

MAPPING SKILLS

FUN WITH MAPS

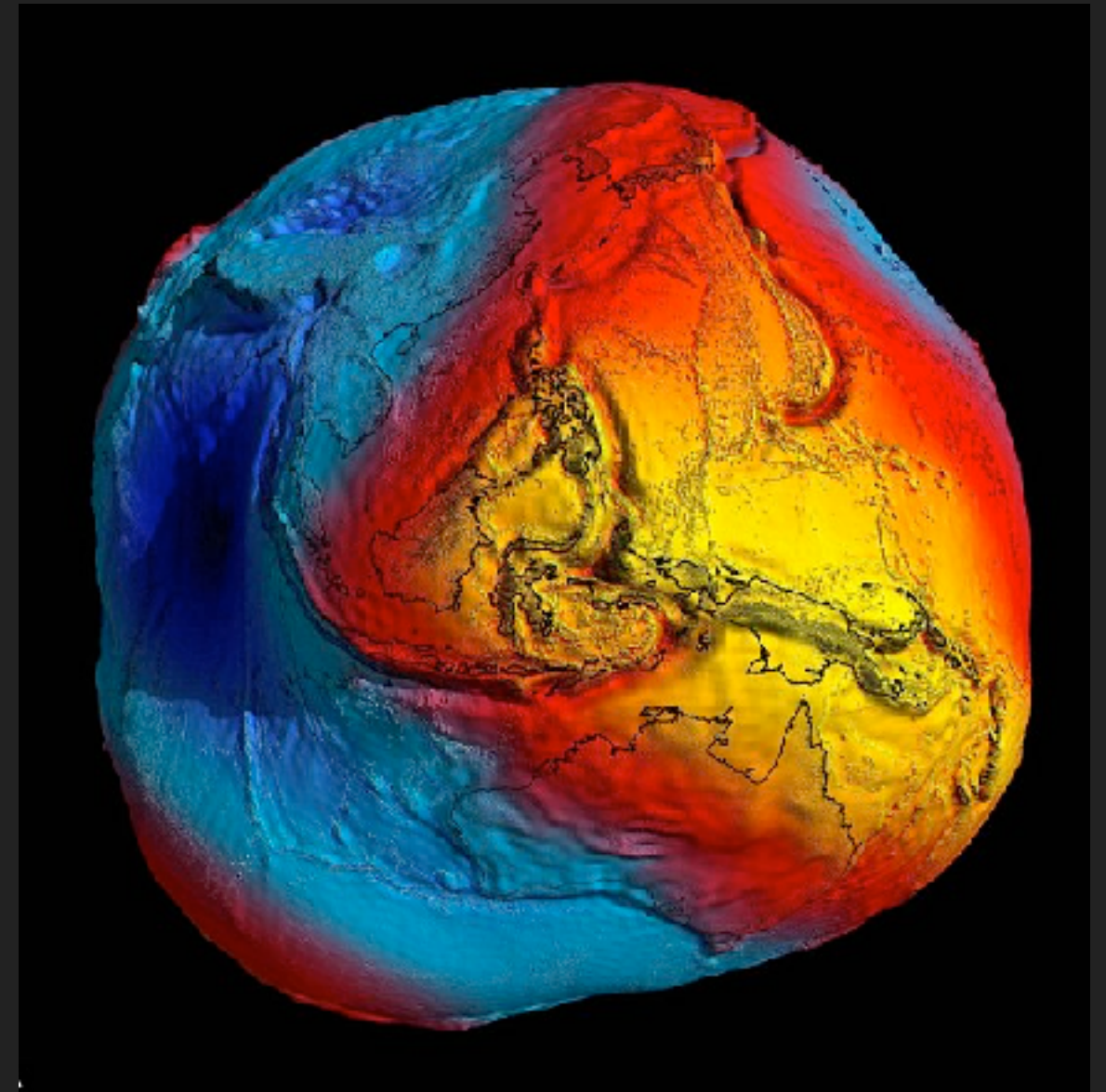
MAPPING SKILLS

- ▶ **10 - 15 minutes per night reviewing what is covered in class or areas of difficulty. Practice is important.**
 - ▶ **Kleeman, G. "Skills in Australian Geography" - practice what you need, not every question.**

- 1. Map projections**
- 2. Types of maps**
- 3. Topographic maps**
- 4. Marginalia**

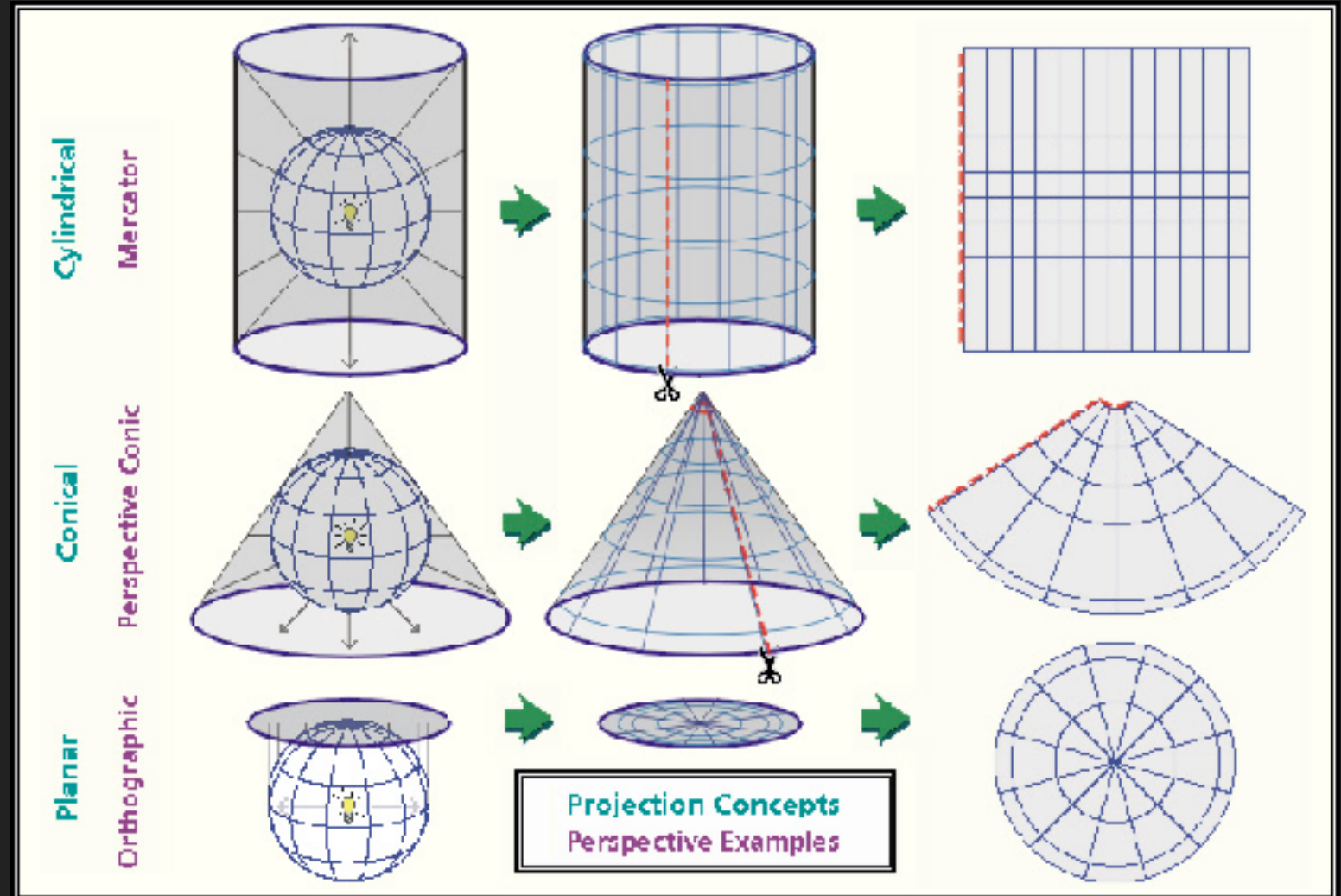
MAP PROJECTIONS

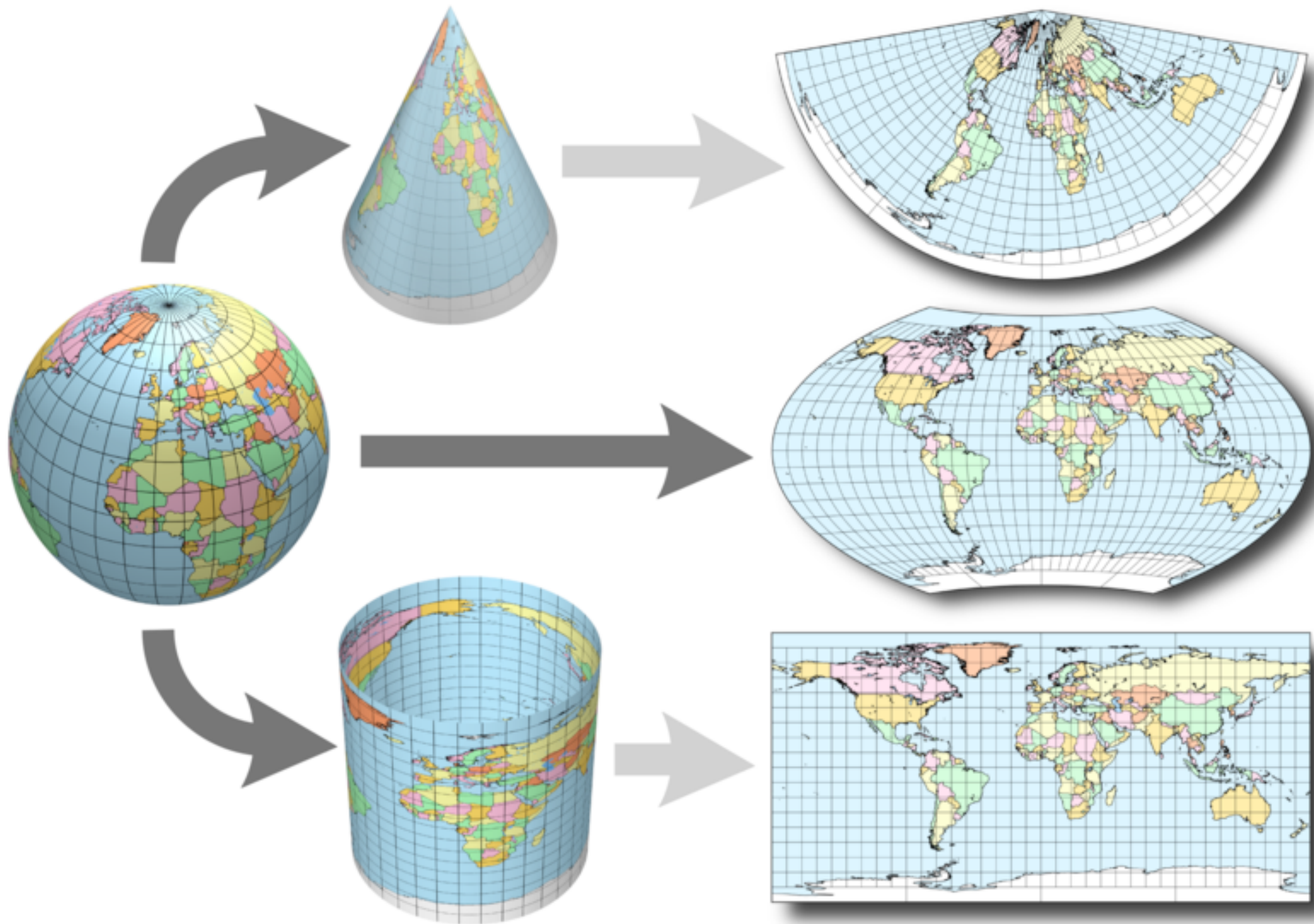
- ▶ The earth is not round - it is a lumpy potato!
- ▶ Map projections attempt to translate an irregular three-dimensional shape to a flat surface.
- ▶ All maps will show some distortion of angular conformity, distance or area



MAP PROJECTIONS

- ▶ There are three main families of map projections
 - ▶ Cylindrical projections
 - ▶ Conical projections
 - ▶ Planar or azimuthal projections



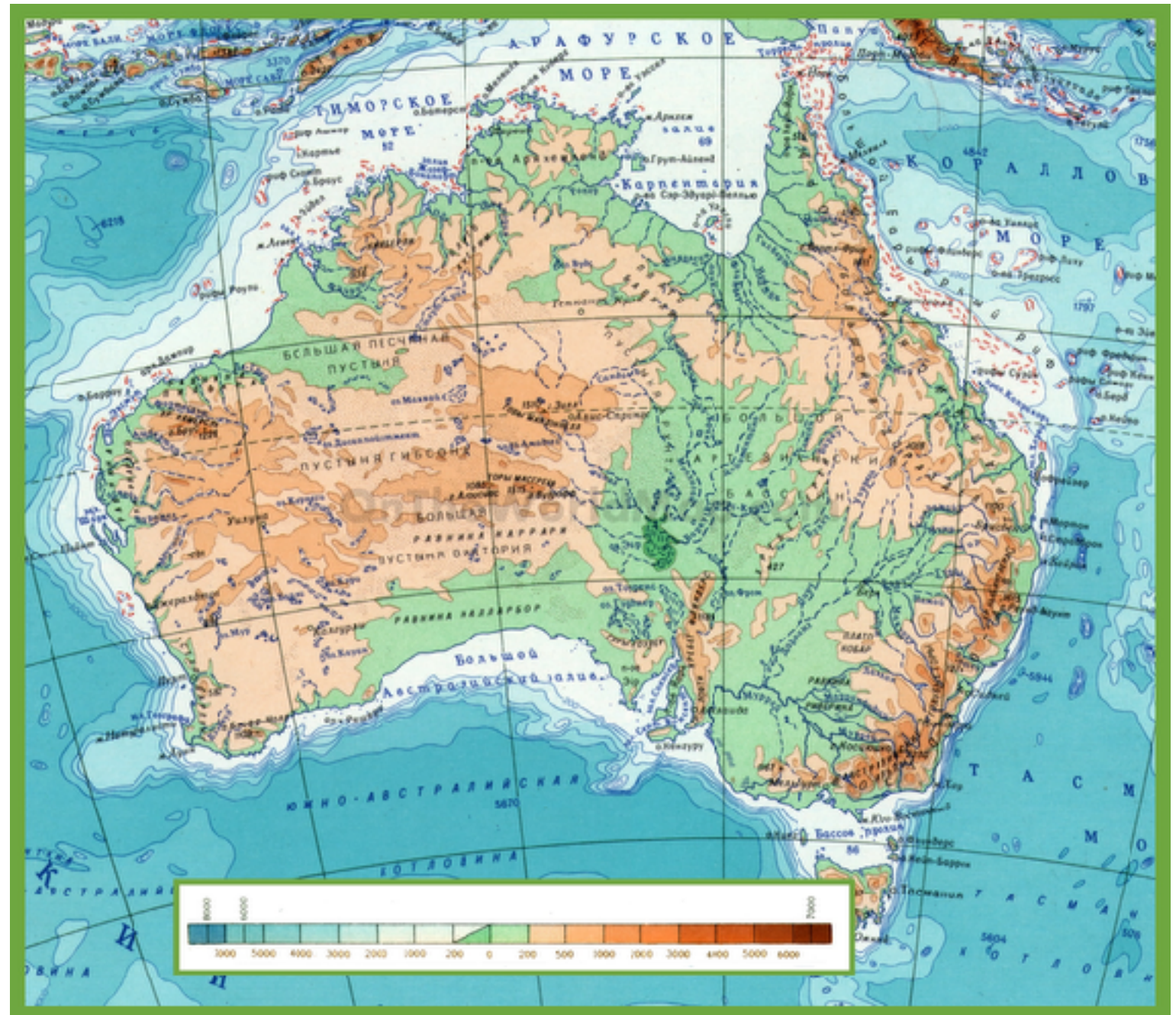


TYPES OF MAPS

- ▶ **Two basic types of maps:**
 - ▶ **Maps that summarise the landscape (topographic & general reference maps)**
 - ▶ **Maps that describe or comment on the landscape (all other maps - often called 'thematic' maps)**
 - ▶ **Physical maps** - physical landscape features
 - ▶ **Political maps** - government boundaries of countries, nations
 - ▶ **Social maps** - social aspects of the human population
 - ▶ **Synoptic maps** - used to display weather conditions
 - ▶ **Climate maps** - climatic data

TYPES OF MAPS

PHYSICAL MAP OF AUSTRALIA



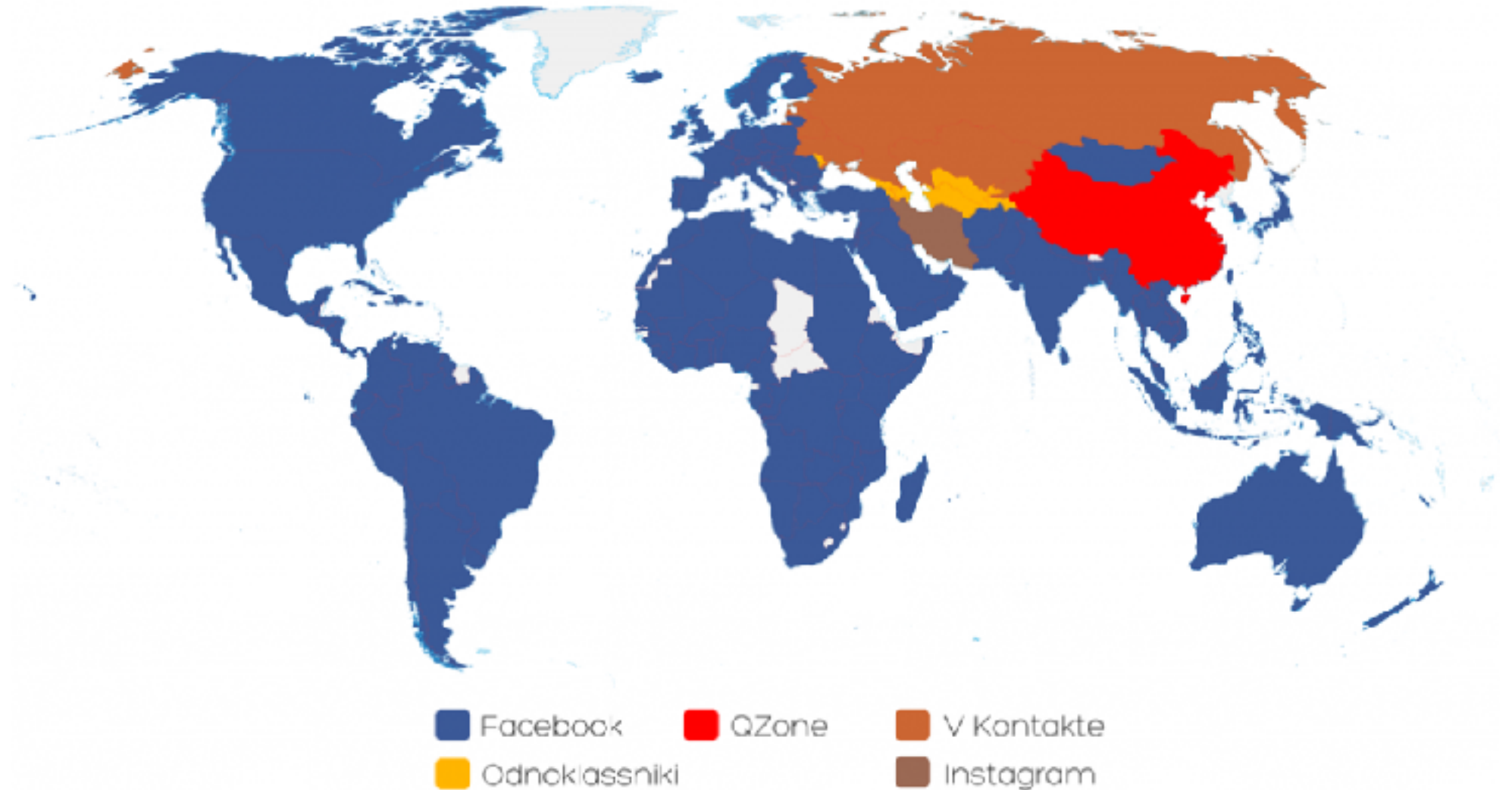
POLITICAL MAP OF AUSTRALIA



SOCIAL MAPS

WORLD MAP OF SOCIAL NETWORKS

January 2018

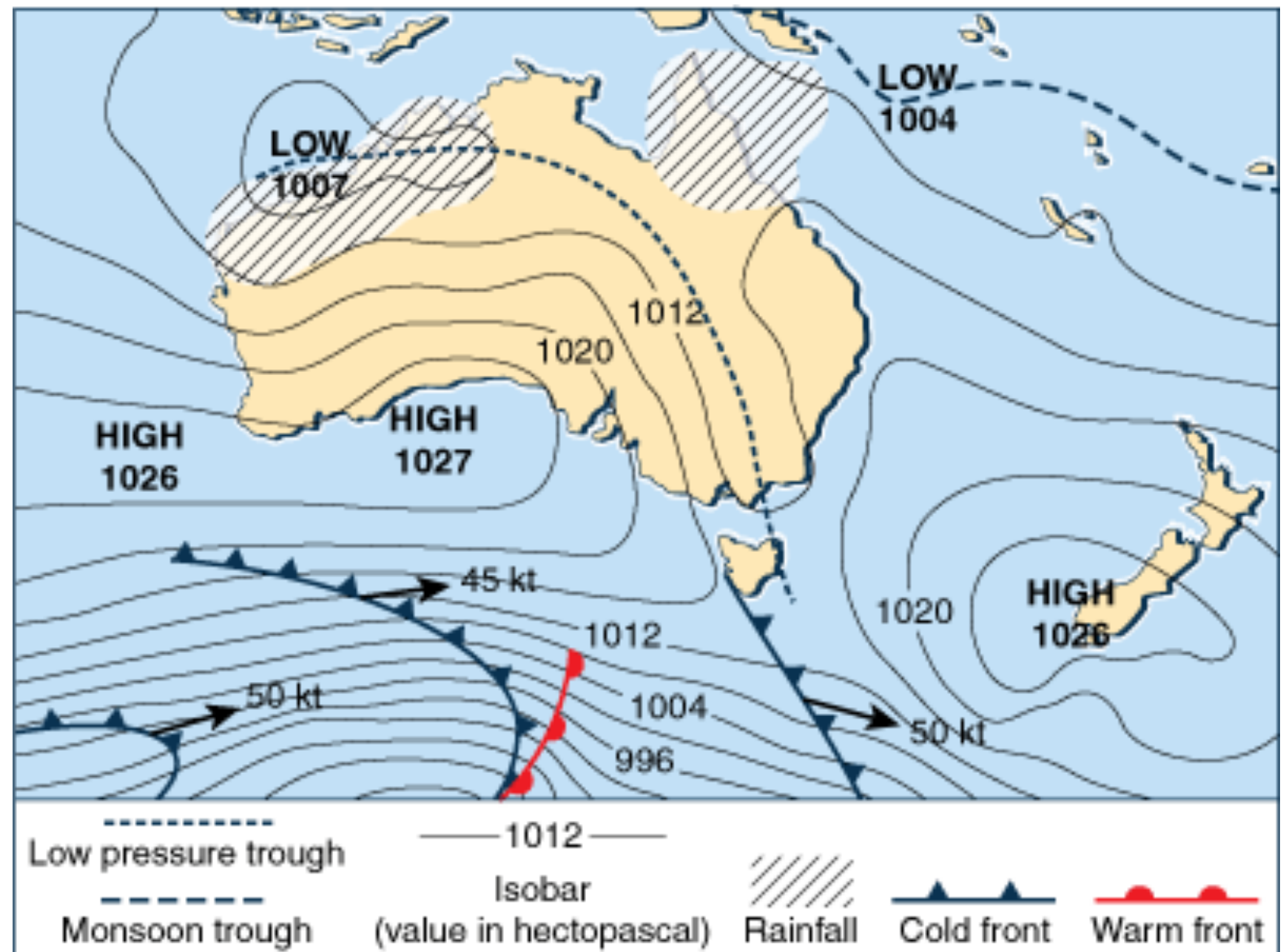


credits: Vincenzo Cosenza vincos.it

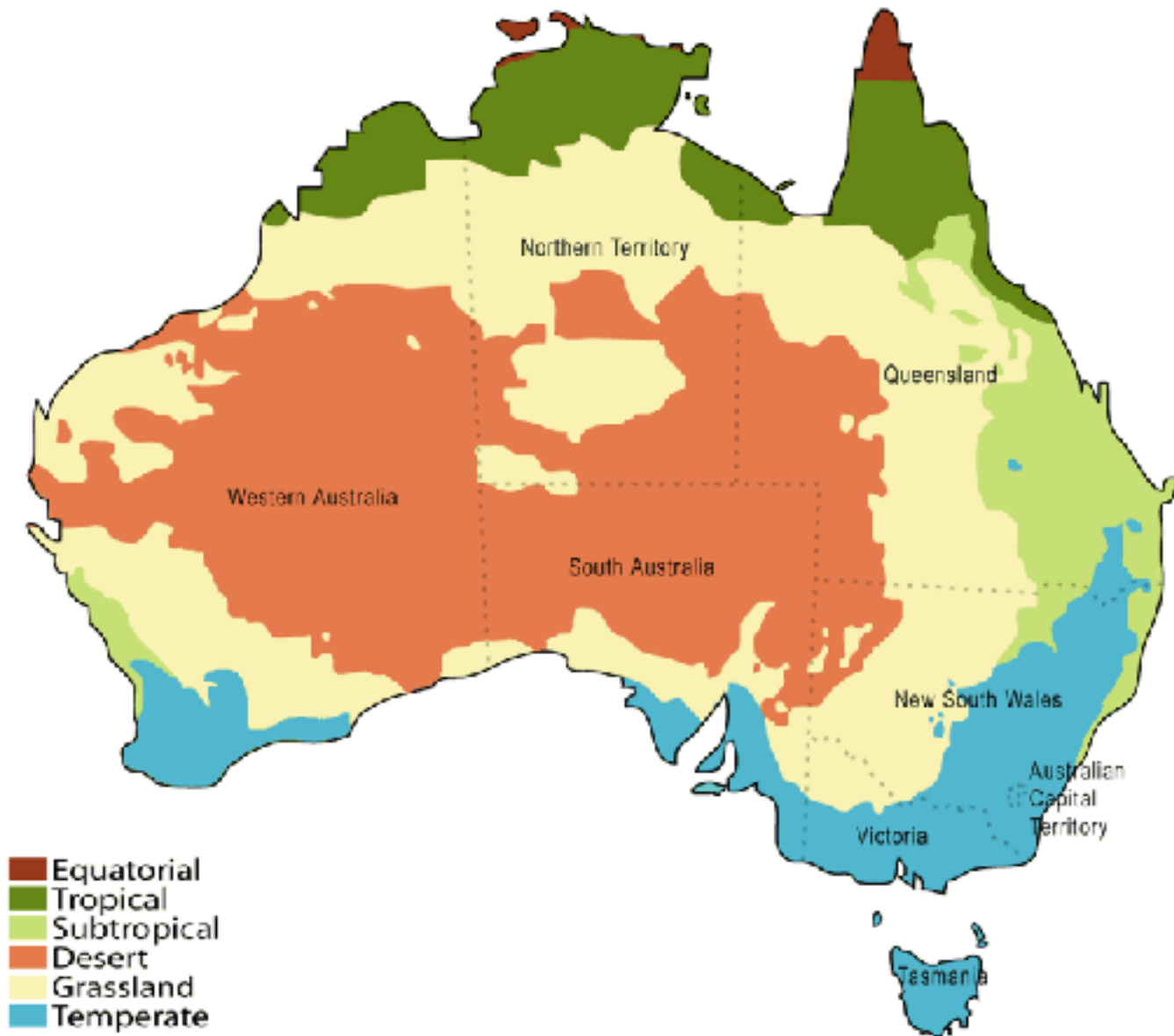
license: CC-BY-NC

source: Alexa/SimilarWeb

SYNOPTIC MAP



CLIMATE MAP OF AUSTRALIA



STATISTICAL DATA

- ▶ Maps can also be used to display statistical data
 - ▶ isoline/isopleth maps use isolines (lines of equal value) and isopleths (regions of equal value) to show continuous data. Sometimes referred to as isopleth maps
 - ▶ Choropleth maps: use shading and colour to show average density or concentration of features such as population.
 - ▶ Proportional circle maps: use symbols of different sizes to represent data associated with particular areas/locations within the map
 - ▶ Overlay maps: data is added to maps in layers; electronic form is GIS
 - ▶ Dot distribution maps: used to illustrate the distribution and density of a particular feature

ISOLINE/ISOPLETH MAPS

ISOLINES join places of equal value.

ISOTHERMS - temperature

ISOBARS - atmospheric pressure

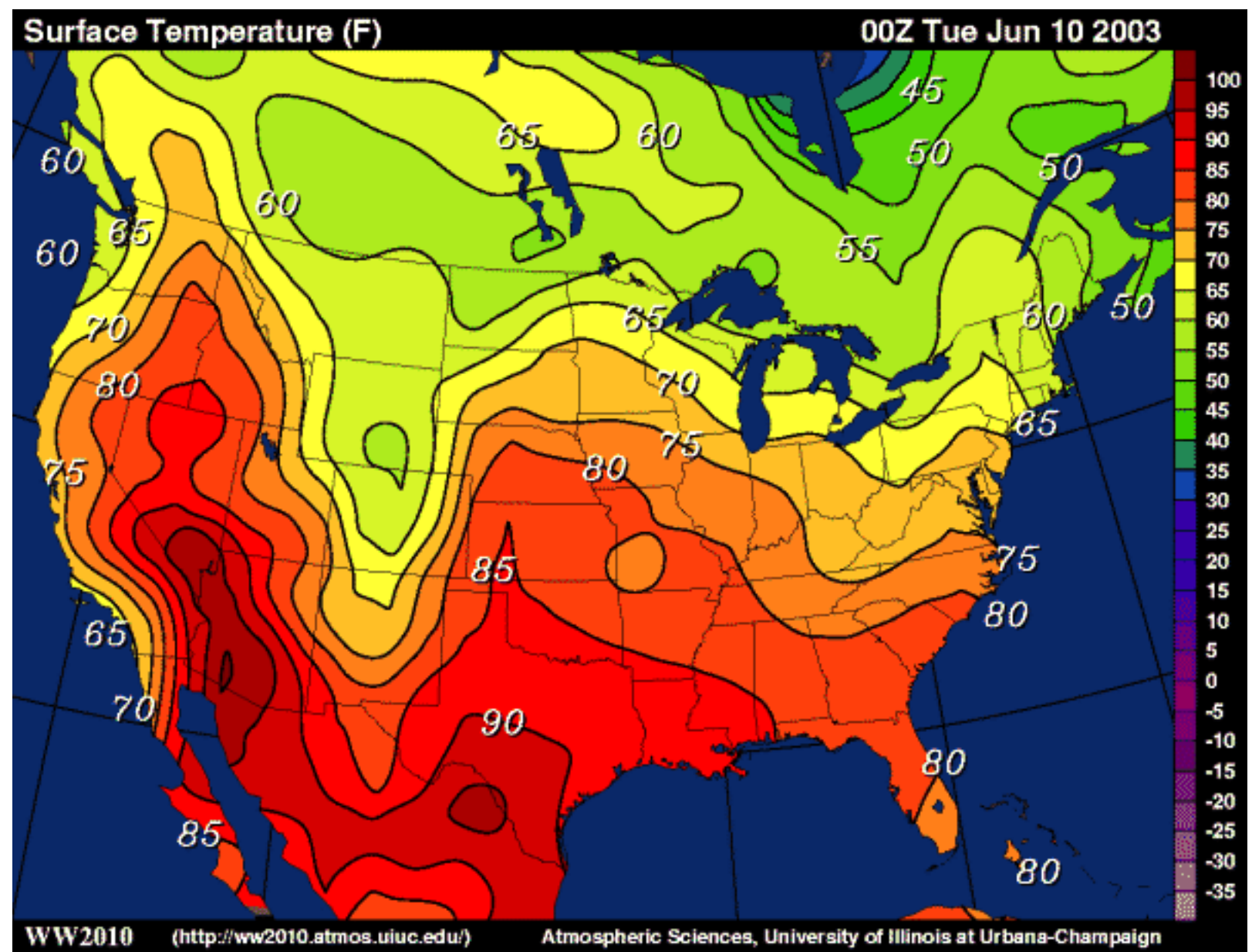
ISOHEIGHTS - more commonly referred to as contour lines

ISOBATHS - depth or bathymetry

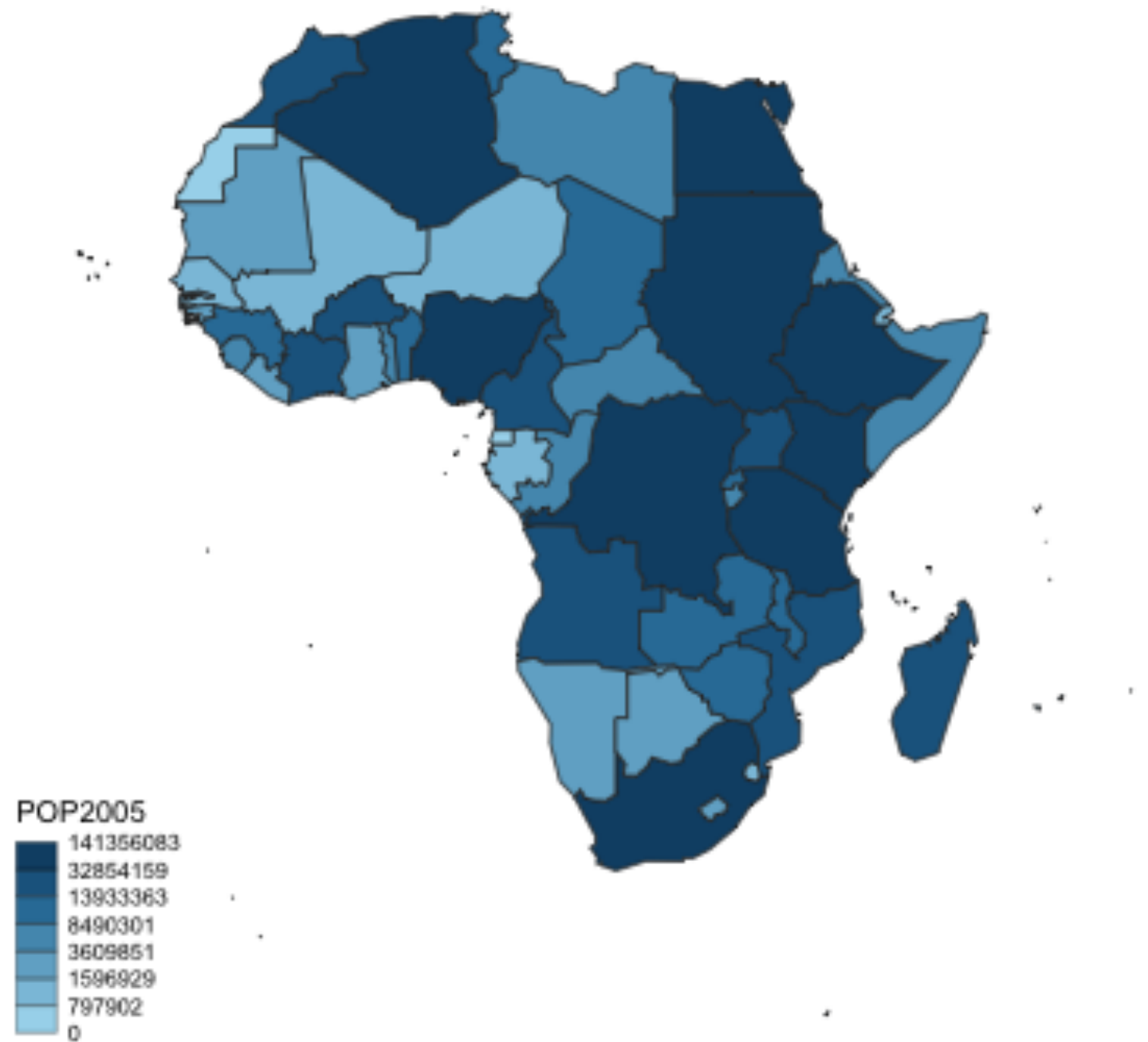
ISOHALINE - salinity

ISOPYCNALS - rainfall

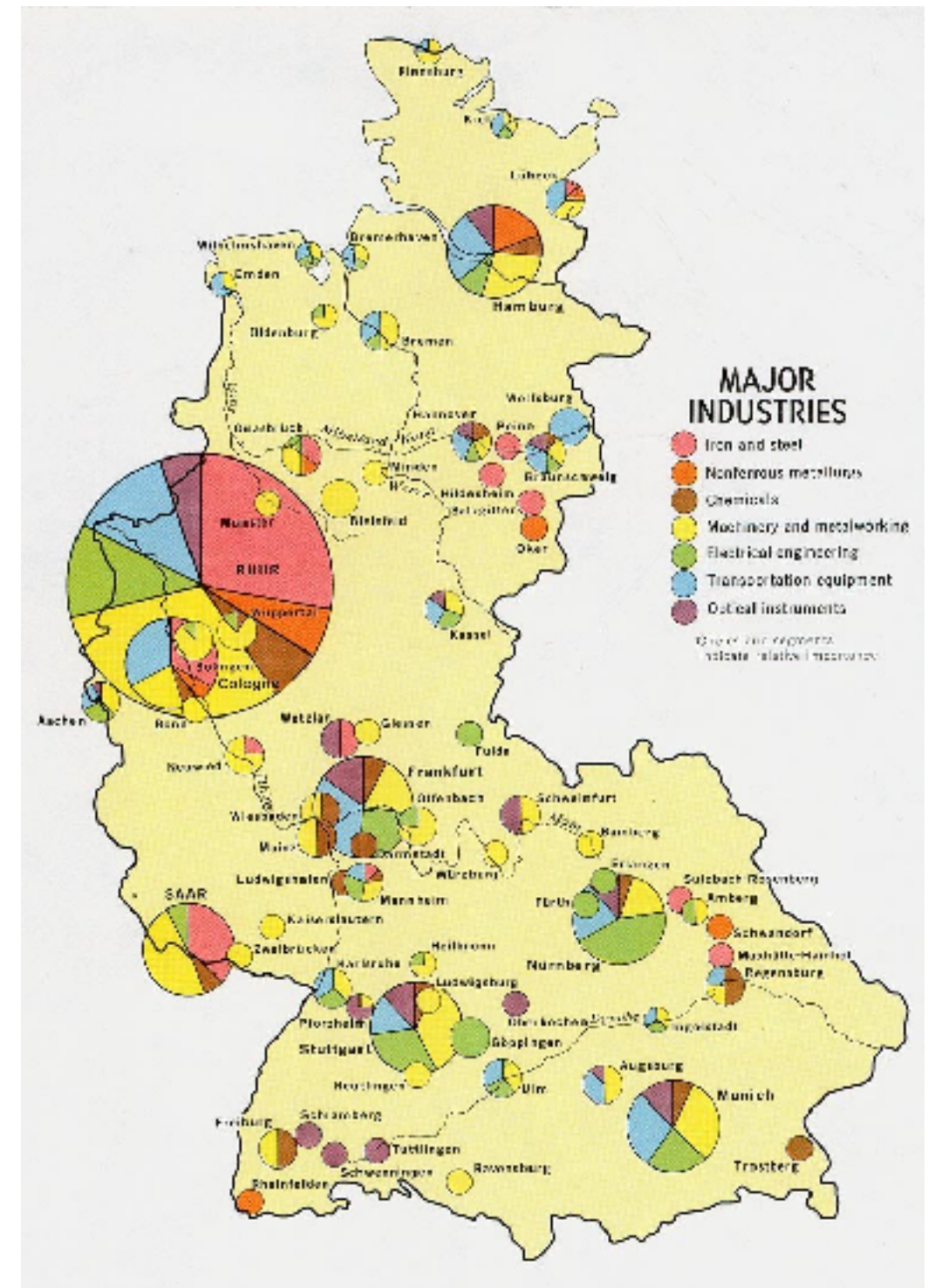
ISOTACHS - windspeed



CHOROPLETH MAPS

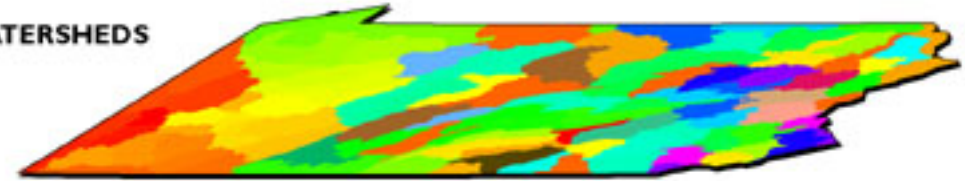


PROPORTIONAL CIRCLE MAPS

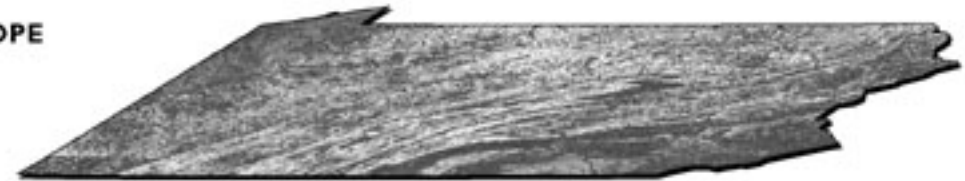


OVERLAY MAPS

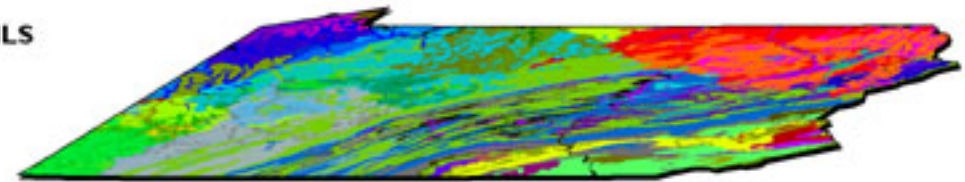
WATERSHEDS



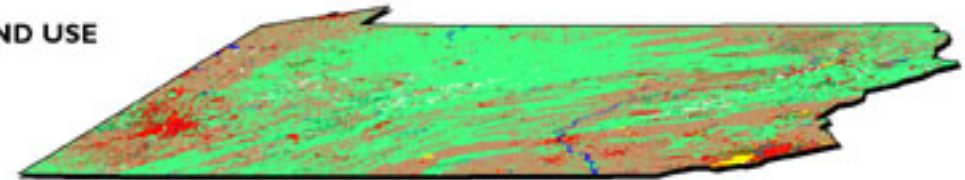
SLOPE



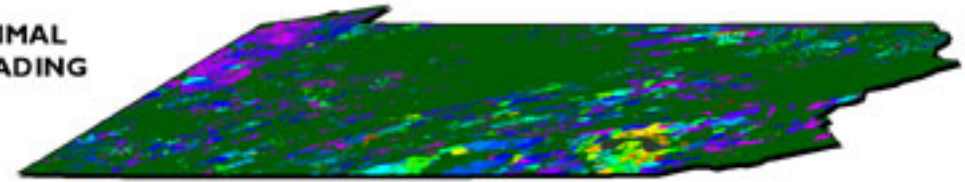
SOILS



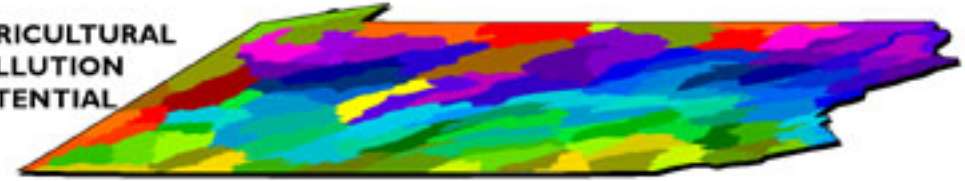
LAND USE



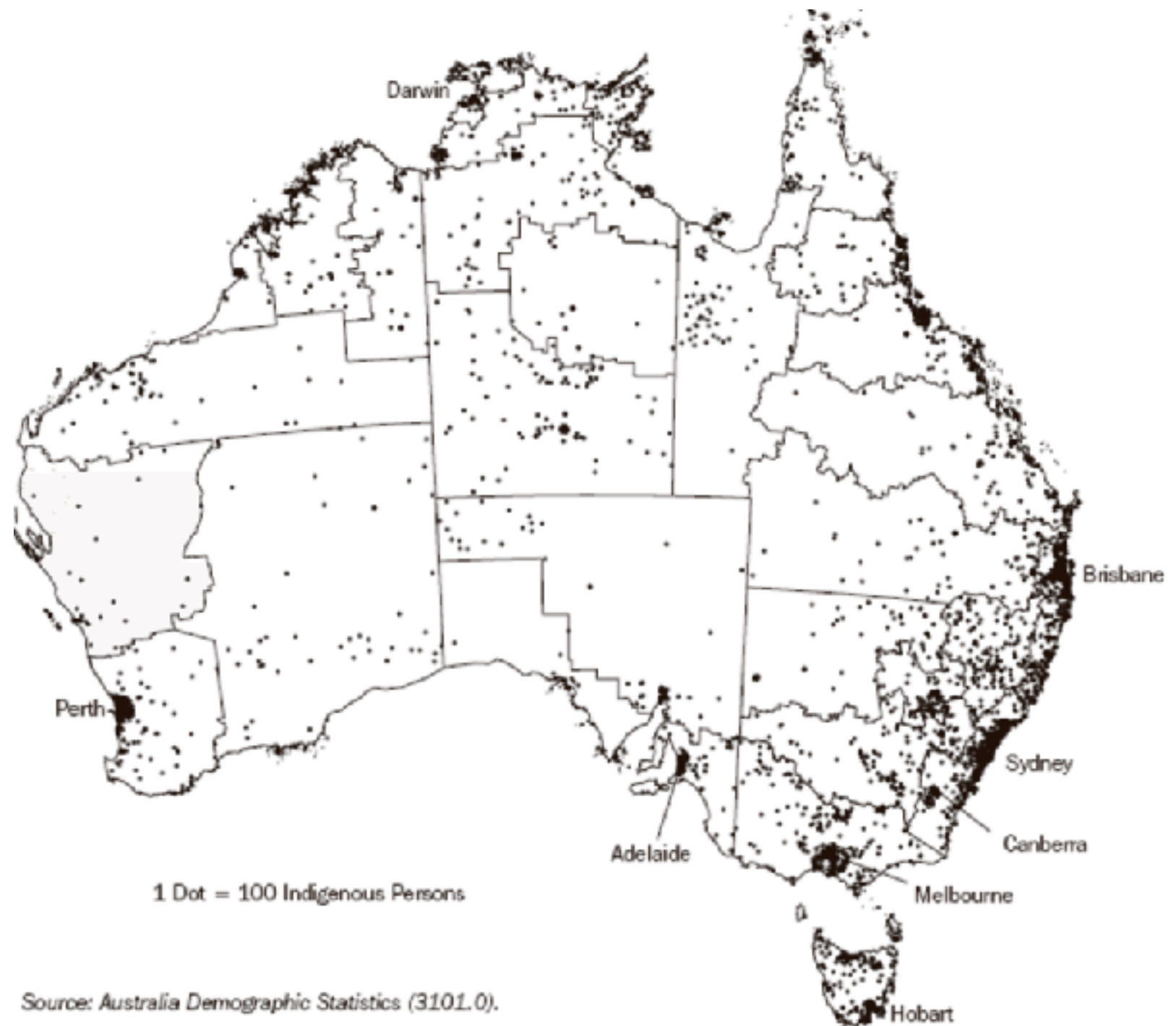
ANIMAL
LOADING



AGRICULTURAL
POLLUTION
POTENTIAL



DOT DISTRIBUTION MAP



TOPOGRAPHIC MAPS


- ▶ Topographic maps are detailed, accurate graphic representations of features that appear on the Earth's surface. These include:
 - ▶ **CULTURAL**: generally shown in red or black and include roads, buildings, urban development, railways, airports, names of places and geographic features, administrative boundaries, state and international borders, reserves
 - ▶ **HYDROGRAPHY**: water features are generally shown in blue and include lakes, rivers, streams, swamps, coastal flats
 - ▶ **RELIEF**: generally brown is used for contour lines to show landforms such as mountains, valleys, cliffs, depressions
 - ▶ **VEGETATION**: green is used to show wooded and cleared areas, vineyards and orchards. A map
- ▶ **LEGEND** (or key) lists the features shown on that map, and their corresponding symbols. The feature is named relative to its position in the legend.

CULTURAL FEATURES

ROADS





Road surface (sealed and unsealed) is indicated by full or broken lines. Classification is based on function, not road width.

Access, particularly via minor roads and vehicle tracks, may be subject to private property restrictions, weather conditions, surface quality and locked gates.

-  **Dual carriageway:** Divided highways, freeways, tollways or other major roads with separated carriageways.
-  **Principal road:** Highways and major through-routes as well as major connecting roads.
-  **Secondary road:** Connecting roads between major roads and/or population centres.
-  **Minor road:** Scale may dictate that only some of these local area access roads can be shown in settled areas and that only some are named.
-  **Vehicle track:** Public or private roads with minimum or no construction. Where fences and farm tracks are side by side, only one of these features is shown.
-  **Foot track:** A track designed to carry pedestrian traffic only

RAILWAYS

Some railway lines and some railway stations may not be shown within built-up areas.

-  **Multiple track; Single track:** Indicated by double or single bar symbology.
-  **Abandoned railway:** Non-operating but not dismantled lines. Dismantled lines are not shown.
-  **Light railway:** A lightly constructed line, eg sugar cane railway, scenic railway or monorail.
-  **Railway station or siding:** A recognised stopping place for trains for loading passengers or freight.

ROAD & RAILWAY ASSOCIATED FEATURES

-  **Bridge:** A structure erected over a depression or

CULTURAL FEATURES

-  **Powerline:** Wire or wires supported on poles, towers or pylons, used for the transmission of high voltage electricity.
-  **Substation:** A feature associated with the generation and distribution of electricity.
-  **Pipeline - above ground; underground:** A pipe used for carrying gases and/or liquids.
-  **Storage tank:** A large vessel for the storage of liquids or gas (not water) often associated with refineries or chemical plants.
-  **Gas or oil well:** A pipe sunk in the ground for the purpose of obtaining subterranean oil or gas.
-  **Water tank:** A construction at or below ground level to contain water.
-  **Homestead/Outstation:** A residence or large building in a rural area.
-  **Building/s:** A group of buildings that cannot be shown individually may be shown by a representative pattern. Very large buildings may be shown to scale.
-  **Golf course; Cemetery:** Only significant features are shown.
-  **Lookout; Tower; Wind turbine; Silo; Chimney:** Structures taller than 45 metres are labelled with a height if known.
-  **Yard; Fence:** Vermin proof fences are labelled. Property fences are omitted when side by side with a road or track.
-  **Levee:** A wall higher than 2 metres to restrain floodwaters or to contain irrigation or other water.
-  **Mine - large open cut; operating; non-operating:** The point symbol may be used to indicate a small group of mines. Small quarries and scrapes are not shown.
-  **Seismic line:** A graded line in a straight path.

ADMINISTRATIVE BOUNDARIES

-  **State/Territory border:** Borders that do not follow

RELIEF FEAT

-  
- 
-  **• 500 1502**
-  **• 1502** **• 904**
-  *** The Spire**
-  **• Carey's Cove**
- 
- 

OFFSHORE



NATURAL FEATURES – HYDROGRAPHY

type with a

road, with a

in water.

ring: The ill group of town.


ollow surveyed

line of

ry, or for es, fossils, This

me xility.

is likely to ieve.



between the joints, faults and gilgai or broken stone that is difficult or impassable for vehicles.

Rocky outcrop: An area of large rocks or boulders.

OFFSHORE & COASTAL FEATURES

Saline coastal flat: A nearly level tract of land between mean high water and the line of highest tide.

Foreshore flat: A seabed or estuarine area between mean high water and the lowest tide.

Wreck: Visible wrecks, as well as submerged features which are a danger to shipping and those of historic significance, are shown.

Lighthouse: A building or structure housing a light used as a navigation aid. Lighthouses are shown for their landmark value and may not be operational.

Boat ramp: A sloping construction to facilitate launching or retrieving vessels from water.

Navigation light: Only significant or prominent lights are shown. Users should refer to Hydrographic Charts for a comprehensive display of these features. Note that this map should not be used for navigational purposes.

Mangrove: Land between low and high water vegetated with mangrove plants.


Tidal ledge; Reef or shoal: Rock, coral or sand exposed between mean high water and approximate lowest tide, visually prominent or a shipping hazard.

Breakwater: A solid structure to break the force of waves to protect an anchorage.


Wharf; Jetty or pier: A structure used as a promenade or platform for loading passengers or cargo.

Rock, bare or awash: A hazard to shipping.


HYDROGRAPHIC FEATURES




Watercourse: A natural channel along which water may flow from time to time. The rainfall graph in the map marginalia is provided to assist map users to assess the likelihood of water.




Canal or drain: An artificial watercourse used for inland navigation, domestic water supply, irrigation or drainage.




Waterfall: A sudden descent of water over a step or ledge in the bed of a watercourse.




Lock: An enclosure in a water body with gates at both ends to raise or lower the water level to enable vessels to pass from one level to another.




Spillway: A channel or duct formed around the side of a reservoir past the end of a dam, to convey flood discharge from the watercourse above the reservoir into the watercourse below the dam.




Perennial waterbody; Reservoir; Non-perennial lake: Those features which hold water for at least nine years out of ten, are classed perennial.




Bore/Well; Tank/Small dam; Windpump; Dam wall: Built water-producing and/or holding features. Where a windpump and other water features are situated together, only the windpump is shown, as it usually has the greater landmark value.




Waterhole; Spring: Naturally occurring water features.



Settling pond: Shallow beds, usually segmented by constructed walls, for the treatment of sewage or other wastes, or used for aquaculture.






















Land subject to inundation: Land regularly covered with floodwater for short periods.



Swamp: Land saturated with water that it is not suitable for agricultural or pastoral use.

NATURAL FEATURES – RELIEF

	RELIEF FEATURES	VEGETATION
orted on poles, towers sion of high voltage		 Forest or rainforest canopy cover
d with the generation		 Rainforest 25 metres
ground: A pipe used ks.		 Windbreak the force of
r the storage of liquids ted with refineries or		 Pine plantation trees.
the ground for the can oil or gas.		 Orchard; orderly plantations
or below ground level		 Parkland
dence or large building		
s that cannot be shown a representative ay be shown to scale.		 Built-up area close together infrastructure larger built-up
significant features are		 Locality: 100 people
Silo; Chimney; are labelled with a		
res are labelled.		 Watercourse may flow

NATURAL FEATURES – VEGETATION

Depression contour: Lines
y line on the ground, joining
in relation to the Australian
values face uphill.

Spot elevation: A point on the ground
survey. Only
m.

Contour interval: The difference in
elevation is determined

Spot elevations: that best
of slope and high and low

Spire-shaped rock: All slender spire-shaped rock.

Subterranean: Mouth of a subterranean

Cliff: Significant or overhanging face of



Ridges: Areas of loose sand
rescent-shaped (generally
vinds) or longitudinal
vailing winds) respectively.

Fractures: Area characterised by fractures,
r broken stone that is difficult

VEGETATION

-  **Forest or scrubland:** An area with greater than 20% canopy cover of trees or scrub.
-  **Rainforest:** Dense mixed forest generally in excess of 25 metres high and having greater than 85% cover.
-  **Windbreak:** Lines of trees or scrub positioned to break the force of the prevailing wind.
-  **Pine plantation:** An orderly planting of coniferous trees.
-  **Orchard; Vineyard; Plantation other than pine:** An orderly planting of trees, bushes or vines.
-  **Parkland:** Significant recreational areas.

POPULATION CENTRES

-  **Built-up area (BUA):** An area where buildings are close together and have associated road and other infrastructure. A selection of suburbs may be named in larger built-up areas if space allows.
-  **Locality:** A named place with a population about 200 people.

HYDROGRAPHIC FEATURES

TOPOGRAPHIC MAPS

LEGEND

<i>Legend</i>	
	sealed unsealed
Principal road; Built-up area; Locality.....	
Secondary road; Bridge; Causeway.....	
Minor road (access & condition not assured).....	
Vehicle track (access & condition not assured).....	
Dual carriageway; Distance in kilometres.....	
Route marker: National, State.....	
Gate; Stock grid.....	
Embankment; Cutting.....	
Airport; Landing ground; Helipad.....	
Multiple track railway; Station or siding.....	
Single track railway; Bridge; Tunnel.....	
Powerline (110kV and over).....	
Homestead; Building/s; Ruin.....	
Fence; Levee; Open cut mine.....	
Mine; Windpump; Yard.....	
Contour with value; Depression contour.....	
Horizontal control point; Spot elevation.....	
Sand; Sand dunes.....	
Sand ridges; Pinnacles; Cliff.....	
Forest, wood or scrubland; Rainforest.....	
Pine plantation; Urban recreation parkland.....	
Orchard, plantation or vineyard; Windbreak.....	
Watercourse (presence of water not implied).....	
Perennial lake; Non-perennial lake.....	
Bore or well; Spring; Tank or small dam.....	
Subject to inundation; Swamp.....	
Saline coastal flat; Wreck, bare or awash.....	
Foreshore flat; Lighthouse.....	
Mangrove; Tidal ledge or reef; Shoal.....	
Breakwater; Rock, bare or awash.....	
Wharf; Jetty or pier.....	
State or Territory border.....	
Reserved area boundary.....	
Prohibited area boundary.....	

MARGINALIA

- ▶ **Maps consist of two components;**
 - ▶ **The 'face of the map**
 - ▶ **Marginalia - information about the map**
- ▶ **No rules as to what marginalia should accompany a map or how it is shown; there are, however, some well-recognised principles**
 - ▶ **BOLTSS**
 - ▶ **Grids and graticules**

ORIENTATION

- ▶ The orientation of a map refers to the relationship between the directions on the map and the corresponding compass direction in reality.
- ▶ May be shown in a number of ways:
 - ▶ An arrow pointing North
 - ▶ Compass Rose
- ▶ Direction may also be shown using bearings

COMPASS ROSE



CARDINAL POINTS: North, South, East, West

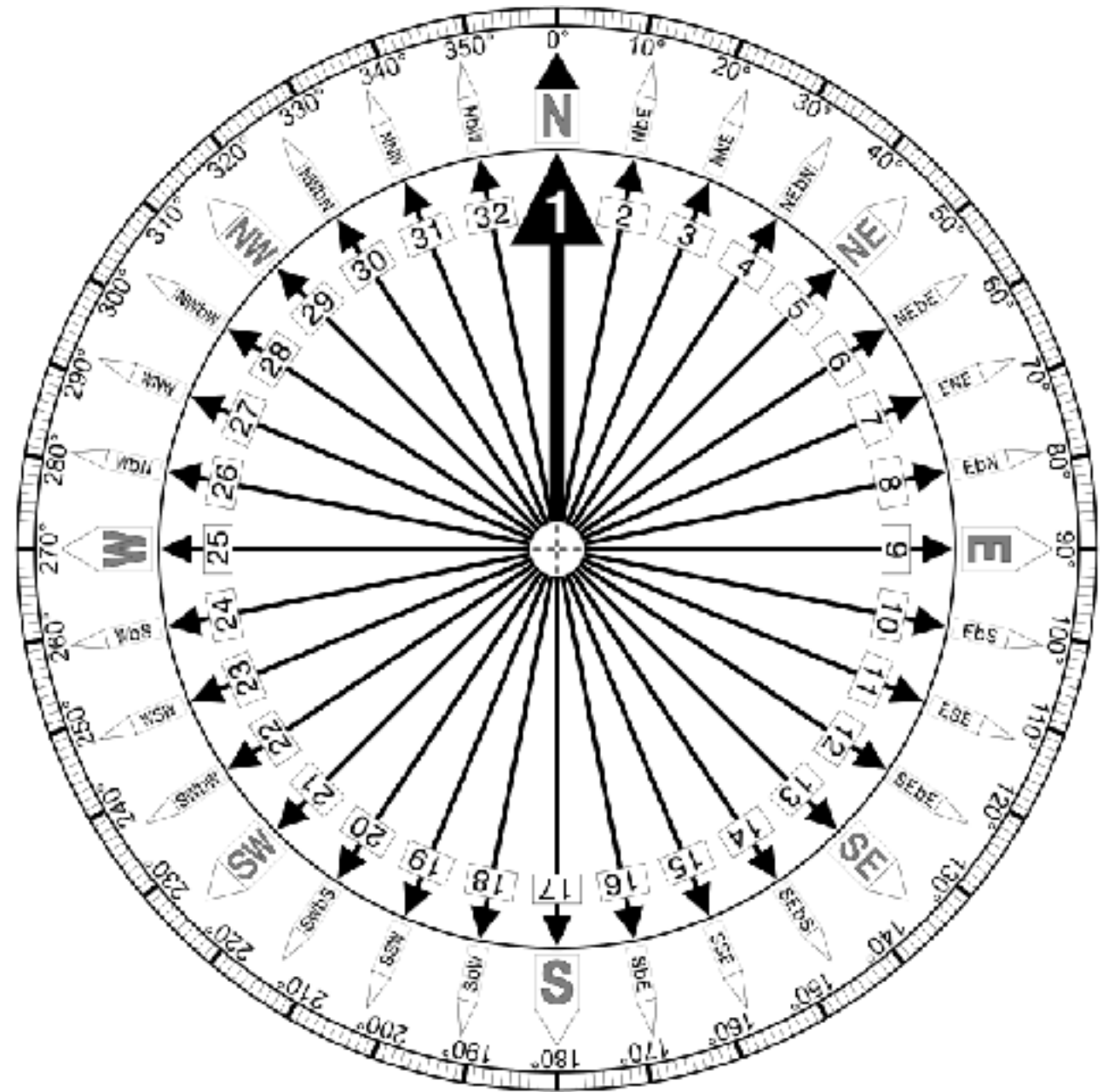
ORDINAL POINTS (or Intercardinal or Intermediate) are northeast, southeast, southwest and northwest.

SECONDARY INTERCARDINALS are the intermediate direction of every set of intercardinal and cardinal directions. They are NNE, ENE, ESE, SSE, SSW, WSW, WNW, NNW

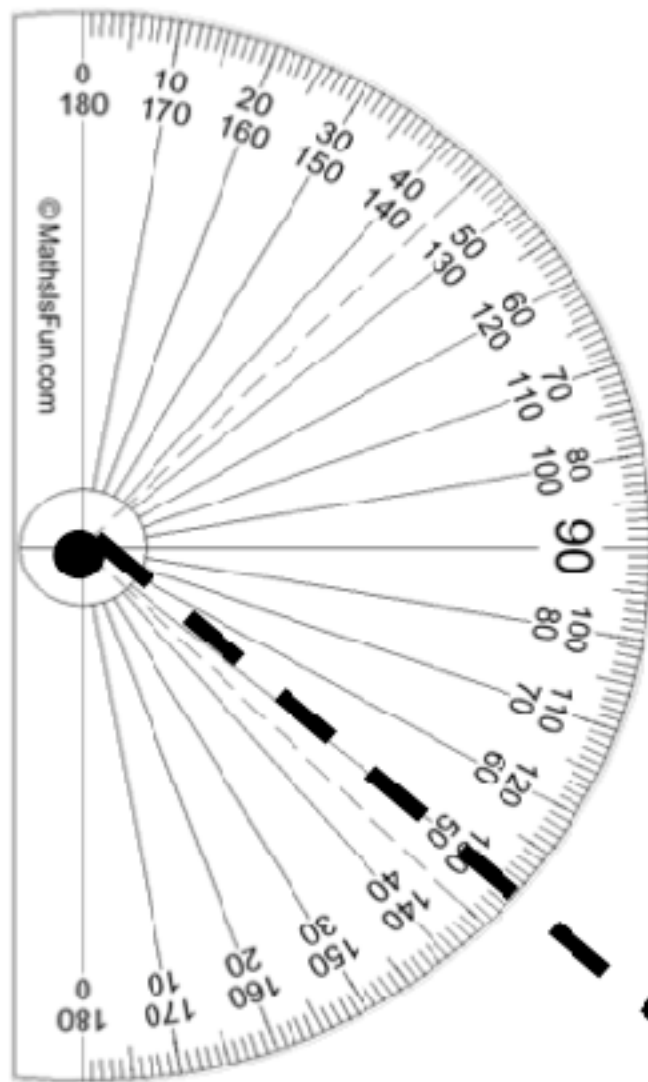
NOTE: Cardinal Points actually divide a map into FOUR quadrants - NE, SE, SW and NW

BEARINGS

A bearing is a measurement of direction between two points and provides a more accurate indication than using compass points. A bearing is the angle, measured clockwise, that a line makes with a fixed zero line. Unless stated otherwise, the zero line is always to be taken to the north.



Bearings



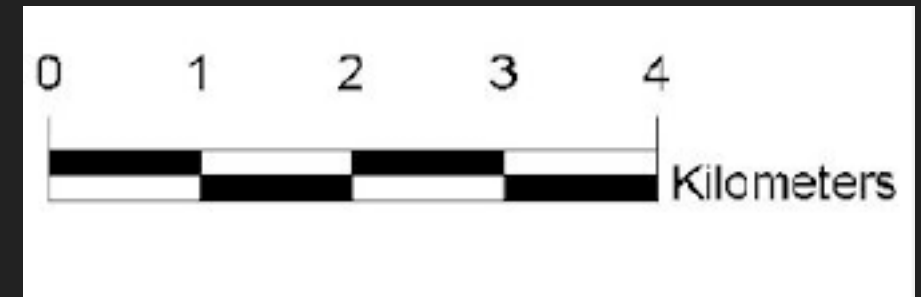
0° is facing the top of the page. The protractor is placed over the top of the “from” point.

To measure the bearing between two points you need to place the centre of the protractor on the “from” point with 0° pointing to the top of the page. Imagine there is a line between the two points. Where the line crosses through the protractor you need to measure the angle.

NOTE: Add 180° if measuring in the SW or NW quadrants

SCALE

- ▶ Scale measures distance and is used to calculate journey times and speeds, find the area of features and to calculate gradient.
- ▶ You may also apply scale between different products such as a topographic map and remote sensing image.
- ▶ Topographic maps provide reference to scale as either a statement, a ratio (or representative fraction), or as a linear scale.



1: 100 000 or 1/100 000 or

1 cm on the map is equivalent to 1 kilometre in real life.

KNOW YOUR CONVERSIONS

100cm = 1 m

1000m = 1 km

1km = 100 000cm or 1000m

COMPARING SCALES

- ▶ Which ratio scale is bigger?
 - ▶ 1:10 or 1:2?
- ▶ the bigger the number the smaller the scale of the map!
 - ▶ small scale maps show large areas with less detail.
 - ▶ large scale maps show small areas with greater detail.

SCALE		DISTANCE ON THE GROUND SHOWN BY 1CM ON THE MAP
	1: 10 000	100m
Larger	1: 25 000	250m
	1: 50 000	500m
	1: 100 000	1km
	1: 250 000	2.5km
Smaller	1: 1 000 000	10km
	1: 5 000 000	50km

REMEMBER

- ▶ **The bigger the number, the smaller the scale of the map**
- ▶ **Large scale maps show small areas in greater detail**
- ▶ **Small scale maps show large areas in less detail**
 - ▶ **Think - you don't see much detail on a map of the world because the scale is so small - probably something like 1:135,000,000**

MEASURING DISTANCE USING SCALE

- ▶ **To measure distance, use a ruler, string or a piece of paper.**
 - ▶ **String or paper best for curved distances**
- ▶ **Accuracy is key, particularly if it is only one part of a question and may affect subsequent answers.**

COMPARING SCALES ACROSS PRODUCTS

- ▶ Occasionally, you will be asked to calculate the scale of an aerial photo or remote sensing product that provides detail of an area within the topographic map study area.
 - ▶ Locate two features on each source for comparison
 - ▶ Using the scale from the topographic map, calculate the length of the feature (eg. a road 5cm long) then measure the same road on the aerial photo/remote sensing product (e.g the same road is 9cm long).
 - ▶ Divide the distance from the topographic map by the the distance from the aerial photo and then multiply by the topographic map scale.
 - ▶ EXAMPLE. if the topographic map scale is 1:100 000 then the 5cm road is 5km long. Apply this to the aerial photo. The road length is the same so although the measurement is 9cm it is still 5km long.

COMPARING SCALE – PRACTICE

- ▶ **My topographic map scale is 1:25 000**
- ▶ **I locate an airstrip on both my topographic map and a remote sensing map. On the map, the feature measures 4cm and on the remote sensing product it is 6.5cm.**
- ▶ **What is the scale of the remote sensing product?**

COMPARING SCALE – ANSWERS

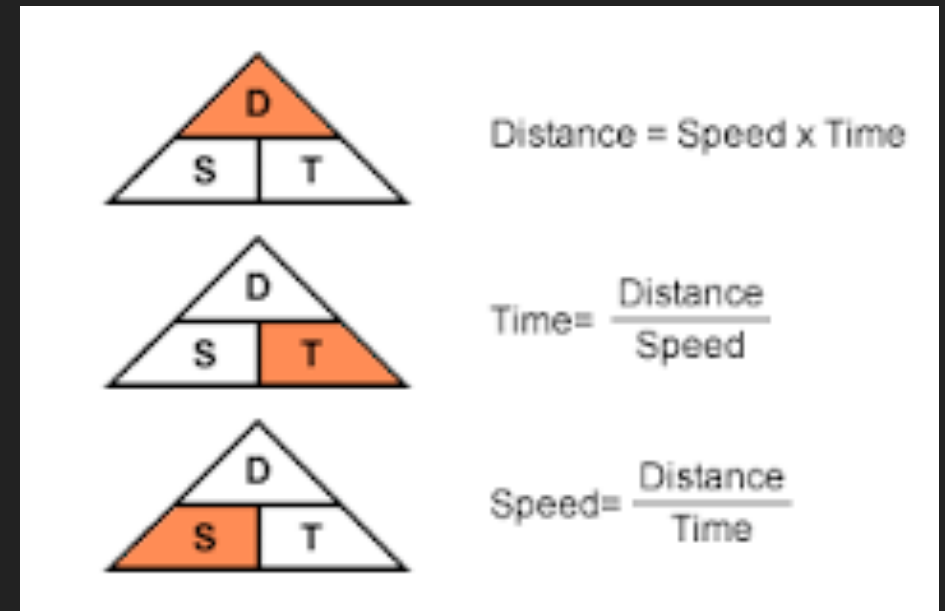
- ▶ **My topographic map scale is 1:25 000**
- ▶ **I locate an airstrip that is on my topographic map and a remote sensing map. On the map, the feature measures 4cm and on the remote sensing product it is 6.5cm.**
- ▶ **What is the scale of the remote sensing product?**
 - ▶ **$4/6.5 \times 25000 = 15,385$ or 1:15 400**
- ▶ **Which product has the larger scale?**

REMEMBER!

- ▶ Find a feature that appears on both sources and measure **ACCURATELY**
- ▶ Use the scale on the topographic map to work out the length of the feature.
- ▶ Divide that length by the measurement of the feature from the second source.
- ▶ A quick check - the source with the longest line will have the larger scale

JOURNEY TIMES & SPEED

- ▶ Time taken to travel between two points can be found if you know distance and speed.
 - ▶ Map scale provides the distance
- ▶ Remember that 60kph is a travel time of 1 km per minute; times shorter than 1 minute per km indicate higher speeds.



Distance = Speed x Time

Speed = Distance /Time x 60/1

Time = Distance/Speed x 60/1

JOURNEY TIME & SPEED

- ▶ Jack travels 75km in 45 mins. At what speed was he travelling?
 - ▶ $S = D/T = 75/45 \times 60/1 = 100 \text{ kph}$
- ▶ If Jack increased his speed to 110 kph, how long would it take him?
 - ▶ $T = D/S \times 60/1 = 75/110 \times 60/1 = 40.90$
 - ▶ $40\text{mins} + (0.9 \times 60) = 40\text{mins } 55 \text{ secs}$

REMEMBER

- ▶ Usually you will need to measure a distance on your topographic map in order to complete the question. **ACCURACY** is essential!
 - ▶ Measure carefully using a ruler, piece of paper or string and use the scale to calculate the distance.
- ▶ Commit the Distance/Speed/Time triangle to memory. Note that they are written alphabetically from the top.
- ▶ Use the same units of measurement when calculating!
 - ▶ To convert seconds to minutes - divide by 60
 - ▶ To convert minutes to hours - divide by 60
 - ▶ To convert decimals - x by 60.

AREA

- ▶ **Scale is also used to help calculate area**
 - ▶ **For regular shapes, use the scale to measure length and multiply by the width**
 - ▶ **For shapes that are contained within a grid square, estimate the proportion of the grid square the feature covers and use scale to calculate**
 - ▶ **For shapes that cover multiple scales, count the grid squares that are more than half covered by the feature and ignore those that are less. Use scale to calculate.**

AREA

- ▶ **Area = Length by Width**

$$= 300 \times 500$$

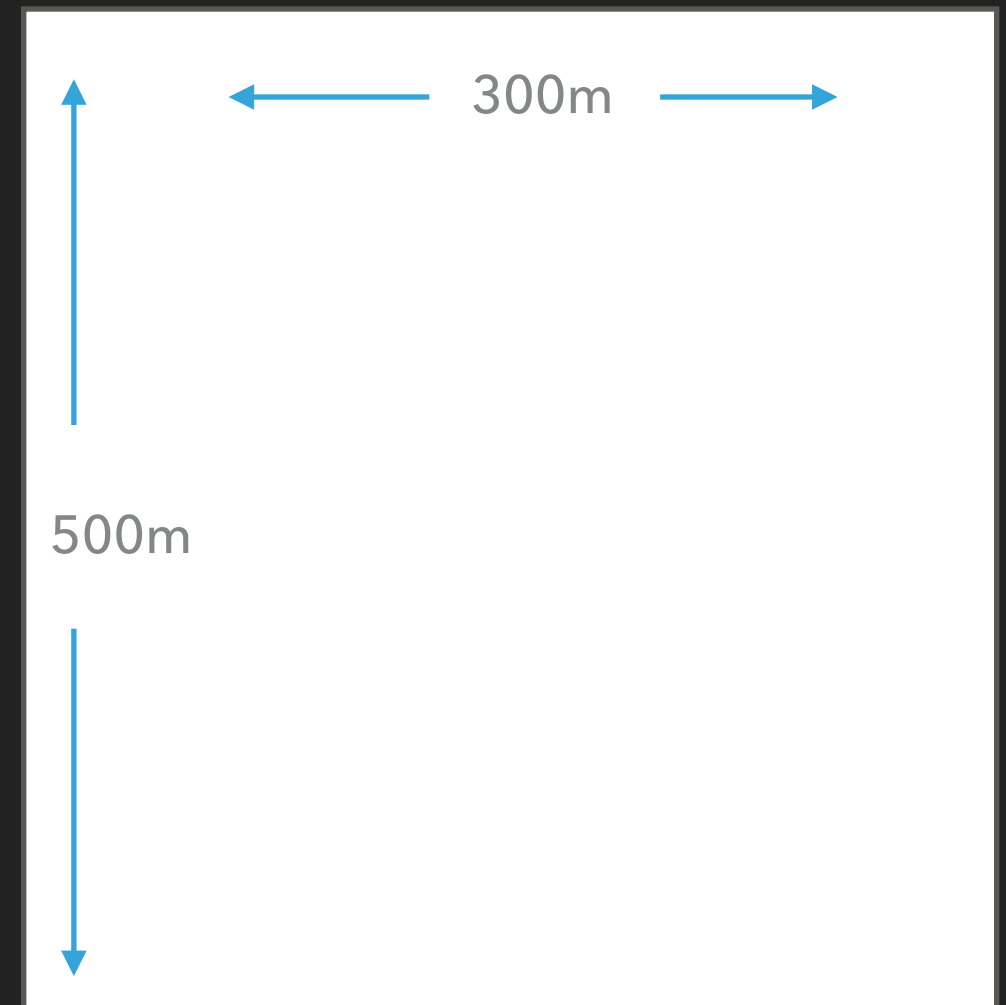
$$= 150,000\text{m}^2$$

- ▶ **You may be asked to convert to hectares (ha)**

- ▶ $150,000\text{m}^2 / 10,000 = 15\text{ha}$ or 0.15km^2

- ▶ **A hectare is 100m x 100m or 10,000m²**

- ▶ **1 sq km is 100 hectares**



REMEMBER

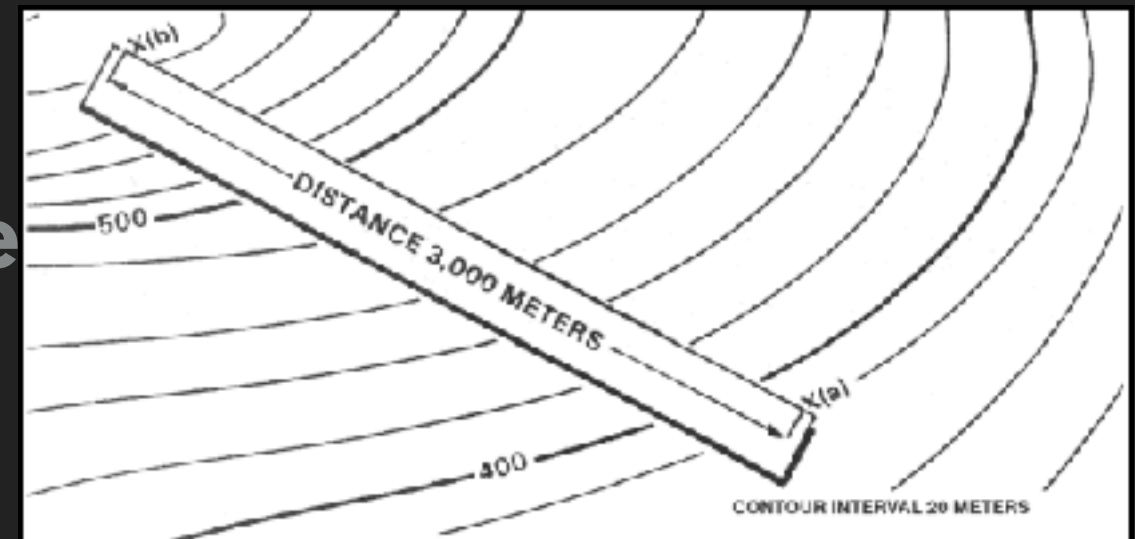
- ▶ **Consider what method is best suited to the feature you are working with.**
- ▶ **Area is often an estimation; in multiple choice questions, look for the best fit.**

GRADIENT

- ▶ **Gradient measures the angle or slope of a surface and is usually expressed as a ratio that indicates the height increase per metre**
- ▶ **The formula used to calculate gradient is RISE:RUN**
 - ▶ **Measure the RISE - use the contour lines to determine the difference in height between the two points**
 - ▶ **Measure the RUN - the distance between the two points using the scale.**

GRADIENT

- ▶ **Gradient = Rise:Run**
 - ▶ to calculate rise: $580 - 390 = 190\text{m}$
 - ▶ To calculate run: 3000m
 - ▶ $190:3000$ (invert to calculate)
 - ▶ $1:15.8$
- ▶ For every 1m increase in height you will need to travel 15.8m



REMEMBER

- ▶ **Learn the formula 'rise:run'**
- ▶ **Make sure that before calculating, all measurements are in the same unit (e.g. both rise and run are in cm/m/km)**
- ▶ **Double check your answer by multiplying your answer by the rise.**

SLOPE & ASPECT

- ▶ **Calculations about gradient sometimes include questions about SLOPE and ASPECT**
 - ▶ **SLOPE - steep, gentle, uniform, concave, convex.**
 - ▶ **Read the contours:**
 - ▶ **CONCAVE:** steep at the top then gentle
 - ▶ **CONVEX:** gentle at the top, steep at the bottom
 - ▶ **UNIFORM:** evenly spaced
 - ▶ **ASPECT refers to the direction in which a slope faces if you were at the top looking down. What direction are you looking?**