The background features a topographic map with brown contour lines and a dashed orange grid. A white rounded rectangle with a thin brown border is centered on the right side, containing the title and authors. Two blue wavy lines are positioned at the top and bottom right corners of the slide.

# QGIS Mappin g

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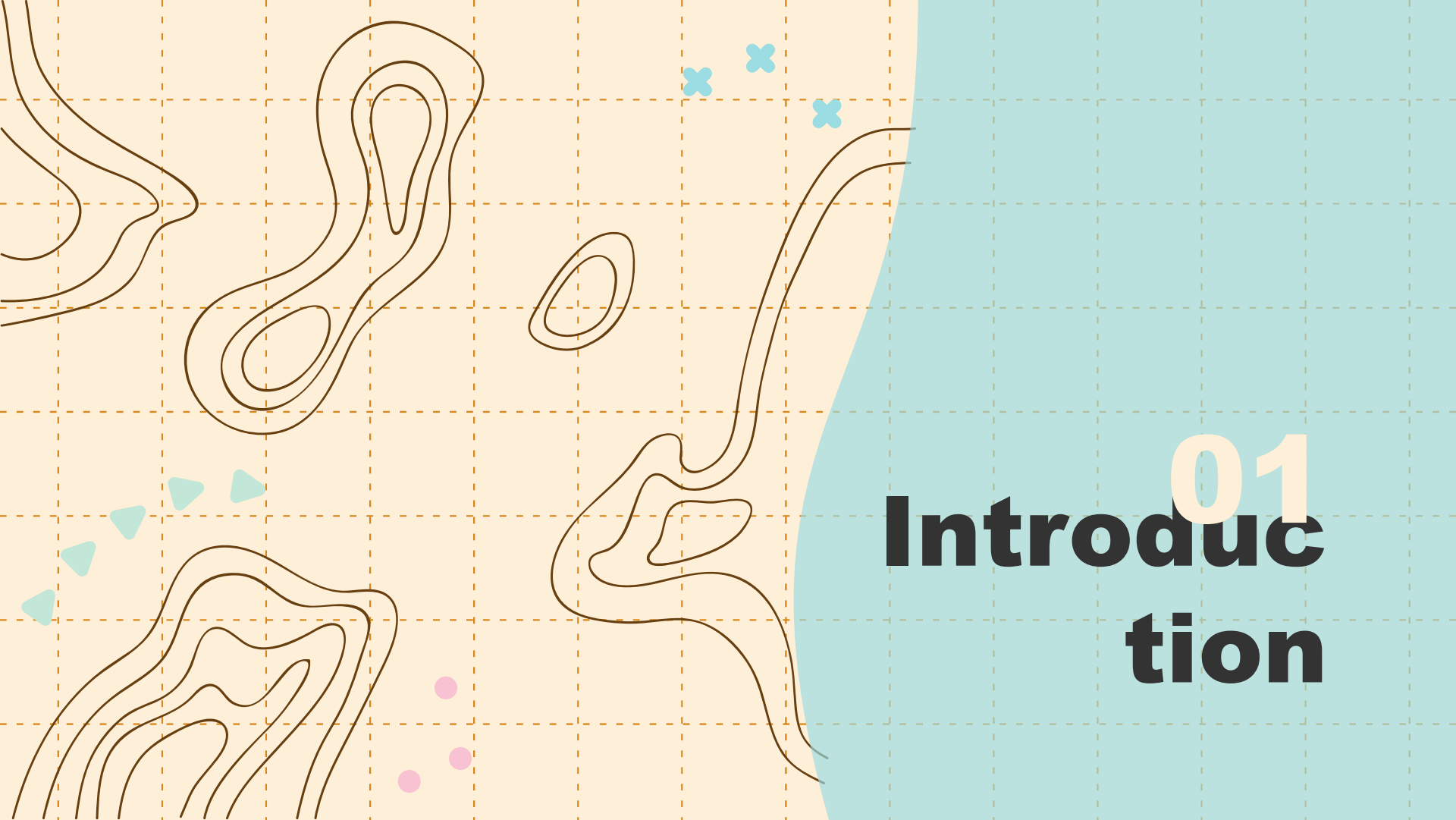
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CHALLENG  
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# 01 Introduction



# Project Descripti on

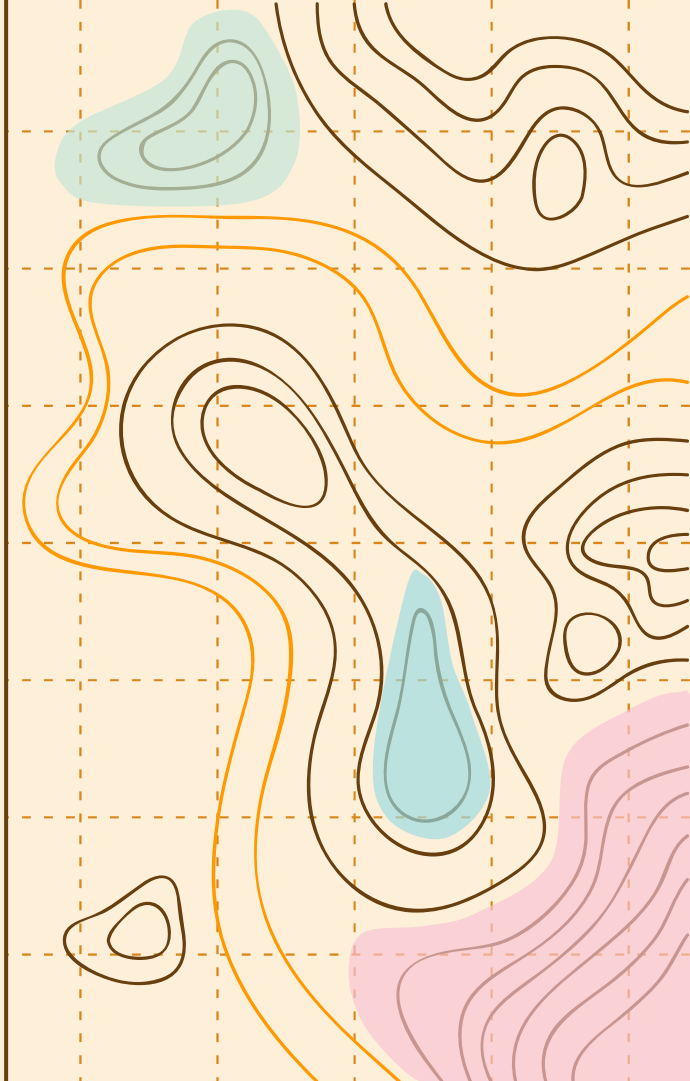
- We created a global raster dataset representing travel times and components such as urban areas, geography, and road network proximity for the period 1980-1990
- We compiled our data on QGIS, a geographic information system software

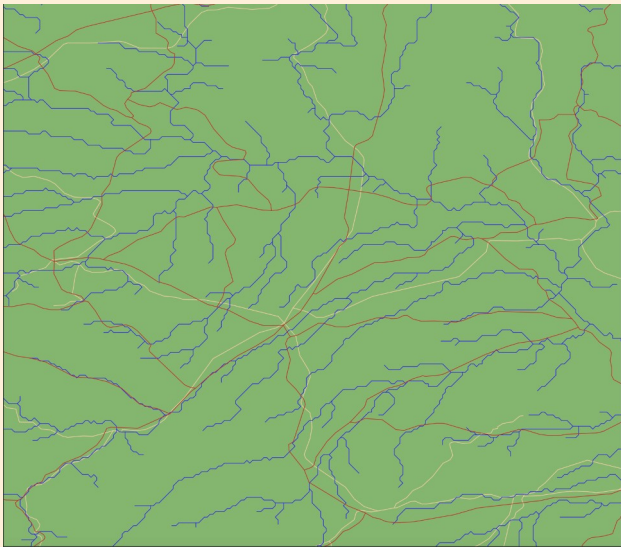
# Friction Surface

**Vector layer:** composed of polygons, lines, and points

**Raster layer:** composed of cells/pixels, each cell has a value

- Friction surfaces are raster grids in which the cell values indicate the cost to travel across them
- **Cost** is measured in units of time.



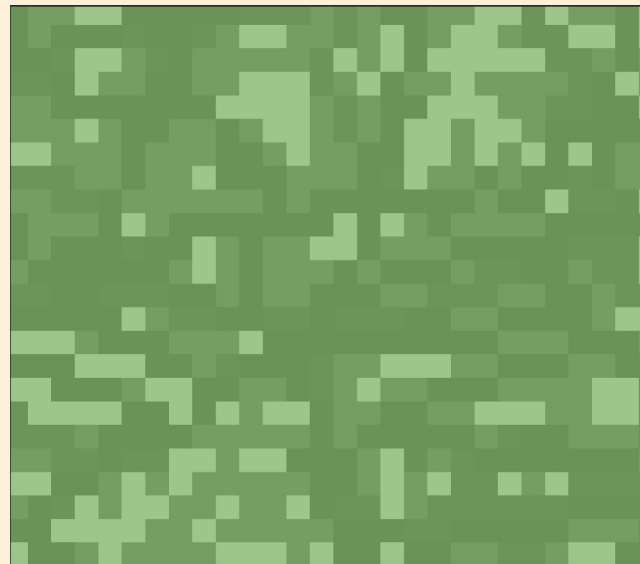


### **Vectors**

Brown: road networks

Blue: rivers

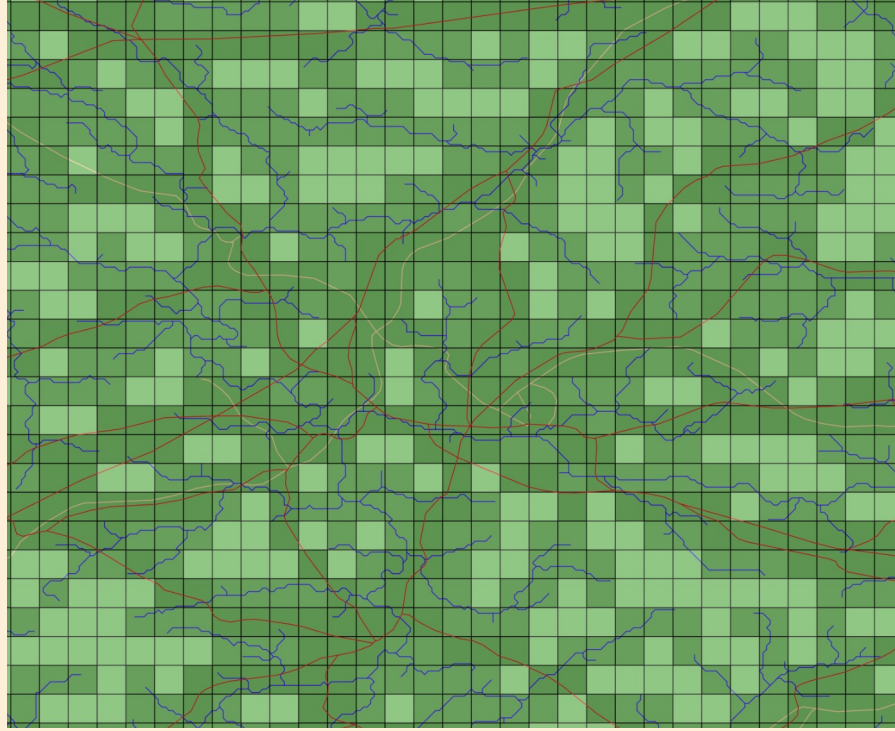
Tan: railway networks



### **Rasters**

Grid

## Combined



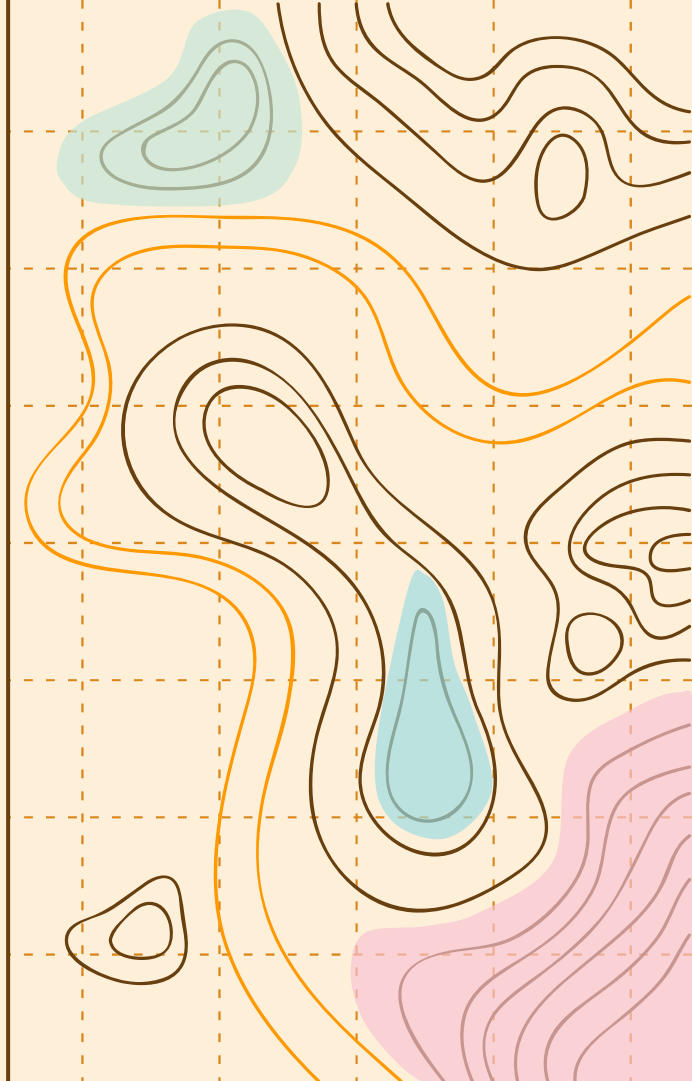
# Accessibility

**A**ccessibility refers to the travel time required to reach a certain location.

- computed by a cost-distance model

Factors that impact accessibility include:

- Land / water
- Road / off road
- Elevation & slope

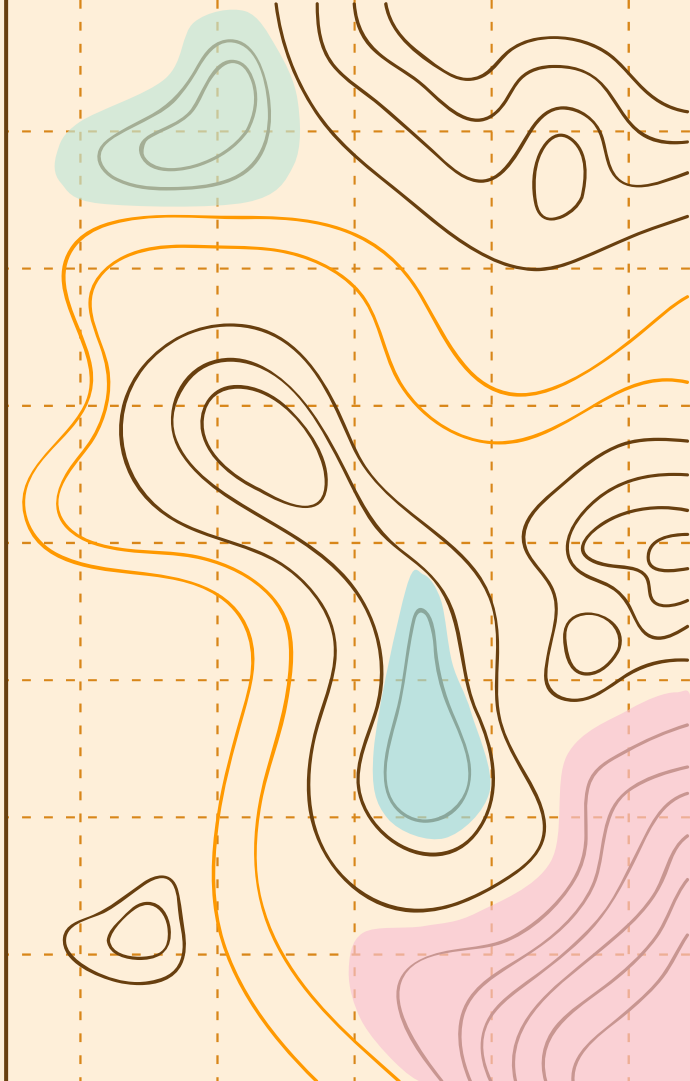


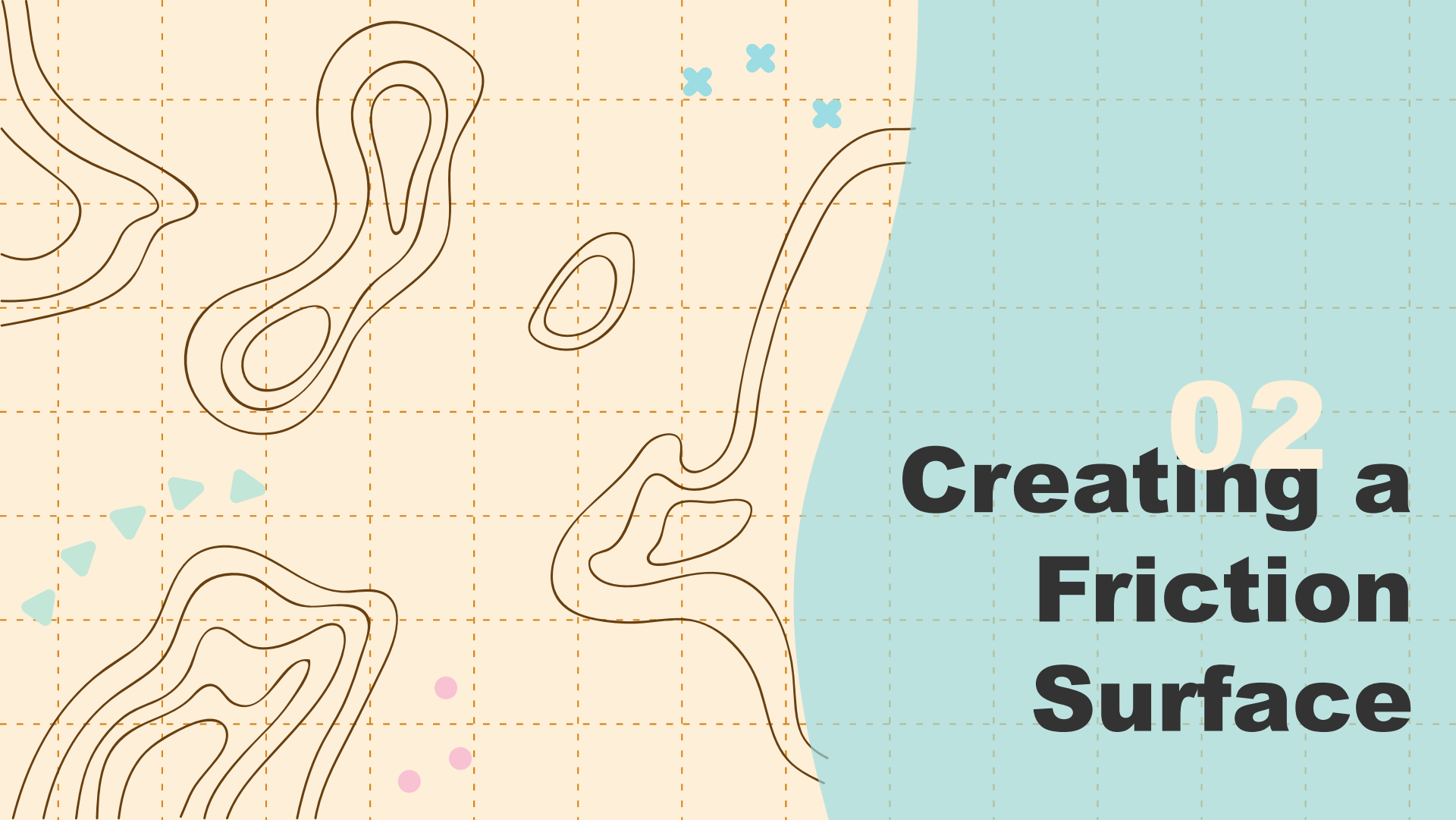
# Cost- Distance Model

A cost-distance model consists of:

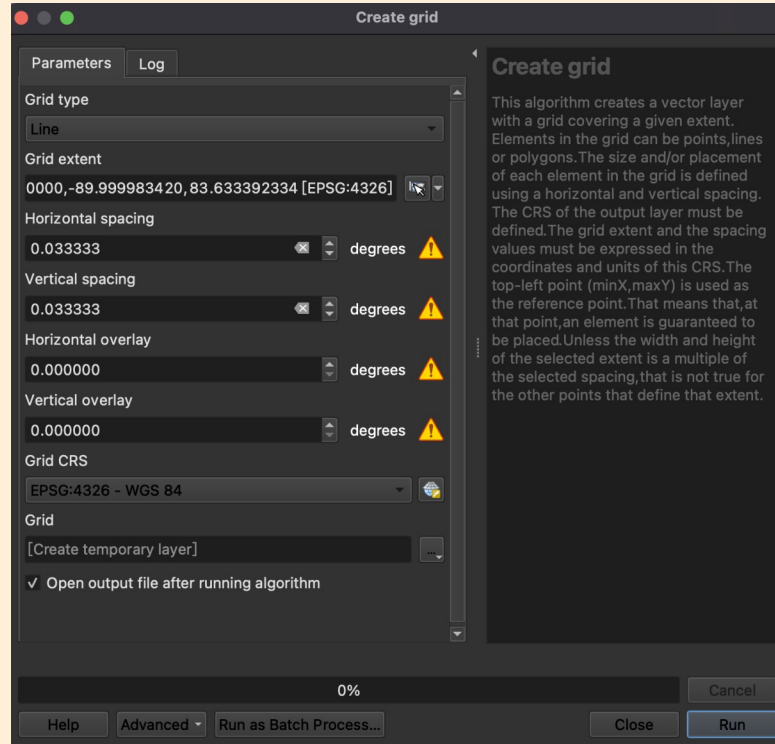
- 1) A target raster map which contains the locations of interest
- 2) A friction surface raster in which each cell contains the time it takes to travel across the cell

This allows us to calculate the cost of traveling between two locations on a raster grid





# 02 Creating a Friction Surface



## 1. Choosing a projection for the data:

- World map

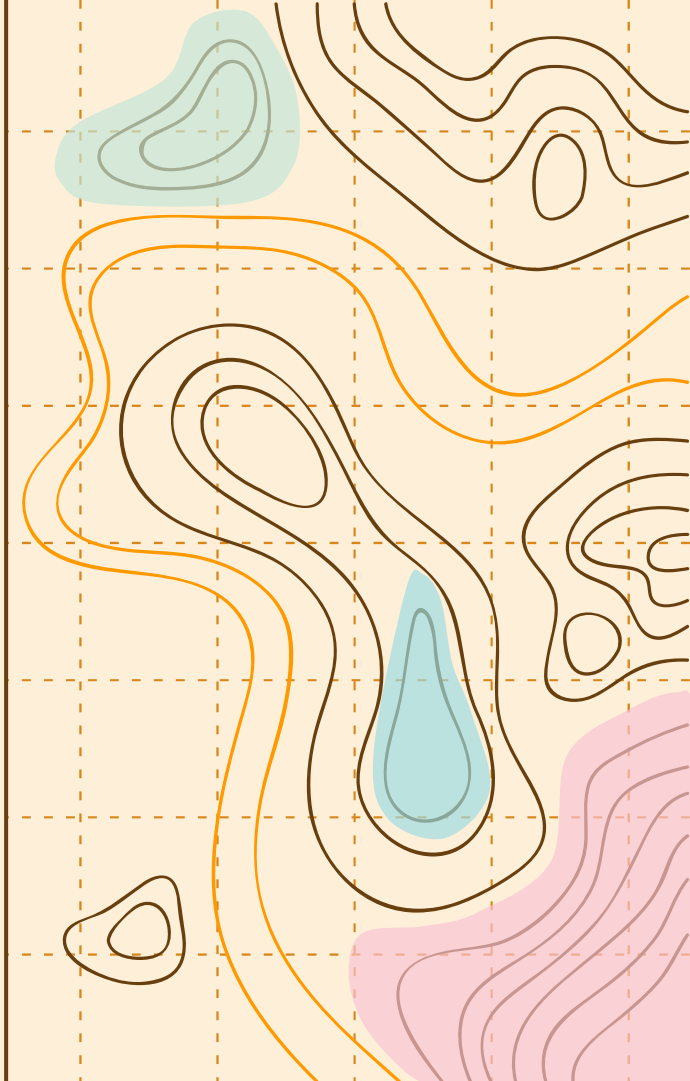
## 2. Choosing a spatial resolution for the friction surface (create grid)

- 1km x 1km cells  
(0.033333 degrees)

### 3. Identifying relevant spatial datasets to define the friction surface

We included rivers, railways, roads, shipping lanes, major water bodies, and slope

- We assumed modes of travel for each layer:
  - Roads → motorized travel
  - Off road → travel by foot
    - Land cover + slope
  - Rivers → boat/ship

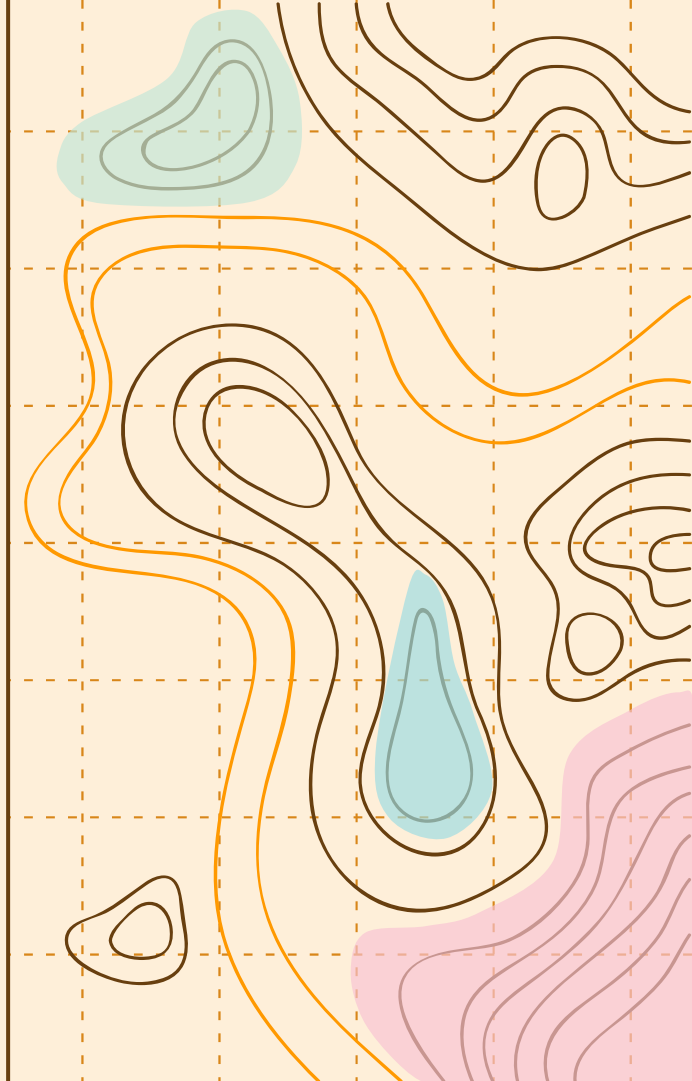


## 4. Converting data to raster

- QGIS convert vector to raster function

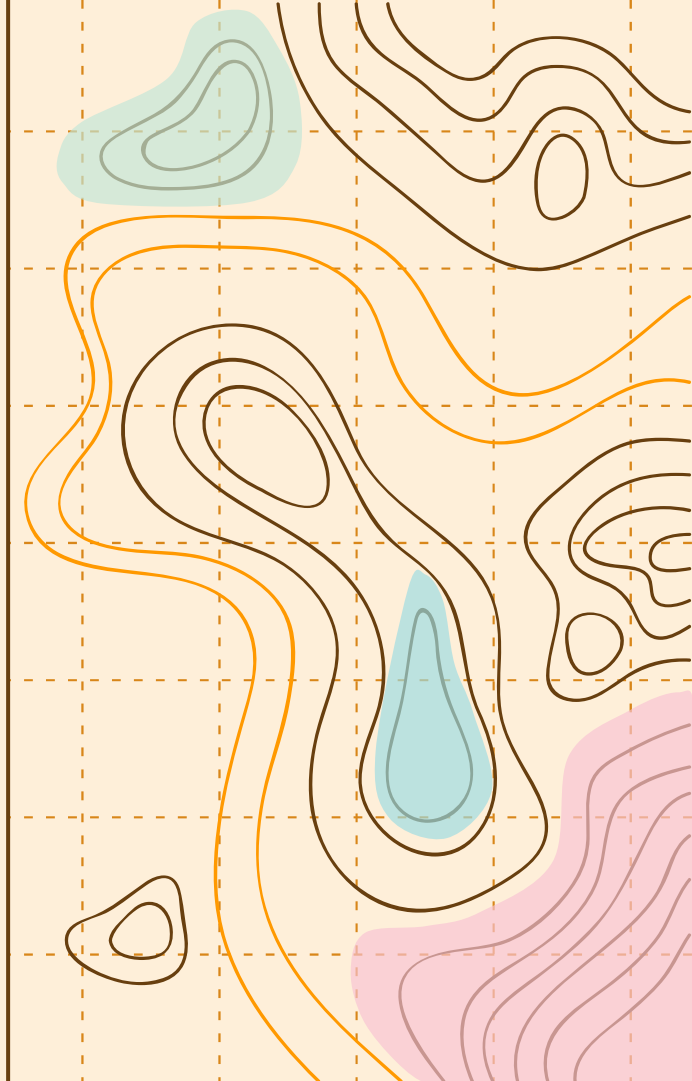
## 5. Assigning travel speeds for each class in each raster




- In minutes per km
- Binary vs continuous cost values



## 6. Creating a friction raster for each raster component



- Computing the time it takes to cross one raster cell
  - We found travel speeds online through the EU Science Hub
  - Units we used: min/km




Input layer  
railway\_network\_rep [EPSG:4326]   



Selected features only



Field to use for a burn-in value [optional]




A fixed value to burn [optional]  
1.500000  



Burn value extracted from the "Z" values of the feature [optional]

Output raster size units  
Georeferenced units 

Width/Horizontal resolution  
0.033333  


Height/Vertical resolution  
0.033333  

Output extent [optional]  
-180.000000000,180.000000000,-89.999983420,83.633392334 [EPSG:4326]   



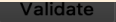

Assign a specified NoData value to output bands [optional]  
0.000000  


Advanced Parameters



Additional creation options [optional]

Profile Default 

Name	Value
------	-------


   

Output data type  
Float32 

Pre-initialize the output image with value [optional]  
10.000000  

Invert rasterization

Additional command-line parameters [optional]

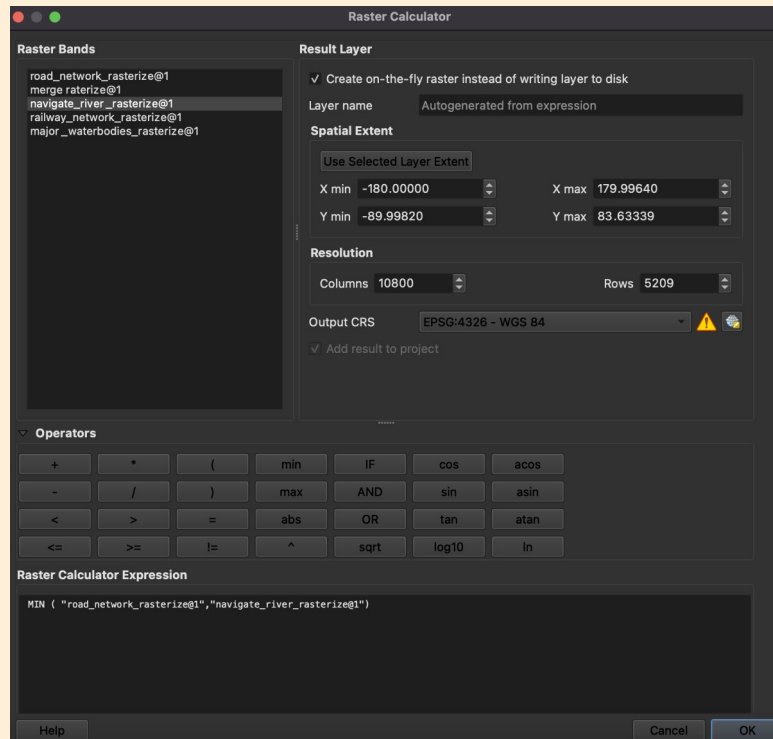
Rasterized  
[Save to temporary file] 

Open output file after running algorithm

# 7. Merging friction components into a single friction surface

Combining all of our overlapping raster layers into a single raster using the minimum function:

$\text{MIN}(\text{Raster1@1}, \text{Raster2@2})$

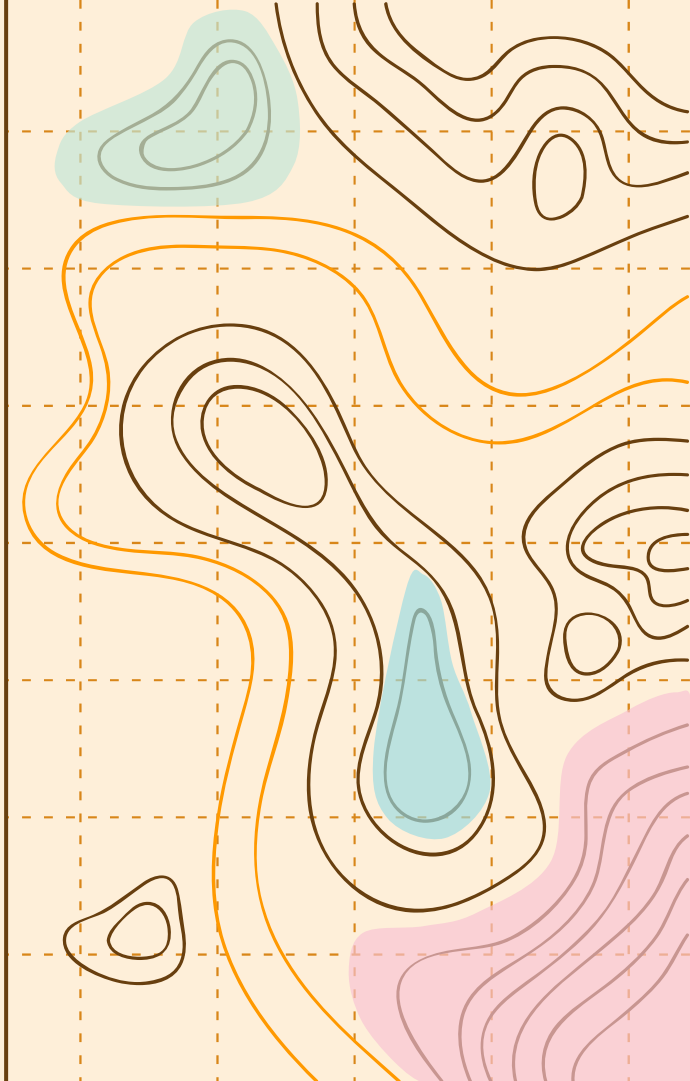




# 03 Challenges

# Metadata (data about data)

- When loading datasets we found online, we ended up with metadata that consisted of vector polygons representing where data exists, however it was not actual data
- When opening data we made sure to check attribute table



# Water body Projections do not line up with World Map

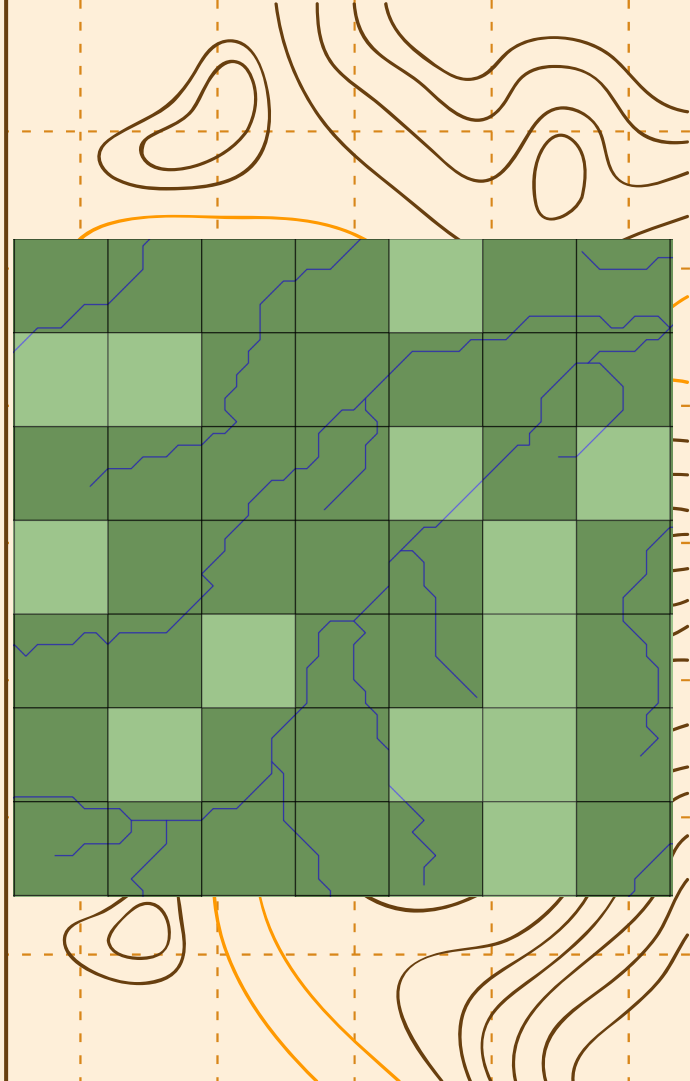
- Solution: finding data from the same year or closer in time.



# Rasterization doesn't capture all the vectors

How we improved: changed the grid  
cell size from 0.001 to 0.03333  
degrees

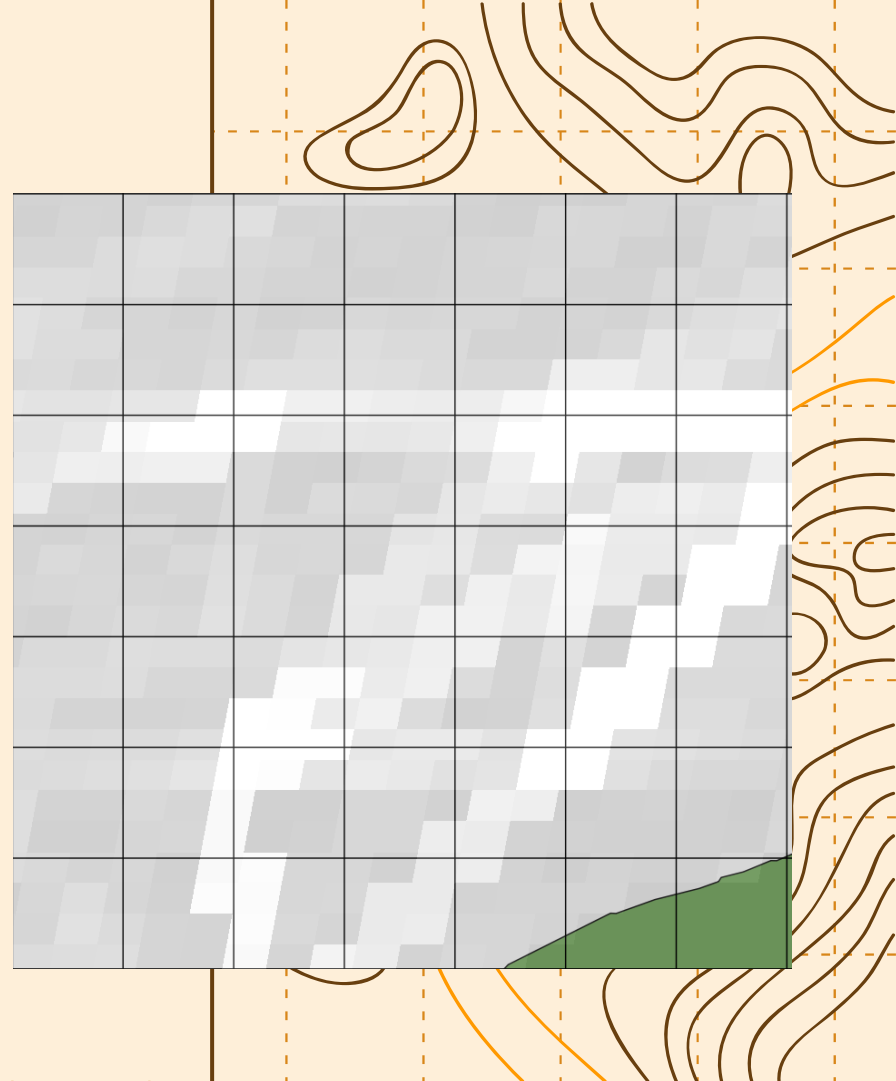
Rasterization capture % of vectors?

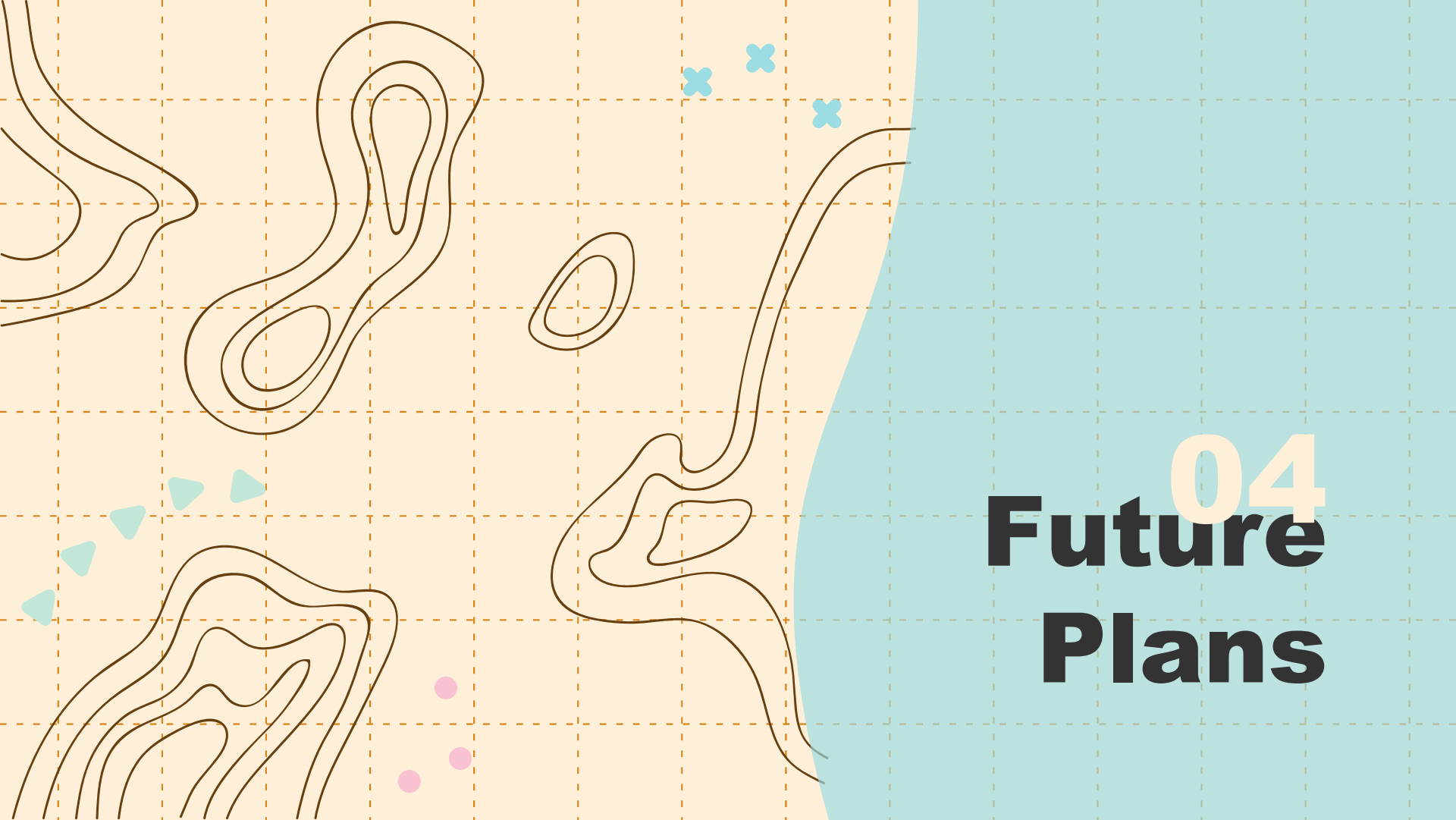


# Different Raster Shape

Slope and Shipping Lanes

Next step: Try to find vector data for shipping lanes, TBD for slope

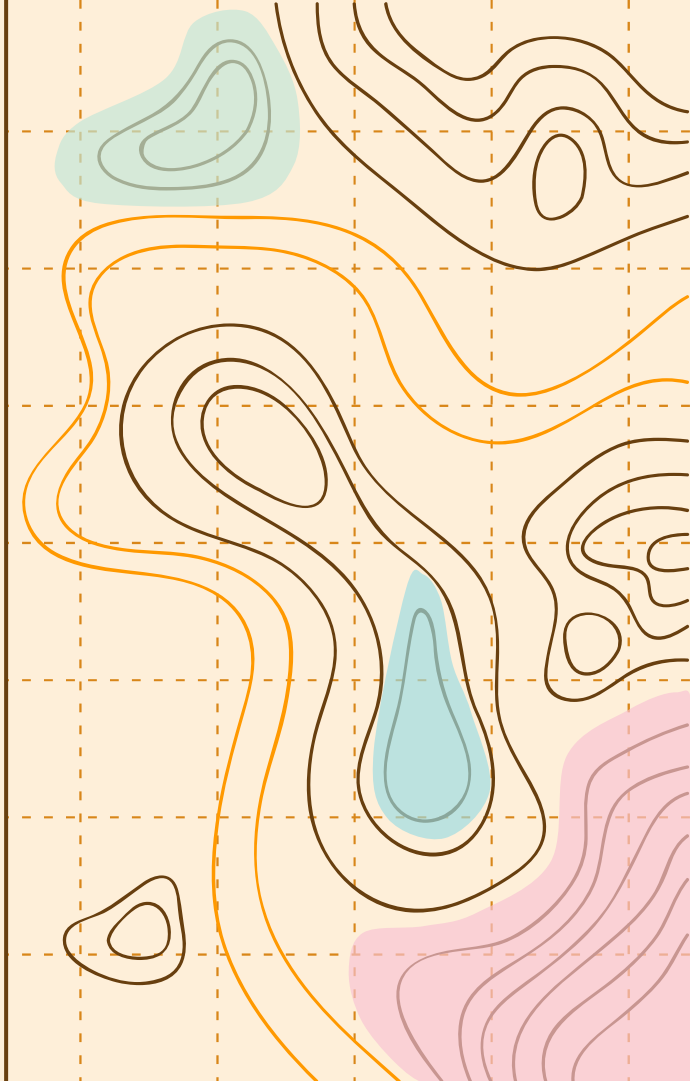




**04**  
**Future**  
**Plans**

# Run the Cost Distance Function

- Computing the time it takes to cross one raster cell
  - We found travel speeds online through the EU Science Hub
  - Units we used: min/km



# Convert to Sensible Time Units

- In some examples, seconds are used
- When calculating the time it takes to cross 1km of land
  - 15 sec → 0.25 min or 0.0042 hr



# Keep Looking for Better Data

- Target: 1970-1980s
- Matches world map
- Making an USGS account

