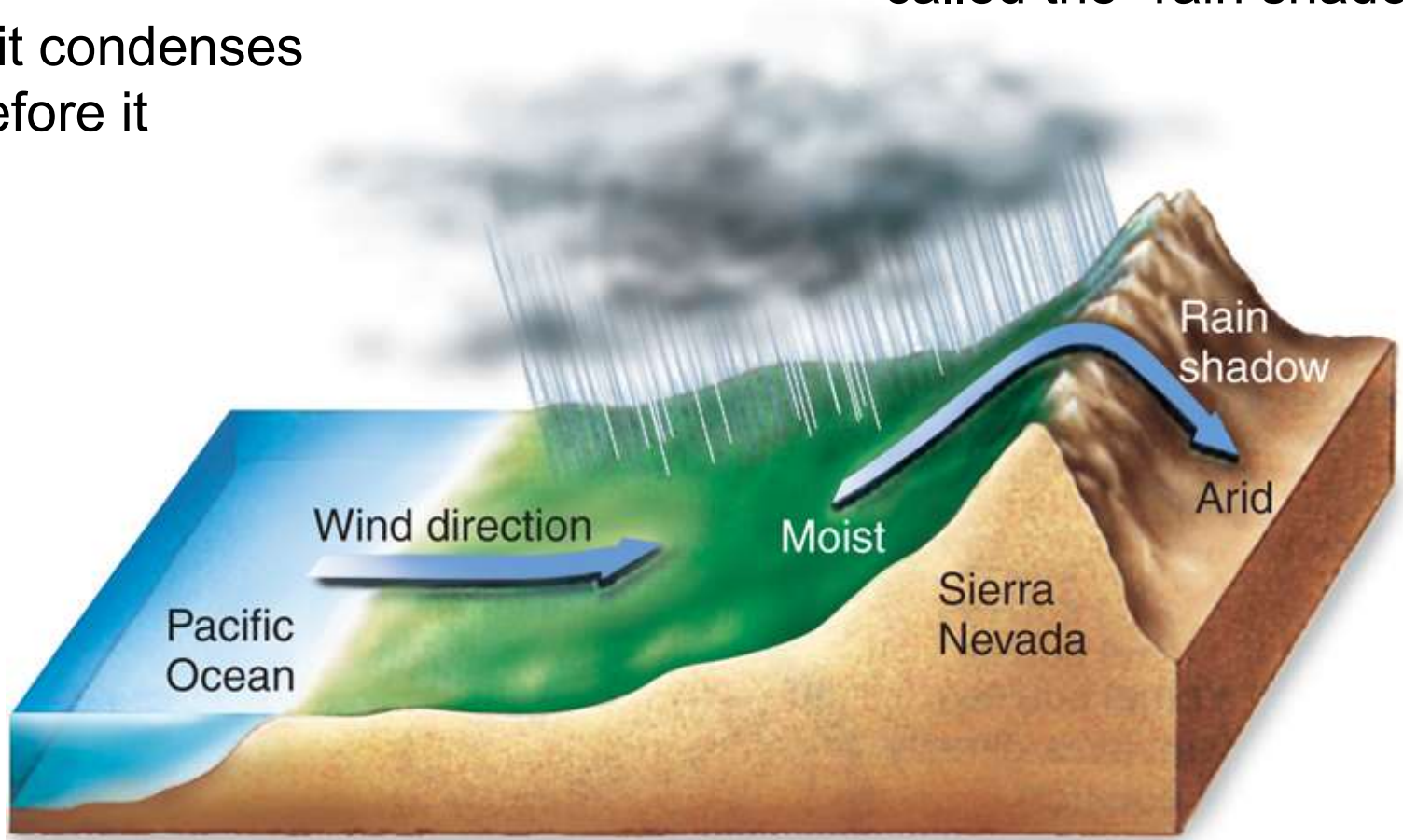

VEGETACIÓN ACTUAL
MAR CANTÁBRICO
FRANCIA
ANDORRA
OCÉANO ATLÁNTICO
PORTUGAL
Islas Baleares
MEDITERRÁNEO
Masas boscosas
(Incluye repoblaciones antiguas)
0 100 200 300 km
Fuente de información: MAPA (Ministerio de Agricultura, Pesca y Alimentación), 1991
Elaborado por Atlas Nacional de España (IGN)
MAR
Estrecho de Gibraltar
Ceuta
Melilla
ARGELIA
MARRUECOS
OCÉANO ATLÁNTICO
Islas Canarias

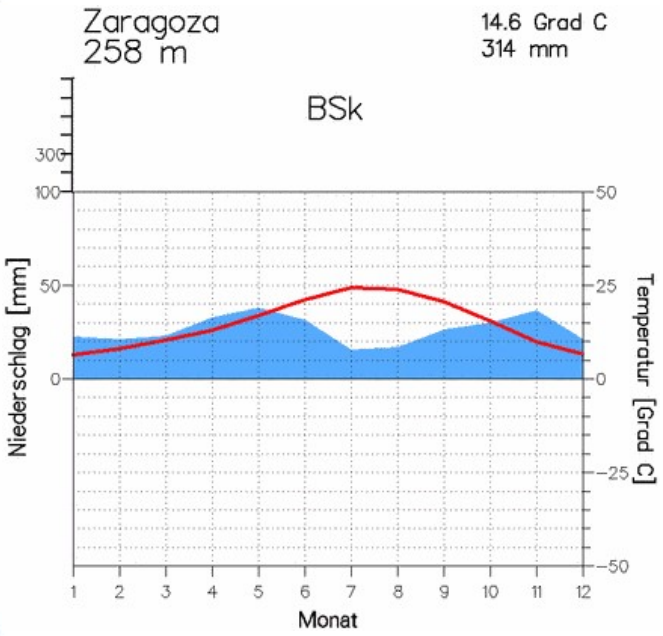
Why so low precipitation: Rain shadow effect

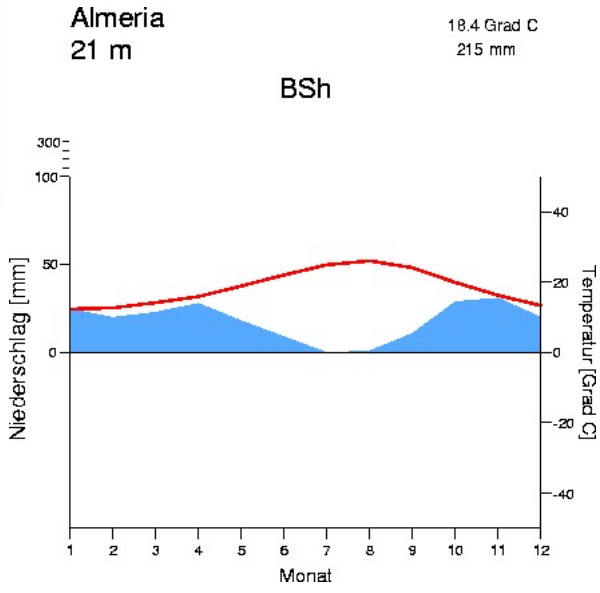
Leeward side of a mountainous area: the mountains block the passage of rain-producing weather systems and cast a "shadow" of dryness behind them.

The incoming moist air is drawn by the prevailing winds towards the top of the mountains, where it condenses and precipitates before it crosses the top.

The air, without much moisture left, advances behind the mountains creating a drier side called the "rain shadow".





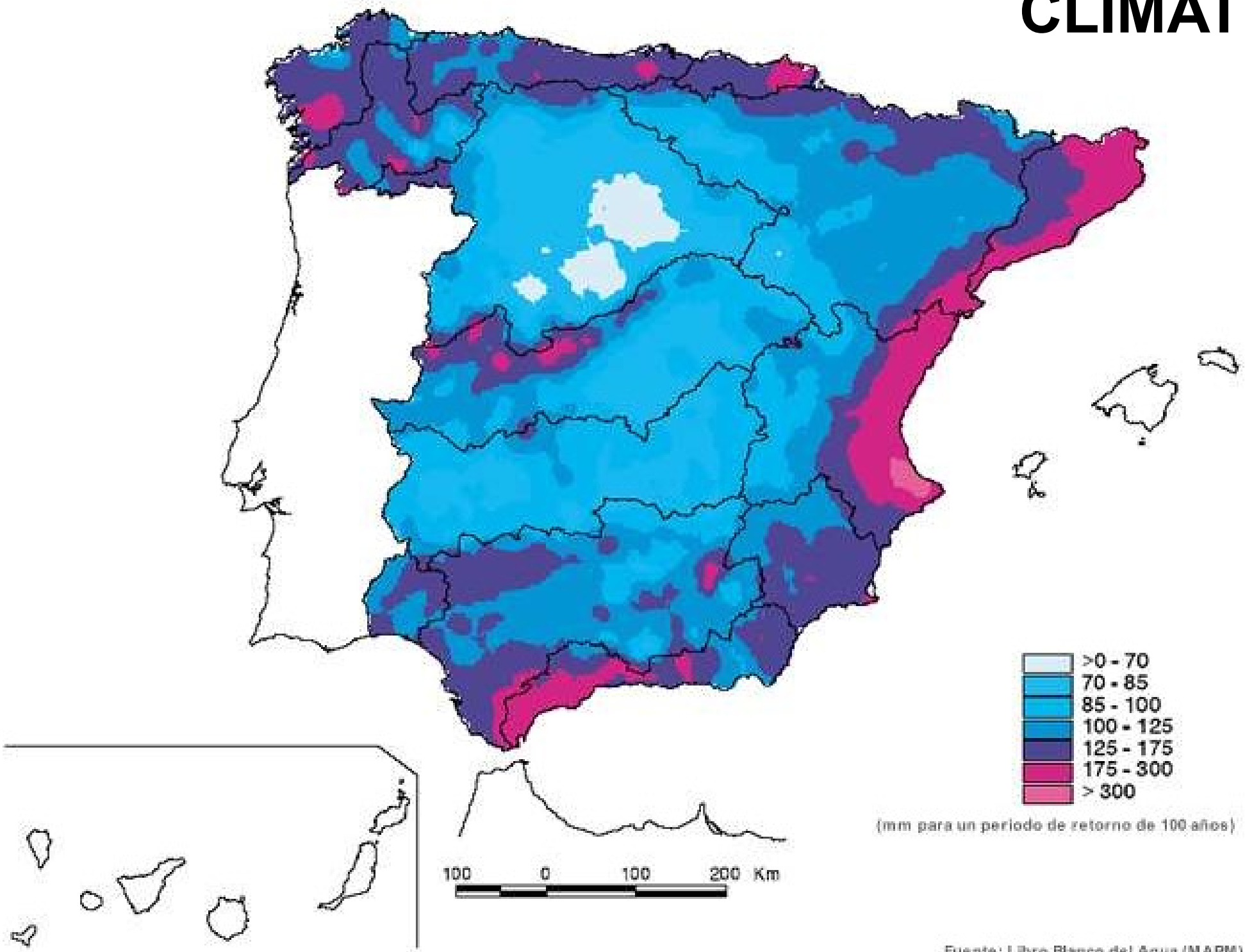


Corresponds to a semi-arid (steppe) climate:

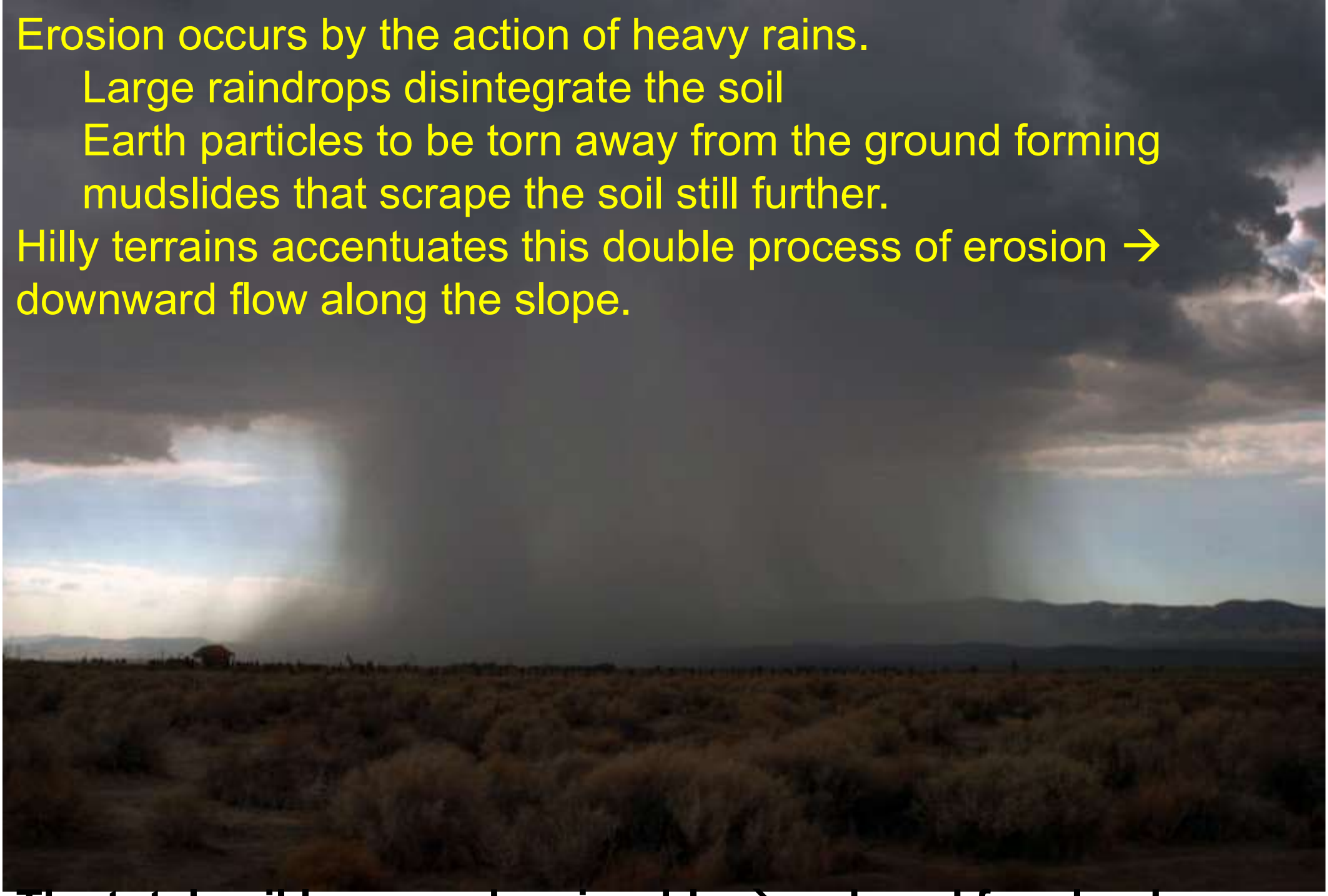
1. Different kinds of semi-arid climates, depending on other variables (temperature)

LOS RIESGOS DE INUNDACIÓN
LLUVIAS MÁXIMAS DIARIAS EN LA ESPAÑA PENINSULAR

CLIMATE

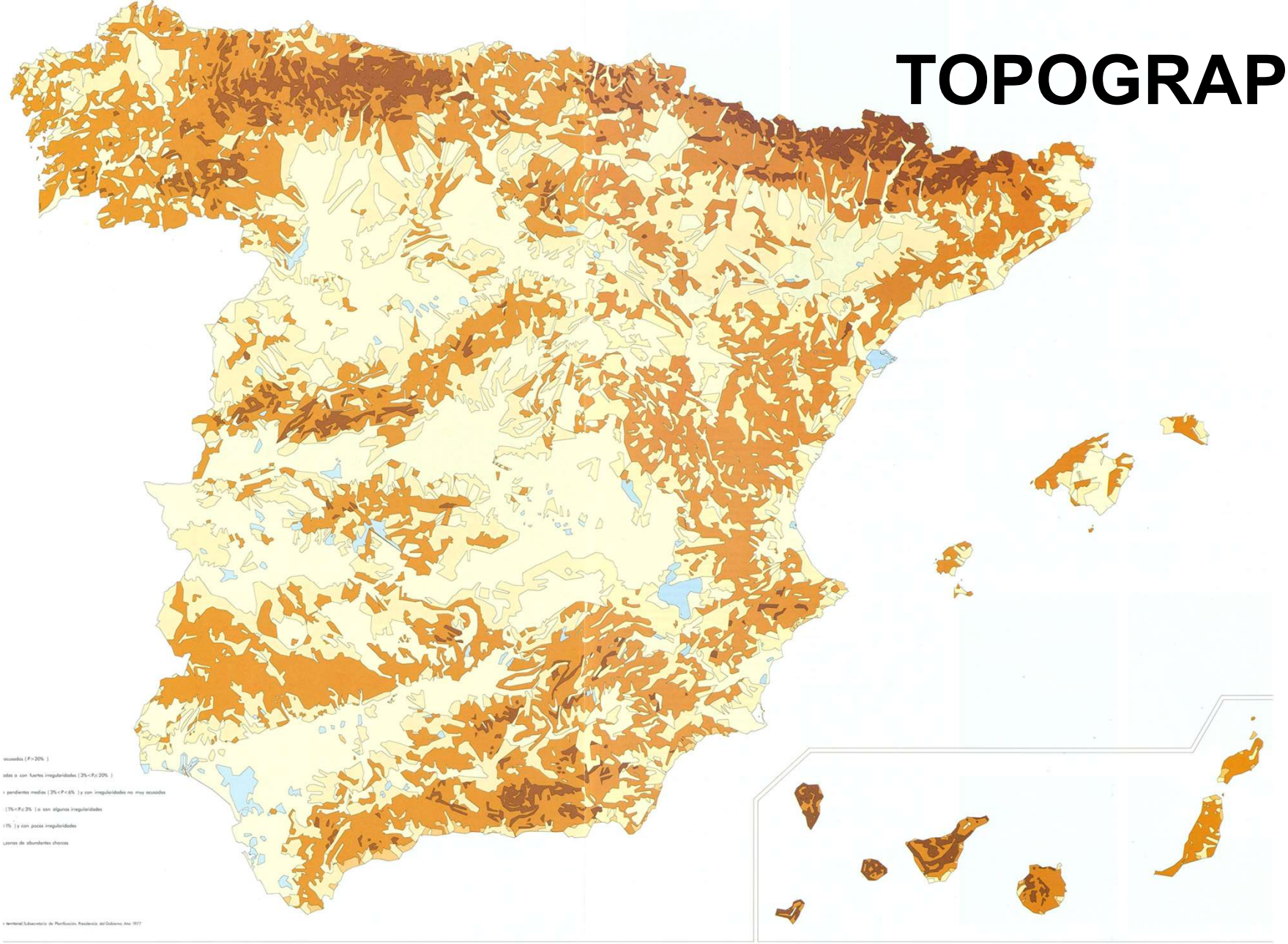


Fuente: Libro Blanco del Agua (MARM)



The total soil loss can be sizeable → reduced farmland productivity and produce sediment

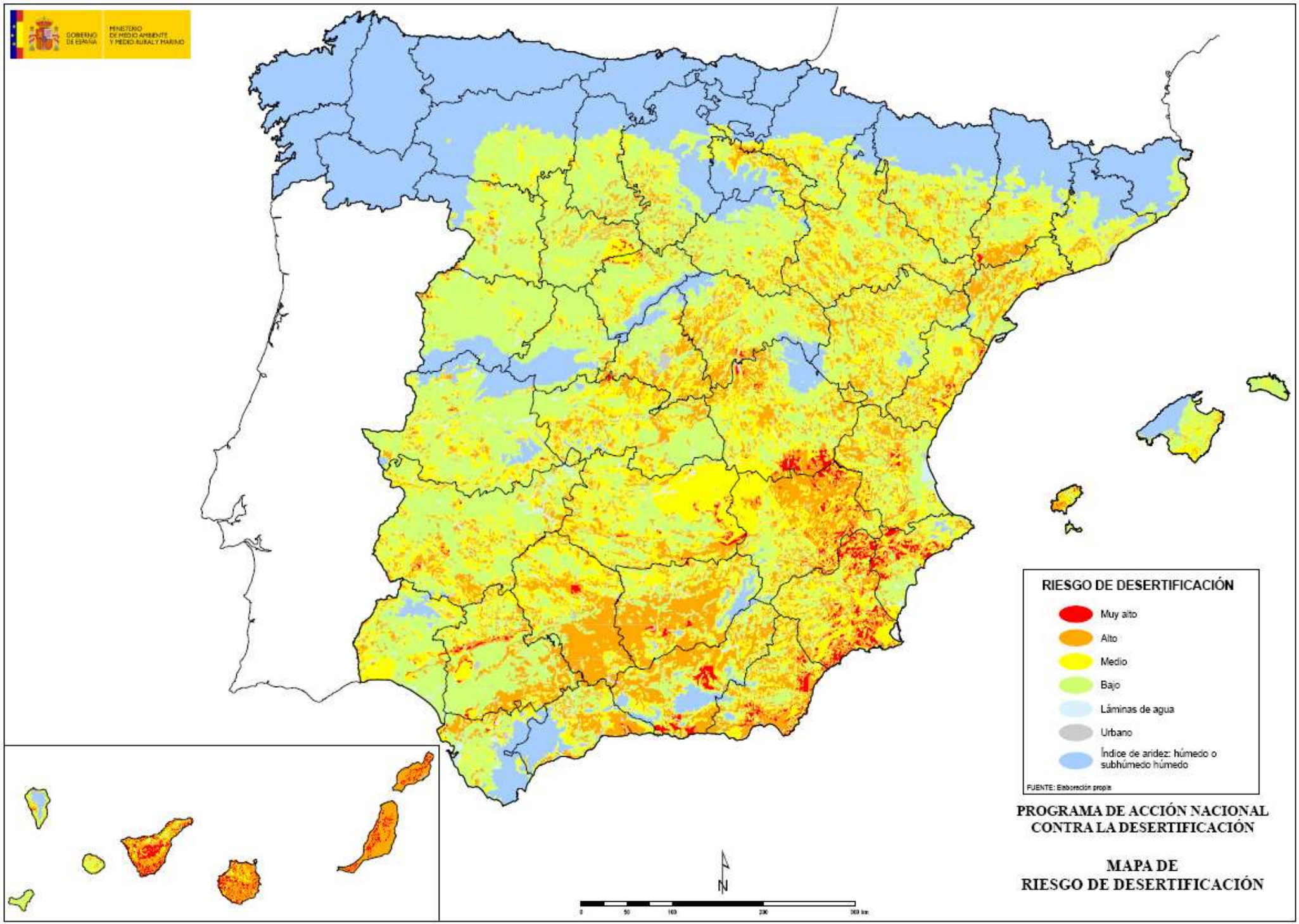
TOPOGRAPHY



Suelo con pendientes acusadas (P > 20 %)
Suelo con pendientes acusadas o con fuertes irregularidades (3% < P ≤ 20 %)
Zona costera de suelo con pendientes medias (3% < P ≤ 6 %) y con irregularidades no muy acusadas)
Suelo con pendiente suave (1% < P ≤ 3%) o con alguna irregularidad
Suelo llano (pendientes P < 1%) y con pocas irregularidades
Lagunas, embalses, zonas con abundantes charcas

- ¿**Human** steppes? mostly due to human mismanagement:
  - Historical fires (deforestation)
  - Overgrazing

DESERTIFICATION TODAY


GOBIERNO DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO
RIESGO DE DESERTIFICACIÓN
Muy alto
Alto
Medio
Bajo
Láminas de agua
Urbano
Índice de aridez: húmedo o subhúmedo húmedo
FUENTE: Elaboración propia
PROGRAMA DE ACCIÓN NACIONAL CONTRA LA DESERTIFICACIÓN
MAPA DE RIESGO DE DESERTIFICACIÓN
N
0
50
100
200
300 km

TYPICAL LANDFORMS

Tables
Canyons
Ravines
Gullies
Hoodoos

Horizontal (“mesas”)

Elevated landform
It takes its name from its characteristic table-top shape.
It may also be called a table hill, table-topped hill or table mountain.

Mesas

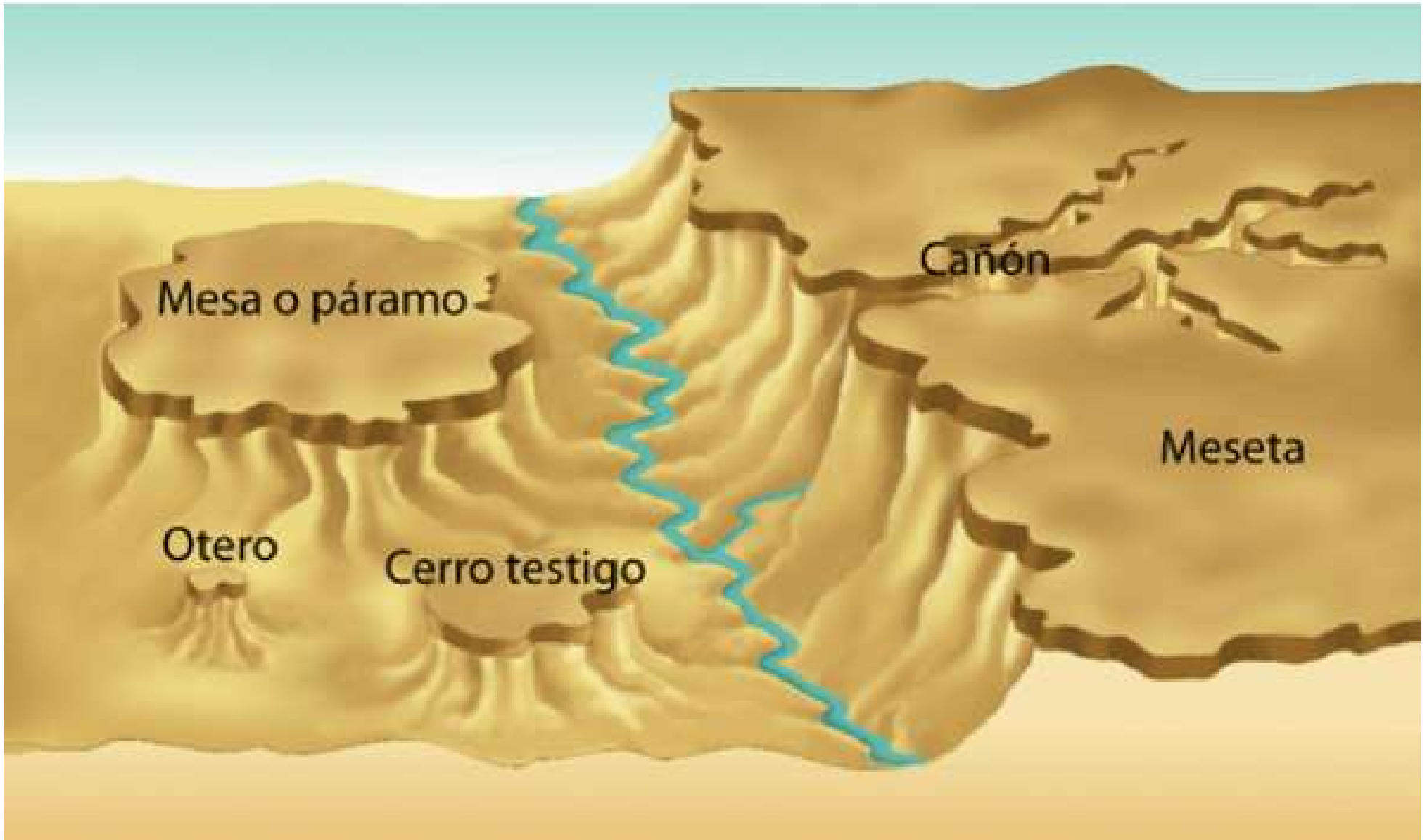
Origin → **differential erosion** of **horizontally layered** rocks→ variations in the ability of different types of rock to resist weathering and erosion

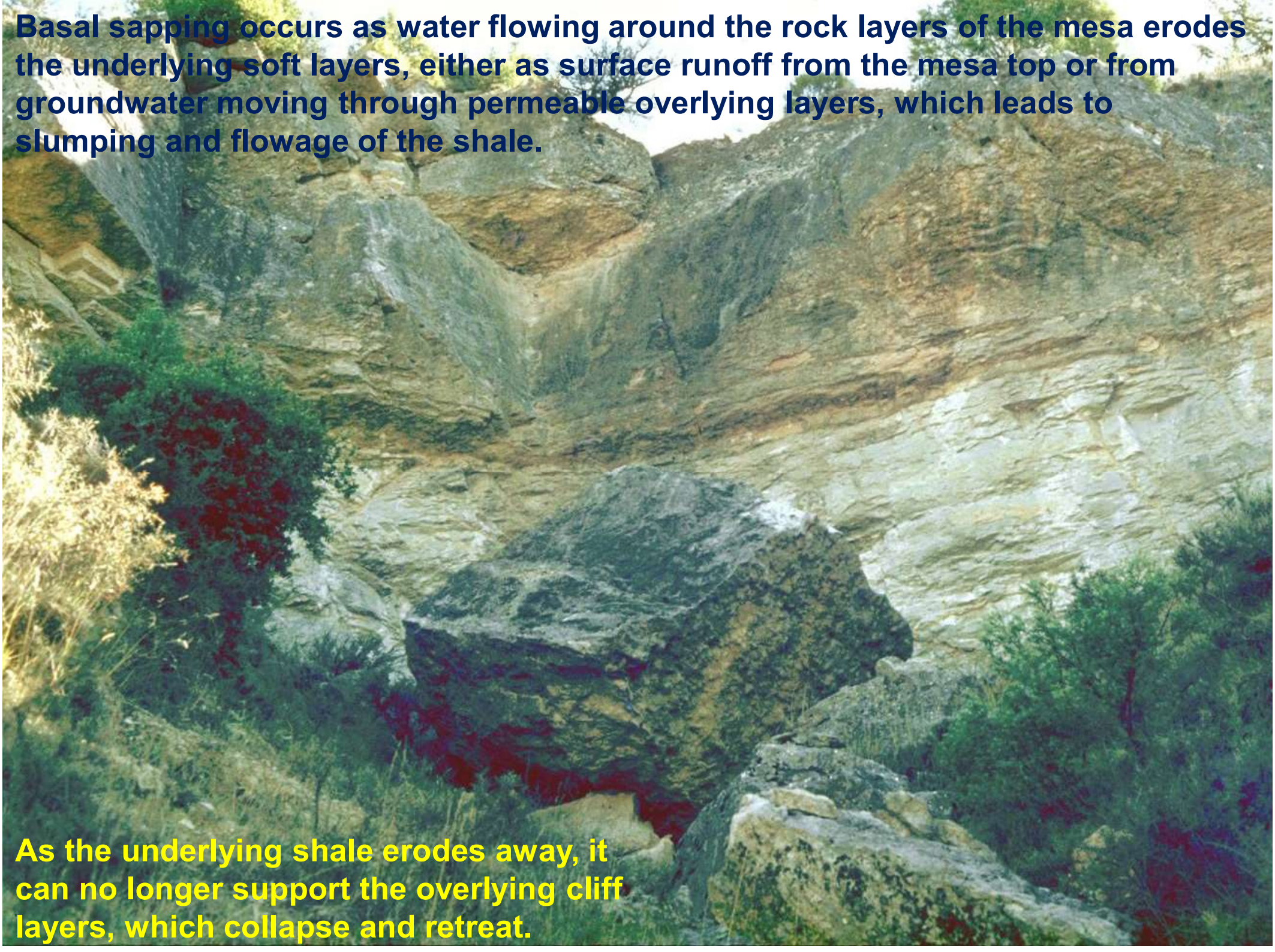
1. The more resistant rocks (sandstone, conglomerate or limestone) are left topographically higher than their surroundings
2. Weaker rocks (shale, mudstone) to be eroded away into valleys
3. Valleys collect water drainage from the surrounding area

Differences in rock type also reflects on the sides → instead of smooth slope, sometimes, the sides can be broken into a staircase pattern called "**cliff-and-bench topography**"

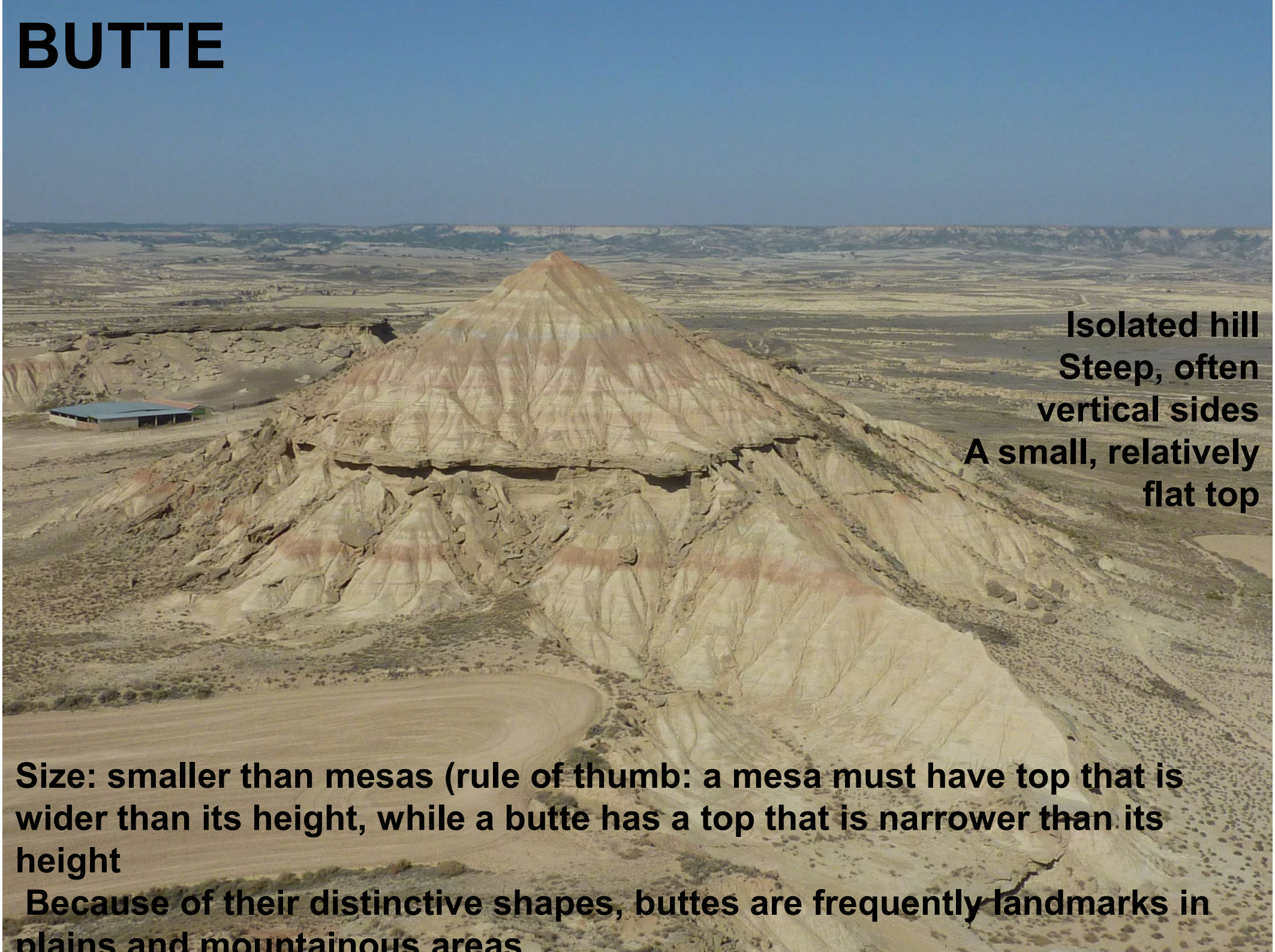
Cliffs retreat and eventually cut off from the main cliff by **basal sapping**.

When the cliff edge does not retreat uniformly, but instead is indented by headward eroding streams, a section can be cut off from the main cliff → mesa.




Basal sapping occurs as water flowing around the rock layers of the mesa erodes the underlying soft layers, either as surface runoff from the mesa top or from groundwater moving through permeable overlying layers, which leads to slumping and flowage of the shale.
As the underlying shale erodes away, it can no longer support the overlying cliff layers, which collapse and retreat.

BUTTE



Isolated hill
Steep, often vertical sides
A small, relatively flat top

Size: smaller than mesas (rule of thumb: a mesa must have top that is wider than its height, while a butte has a top that is narrower than its height

Because of their distinctive shapes, buttes are frequently landmarks in plains and mountainous areas

Ravine

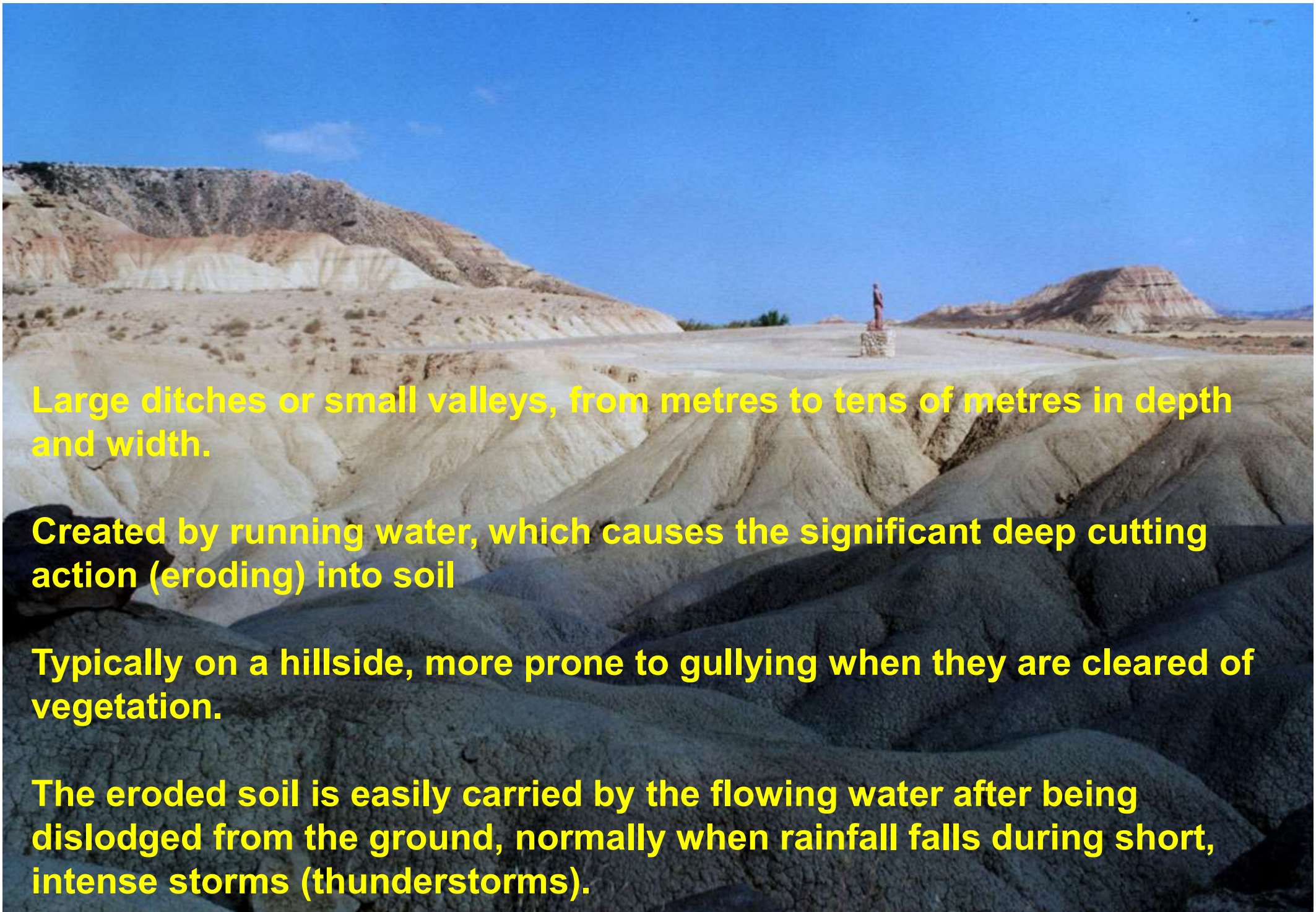
1. Water-derived landform, product of stream-cutting erosion.

2. Relatively steep (cross-sectional) sides.

    - Narrower than a canyon.
    - Larger than gullies.
    - Smaller than valleys.

3. May or may not have active streams flowing along the channel which originally formed them (often intermittent streams)

Gullies



Large ditches or small valleys, from metres to tens of metres in depth and width.

Created by running water, which causes the significant deep cutting action (eroding) into soil

Typically on a hillside, more prone to gullying when they are cleared of vegetation.

The eroded soil is easily carried by the flowing water after being dislodged from the ground, normally when rainfall falls during short, intense storms (thunderstorms).

Cabezos (hoodoos)

1. Tent rock, fairy chimney, earth pyramid

2. Tall, thin spire of rock (may range from 1.5 to 45 m).

3. Consist of relatively soft rock topped by harder, less easily eroded stone (protects each column from the elements).

4. Affected by erosional patterns of alternating hard and softer rock layers.

5. Minerals deposited within different rock types cause to have different colors throughout their height

Cabezos (hoodoos)

1. Typically, they form from two weathering processes eroding the edges of a rock formation
   - Frost wedging: freeze/thaw cycles.
   - Rain washing.

2. Over time, cracks in the resistant layer allow the much softer rock beneath to be eroded and washed away.

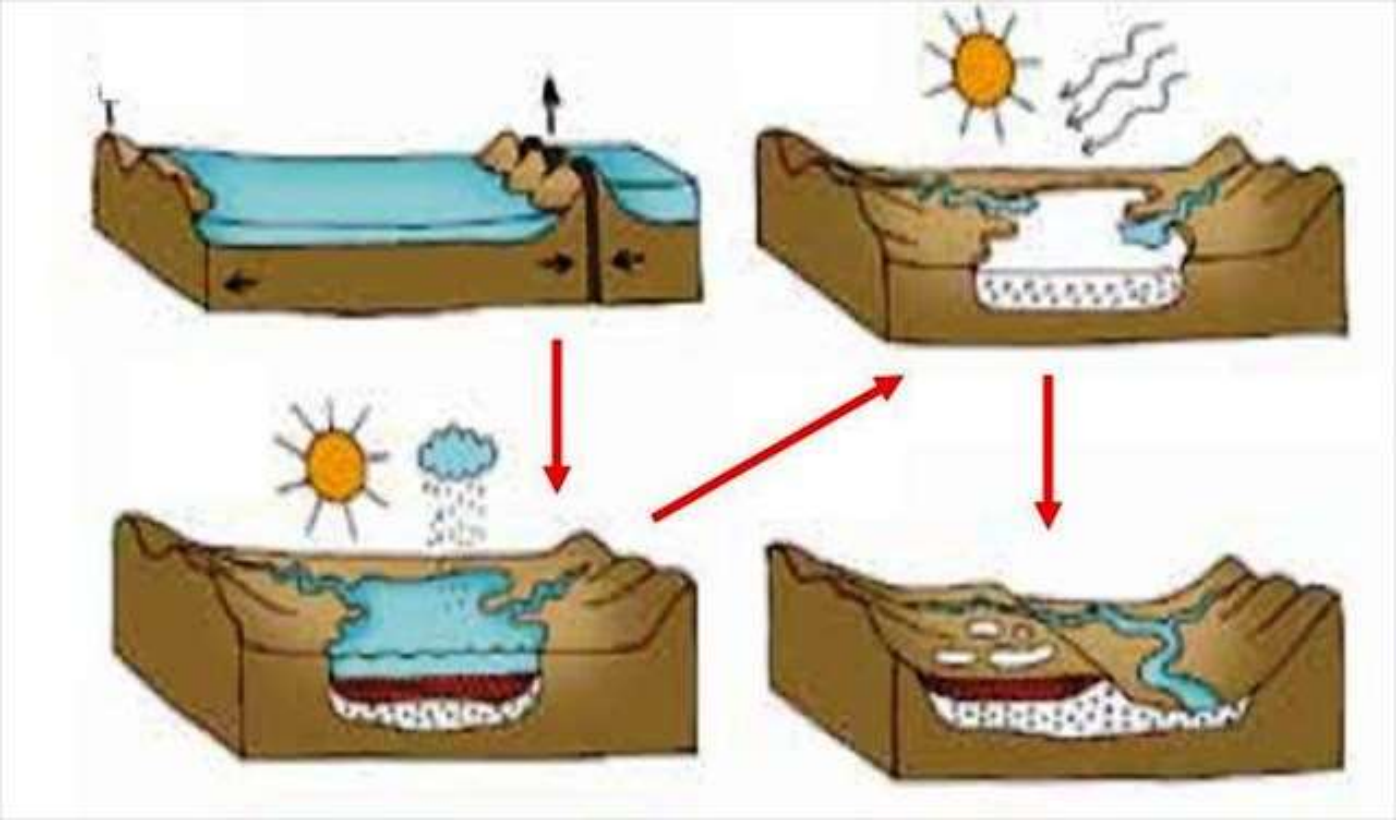
3. Further erosion of the soft layer causes the cap to be undercut, eventually falling off, and the remaining cone is then quickly eroded.

Salares (salty lakes)

Landlocked body of water (endorheic basin): closed drainage basin that retains water and allows no outflow to other external bodies of water (rivers or oceans), but converges instead into lakes or swamps (permanent or seasonal), that equilibrate through evaporation

Suffers a concentration of salts (typically sodium chloride) and other dissolved minerals significantly higher than most lakes (often defined as at least 3 gr/m3)

Salares



Formation

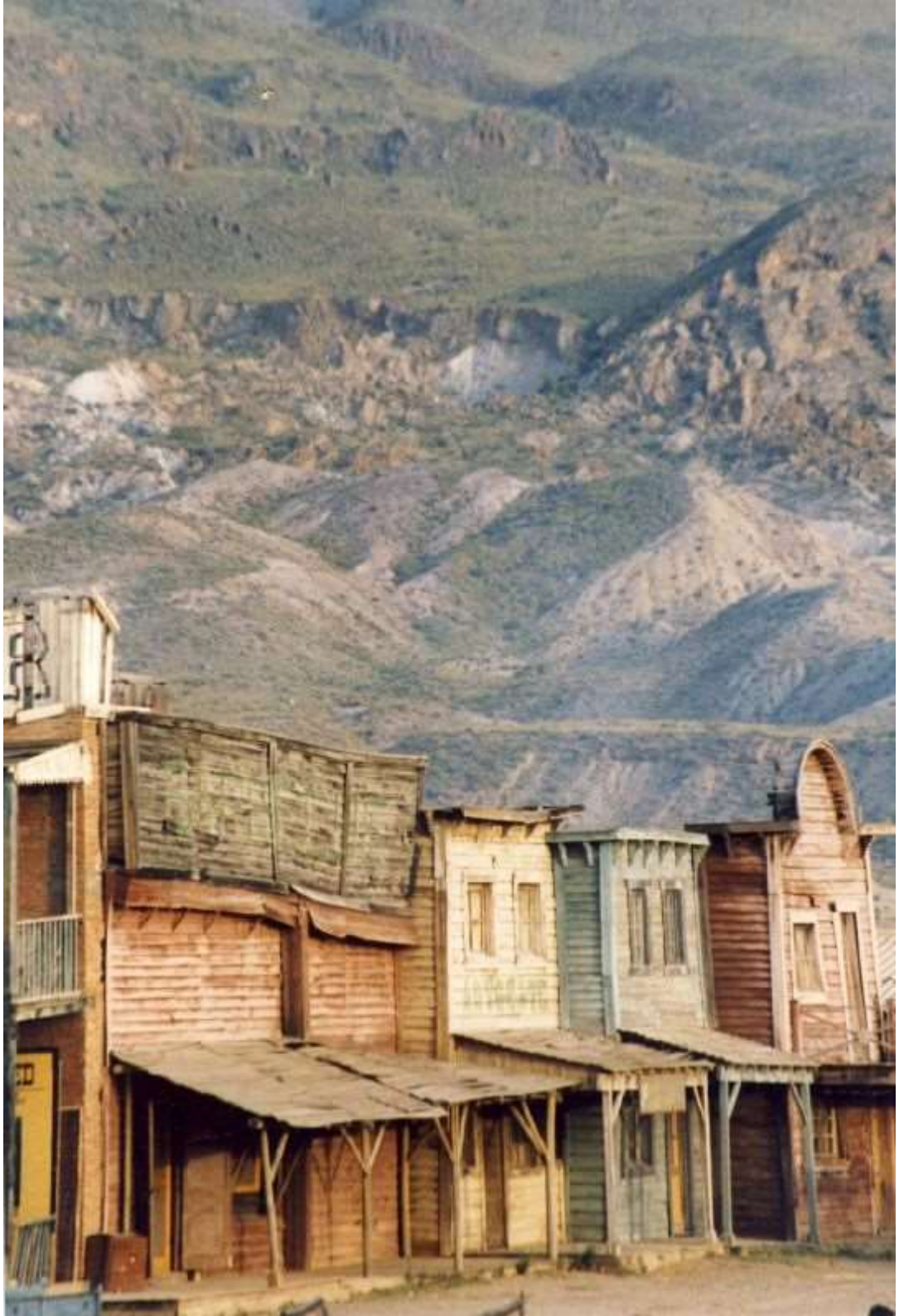
1. Water flowing into the lake, containing salt or minerals, cannot leave.
2. Water evaporates, leaving behind dissolved salts.
3. If the amount of water flowing into a lake is less than the amount evaporated, the lake will eventually disappear and leave a dry lake (also called playa or salt flat).

Salares

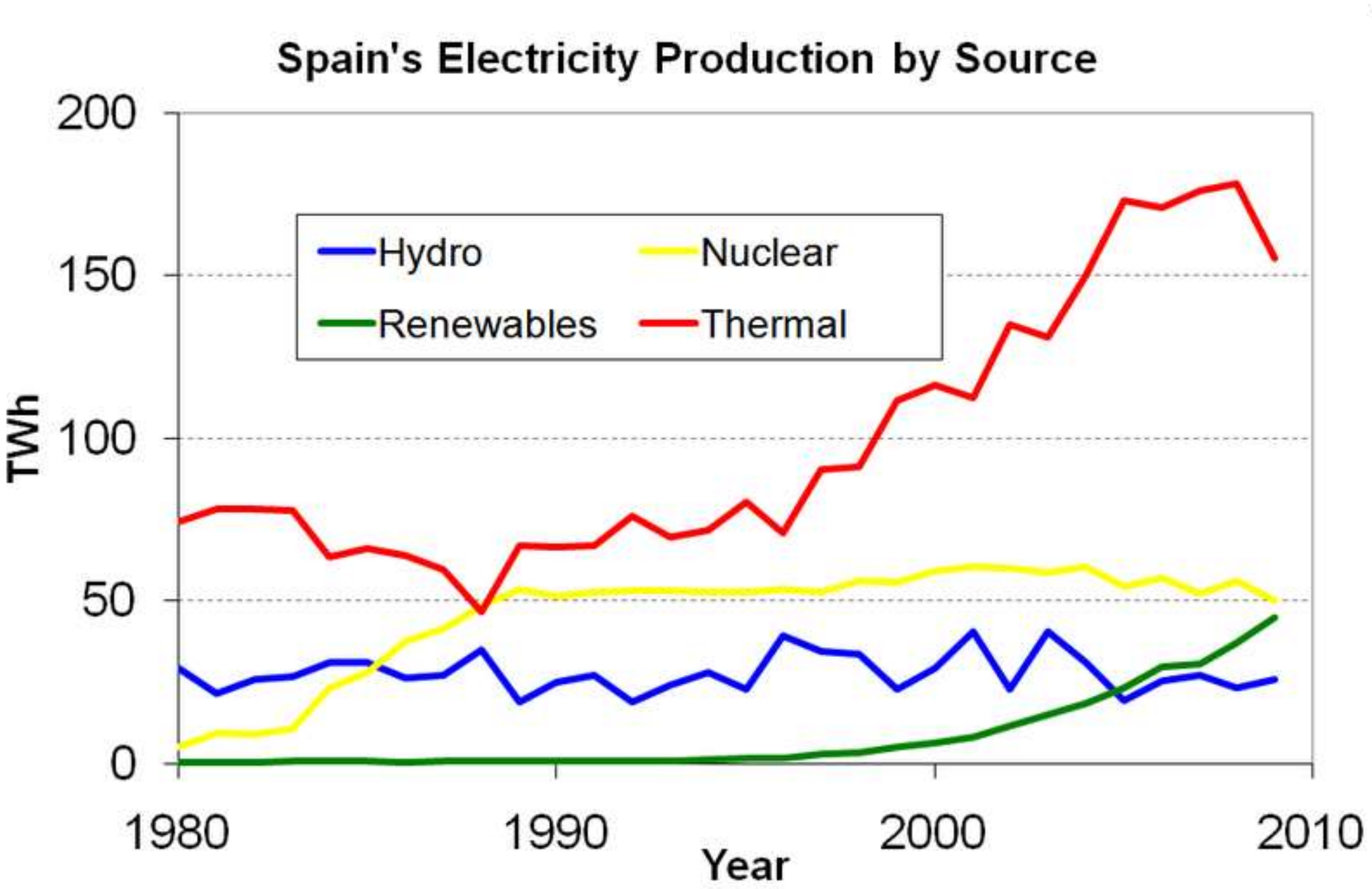
High salinity will also lead to a unique halophilic flora and fauna in the lake in question; sometimes, in fact, the result may be an absence or near absence of life near the salt lake.

Artisan salt-minning during the XVII-XVIII centuries

RESOURCES

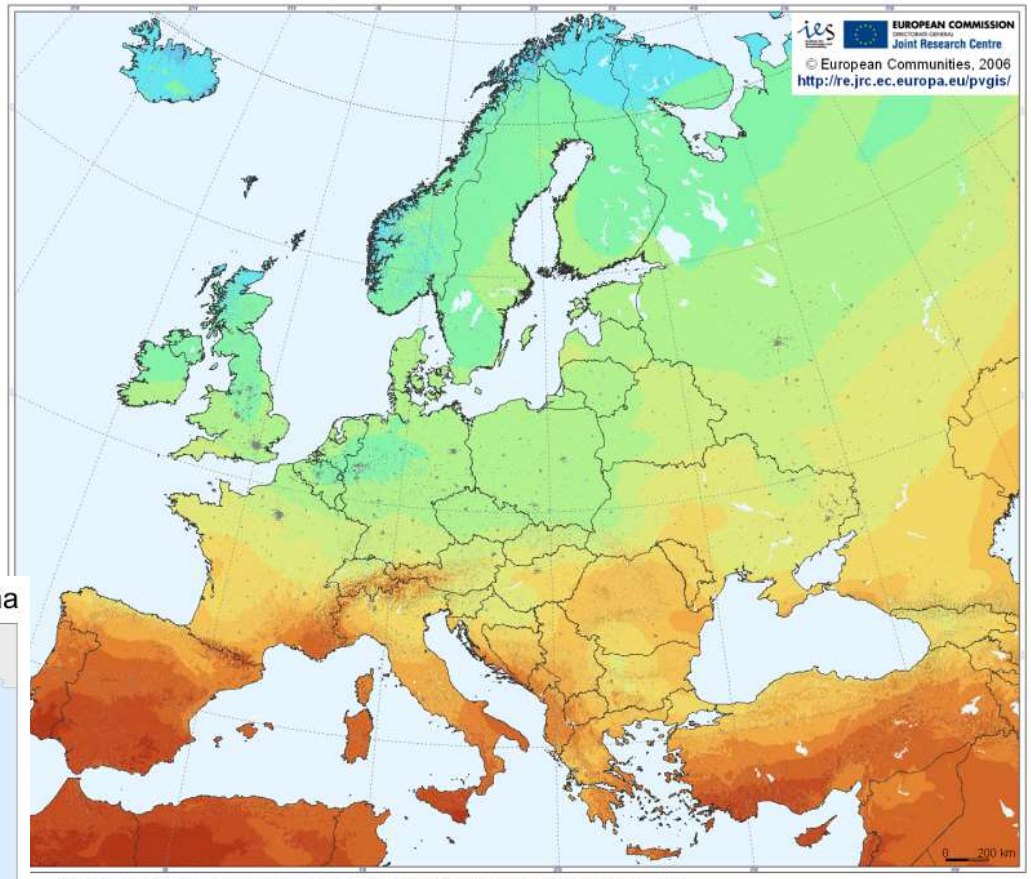



For Three Men
The Civil War
Wasn't Hell.
It Was
Practice!
CLINT EASTWOOD
"THE GOOD,
THE BAD AND
THE UGLY"
LEE VAN CLEEF
ELI WALLACH
SERGIO LEONE
TECHNISCOPE TECHNICOLOR

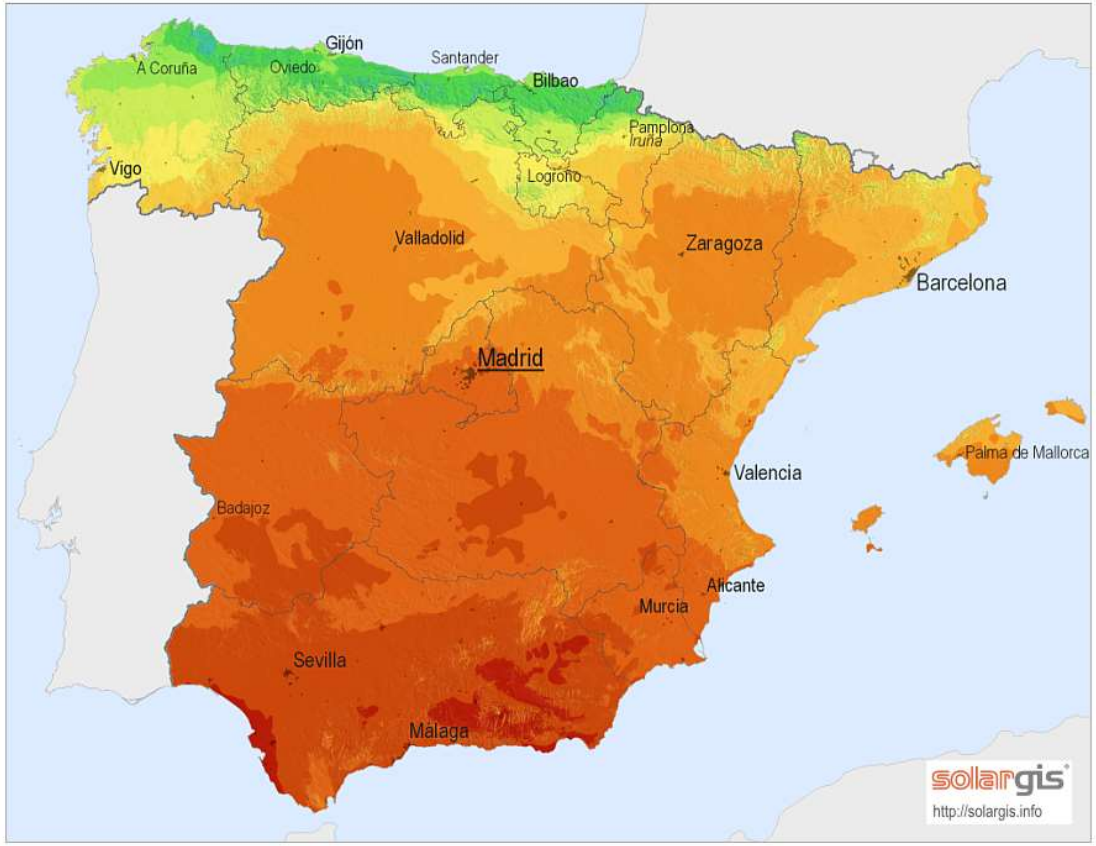

Spain's Electricity Production by Source
200
150
100
50
0
TWh
Hydro
Nuclear
Renewables
Thermal
1980
1990
2000
2010
Year

SOLAR RADIATION

Photovoltaic Solar Electricity Potential in European Countries



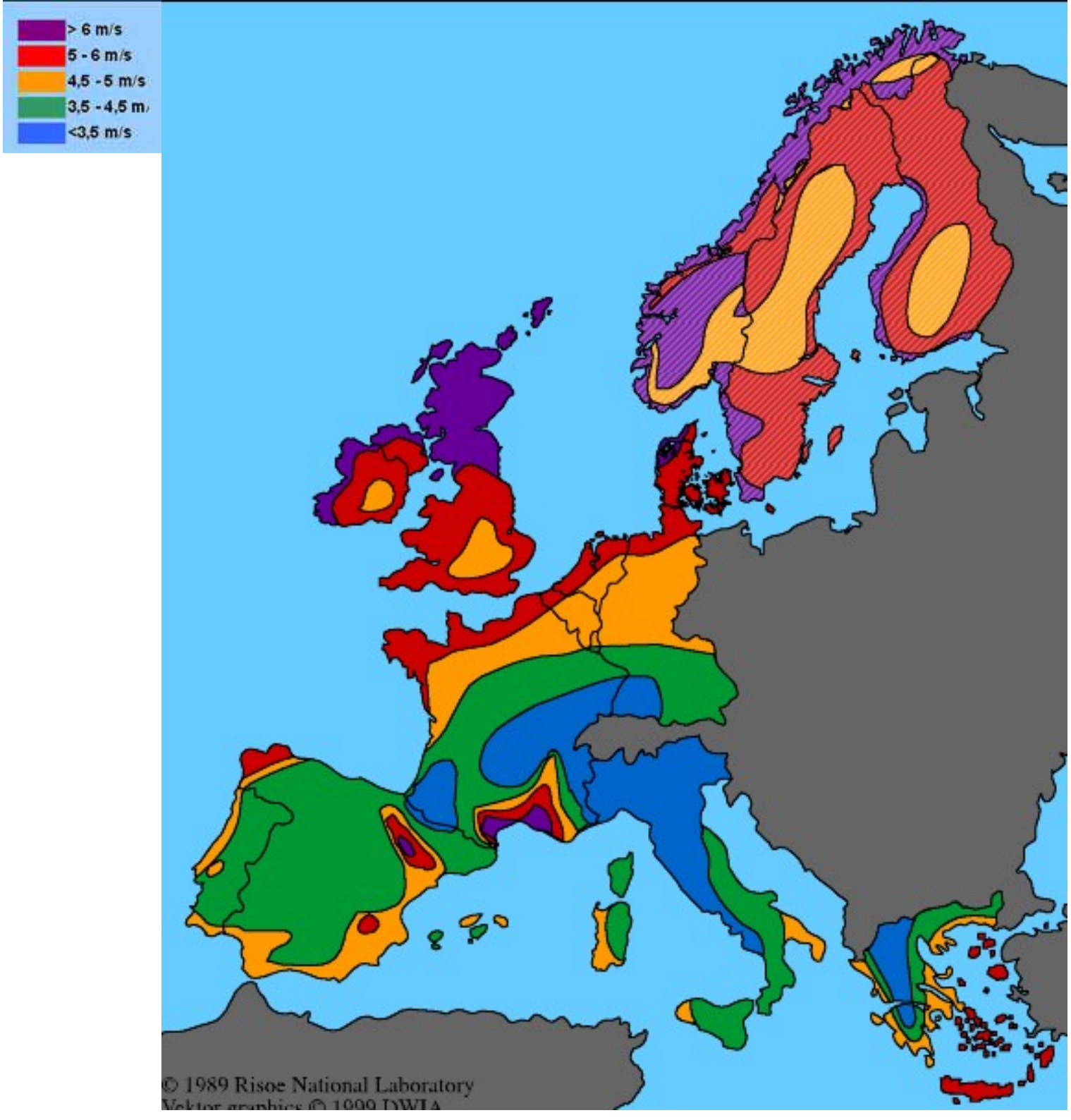
Irradiación global horizontal España



Suma promedio anual (4/2004 - 3/2010)

< 1200 1350 1500 1650 1800 1950 kWh/m²

0 50 100 km



WIND FARMS


EL MAPA EÓLICO EN ESPAÑA
De más a más
Potencia de generación eólica instalada en España y diversas proyecciones para 2010 según fueron publicadas. Datos en megavatios
1999 1.585
2000 2.198
2001 3.389
2002 4.879
2003 6.206
2004 8.504
2005 10.028
2006 11.623
2007 15.131
2008 16.740
2010 20.155
Plan de fomento de las renovables 1999: 8.974 MW
Plan de infraestructuras 2002: 13.000 MW
Plan de energías renovables 2005-2010: 20.155 MW
Potencia acumulada por CCAA a 1 de enero de 2009. Datos en megavatios (Mw)
304,30
17,85
152,77
958,77
3.145,24
446,62
1.749,31
420,64
3.134,04
3.405,60
710,14
3,55
262,31
1.794,99
134,09

https://www.youtube.com/watch?v=vXNW_yhHl5o

https://www.youtube.com/watch?v=Fz32nY6wKv4&nohtml5=False

https://www.youtube.com/watch?v=QnIXrPDdAeU&nohtml5=False

https://www.youtube.com/watch?v=x5HLKwOhWjU

https://www.youtube.com/watch?v=NJ4bnrDiV5I

https://www.youtube.com/watch?v=jGM7yx45cbU